



GEOGRAPHICAL PAPER No. 26

Shoreline Changes in Egmont Bay and Bedeque Bay, Prince Edward Island

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**GEOGRAPHICAL BRANCH
Department of Mines and
Technical Surveys, Ottawa**

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PREFACE

The Geographical Branch carried out this survey of Northumberland Strait shorelines in connection with studies of a proposed causeway between Prince Edward Island and the mainland. It is considered that such a barrier would increase tidal ranges, particularly at the western end of the strait, which in turn would alter rates of shoreline erosion along this shore. Thus, information on present rates of erosion is of practical significance in estimating future rates and possible property damage.

N. L. Nicholson,
Director,
Geographical Branch.

ROGER DUHAMEL, F.R.S.C.
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OTTAWA, 1960

SHORELINE CHANGES IN EGMONT BAY AND BEDEQUE BAY, P. E. I.

INTRODUCTION

An investigation of Northumberland Strait shorelines was carried out in 1958 in connection with studies of a proposed causeway between Prince Edward Island and the mainland. The construction of such a barrier would cause increases in tidal range throughout the strait, especially in the vicinity of Egmont and Bedeque bays. Hence, information on shoreline character and rates of shoreline retreat is of practical significance in providing a basis for estimating the effects of higher water levels. In this paper it is proposed to indicate the general height and composition of the shoreline erosion face and to demonstrate with the use of air photos some of the changes in coastal configuration that have occurred during the last quarter century.

PHYSIOGRAPHY

Prince Edward Island forms part of a broad, Carboniferous lowland that was submerged, forming the southern embayment of the Gulf of St. Lawrence. The drainage pattern established before submergence is apparent in the numerous drowned river valleys of the indented coast. The sedimentary beds, chiefly sandstone, with some shale and conglomerate, are essentially flat-lying and little disturbed. On the whole, the rocks bordering Northumberland Strait are soft and easily eroded; the shorelines, however, are protected by Prince Edward Island from the more severe wave attack generated in the open Gulf of St. Lawrence. As a result, the bays and headlands along the strait retain their initial pattern of irregularity. In contrast, the more exposed north coast of Prince Edward Island is comparatively smooth, and baymouth bars are well developed.¹

Rock is exposed only along relatively short sections of the Egmont Bay and Bedeque Bay shorelines (Figures 3 and 16). Where these exposures occur, the erosion face is generally higher than it is along adjoining sections of unconsolidated material, and, as it is more resistant to wave attack, rock is exposed frequently in headlands. Sandstone, the predominant rock, however, varies considerably in resistance to erosion according to the strength of the limey cement which is the bonding material. The height of the erosion face and the thickness of rock exposure also greatly affects the rate of shoreline retreat. A sub-

¹Johnson, D.W. The New England-Acadian Shoreline, John Wiley and Sons, New York, 1925.

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stantial rock cliff in this area retreats only a few inches a year; where the rock is less resistant and of shallow thickness it may retreat at a rate of several feet a year.

The sections of coast where the erosion face is composed wholly of unconsolidated material are quite extensive. Although the height of the erosion face varies, it is generally less than 10 feet and frequently only 2 or 3 feet (Figures 3 and 16). Such low banks of less resistant material are easily eroded by wave action, and in exposed locations the shoreline retreats rapidly. In less exposed locations, for example, in narrow river estuaries or behind sand bars and spits, sea erosion proceeds quite slowly.

SHORELINE CHANGES

The large-scale Holland map of 1765 was one of the few early maps produced, and details of the shorelines are probably inaccurate. However, comparison between this map and the 1952 topographic map of Bedeque Bay (Figure 1) shows that the peninsulas bordering Sunbury Cove have been eroded on either side, producing a more slender form.

The most reliable early map is Admiralty Chart No. 210, based on the survey by Captain Bayfield in 1839. Comparison with the 1952 topographic map of Egmont Bay (Figure 2) indicates that the shoreline has retreated considerably from West Point to the baymouth bar. Also, this bar has been breached to form

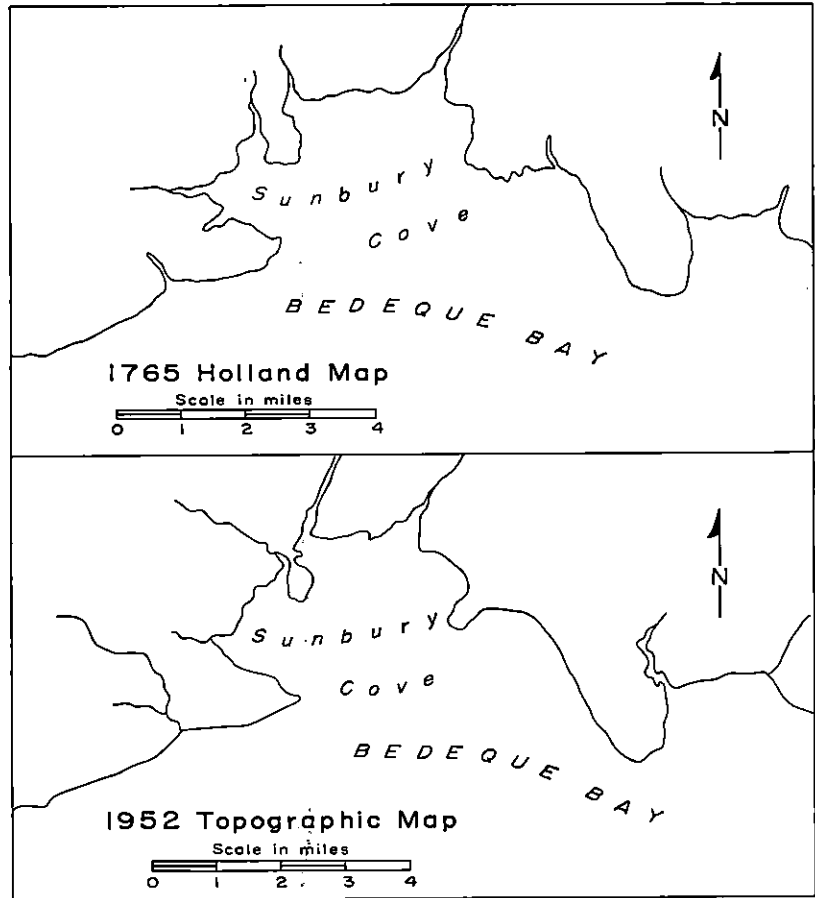


Figure 1. Part of the 1765 Holland map compared with the same area taken from the Summer-side sheet of the National Topographic Series.

 SHORELINE CHANGES IN EGMONT BAY AND BEDEQUE BAY, P. E. I.

two separate bars, one of which has extended eastward more than $1\frac{1}{2}$ miles. The bar off Brae Harbour is located farther westward and appears to be more extensive on the 1839 chart. The process of sea erosion tends to smooth the irregularities of the coast by removing headlands and building baymouth or offshore bars.

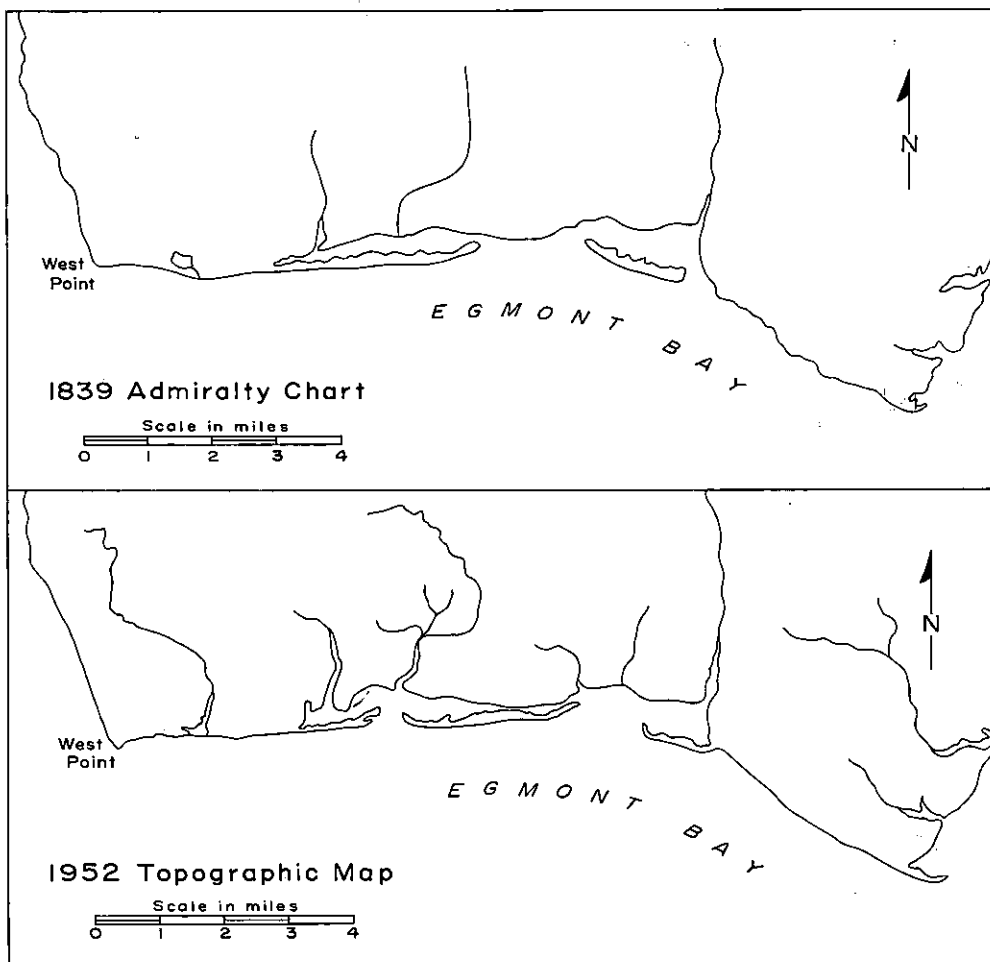


Figure 2. An enlarged section of Admiralty Chart No. 210 (1839 survey) compared with a similar area reduced from the O'Leary sheet of the National Topographic Series.

The rates of shoreline retreat indicated in Figures 3 and 16 have been determined by comparison of air photos taken at different dates. The series of photographs taken in 1935 was compared with the series taken in 1958 (Figures 4 to 24). Measurements were made at points along the coast where identifiable landmarks permitted quite accurate comparison. The scales of both series of photos are approximately $\frac{1}{4}$ miles to 1 inch - the old series slightly larger, and the new series slightly smaller. On the 1958 photographs the positions of the 1935 shoreline have been superimposed to assist the eye in visualizing the

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changes. The locations of photographs in each bay are indicated on Figures 3 and 16.

CONCLUSION

Evidence of rapid changes in the shorelines of both Egmont and Bedeque bays is apparent. Although the coast is still in a youthful stage, the erosional processes are tending to smooth the shoreline. As a result, the more exposed points suffer severe wave attack and shoreline retreat is very rapid where low unconsolidated banks are exposed. Rock appears along the shore only in limited sections of the bays. As indicated by the 25-foot contour, the land rises fairly rapidly inland, except near West Point, Percival River and Sunbury Cove. Consequently, the rate of shoreline retreat will eventually decrease where the erosion face increases in height as the shoreline retreats inland.

ACKNOWLEDGMENTS

This paper is based on a field investigation carried out by the writer with the assistance of C.W. Raymond and J.A. Rayburn of the Geographical Branch permanent staff and R.C. Geen and D.A. Rapson of the seasonal staff.

Air photos included in this study may be obtained from the National Air Photo Library under the following numbers:

<p>Figure 4 A 5328 -41 5 A 16094-138 6 A 5328 -3 7 A 16094-96 8 A 5314 -71 and A 5312-82 9 A 16094-204 10 A 5325 -53 11 A 16094-134 12 A 5061 -95 13 A 16114-59</p>	<p>Figure 14 A 5062 -12 15 A 16094-42 17 A 5075 -73 18 A 16096-31 19 A 5074 -38 20 A 16110-58 21 A 5072 -72 22 A 16112-88 23 A 5073 -35 24 A 16112-88</p>
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SHORELINE CHANGES IN EGMONT BAY AND BEDEQUE BAY, P. E. I.

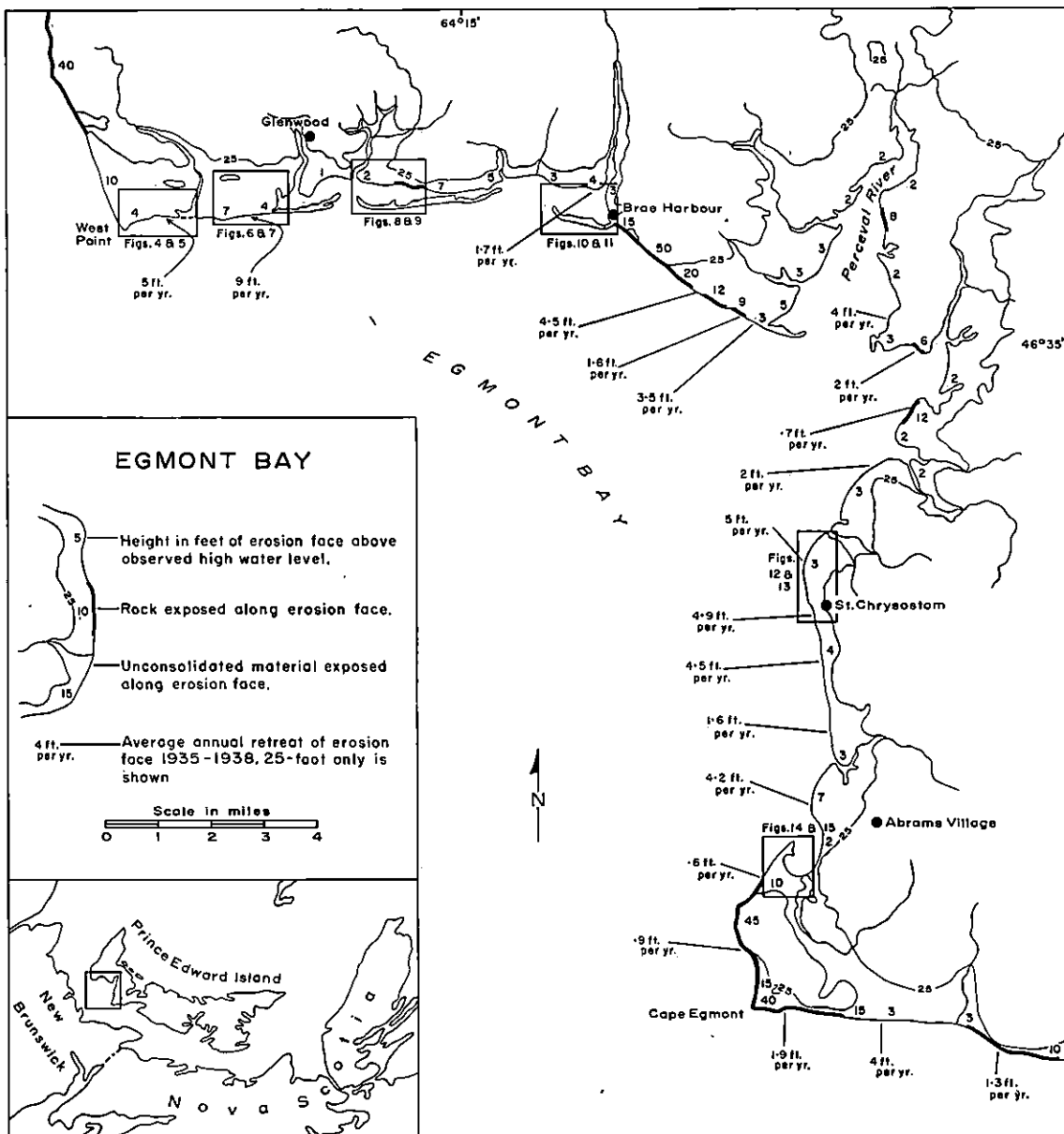
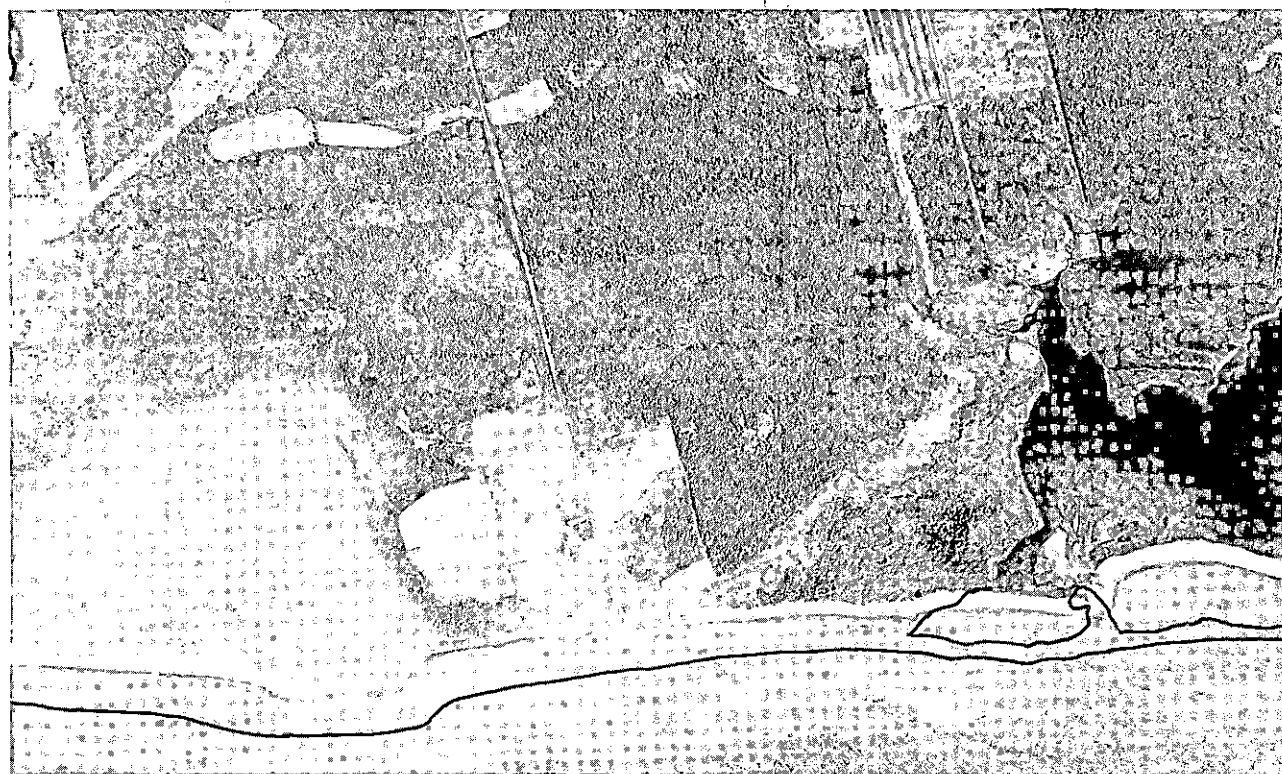


Figure 3. Shoreline characteristics of Egmont Bay with locations of airphotos illustrating this study.



Figures 4 and 5. At West Point a succession of beach ridges has been built up with sand drifted from the west coast of the island. As evidenced by the photographs, considerable deposition has taken place since 1935. While deposition is occurring west of the wharf, the low shoreline east of the wharf is retreating rapidly.

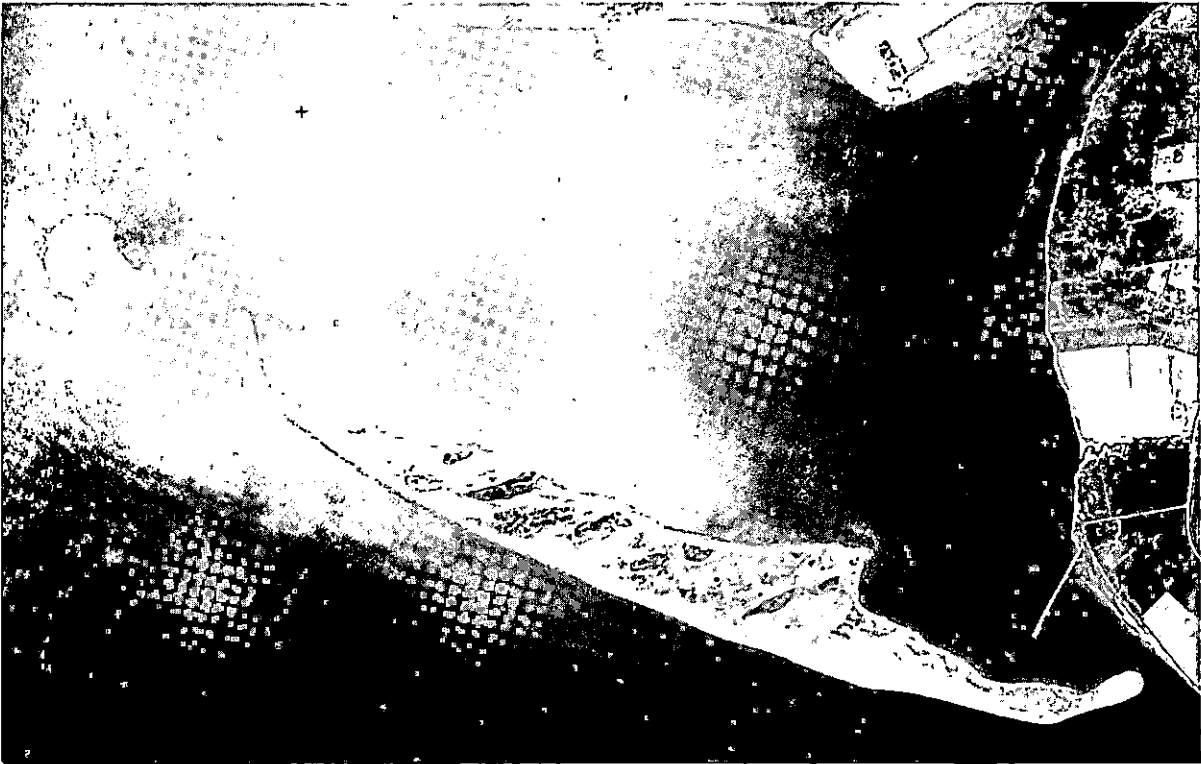
When was wharf built?



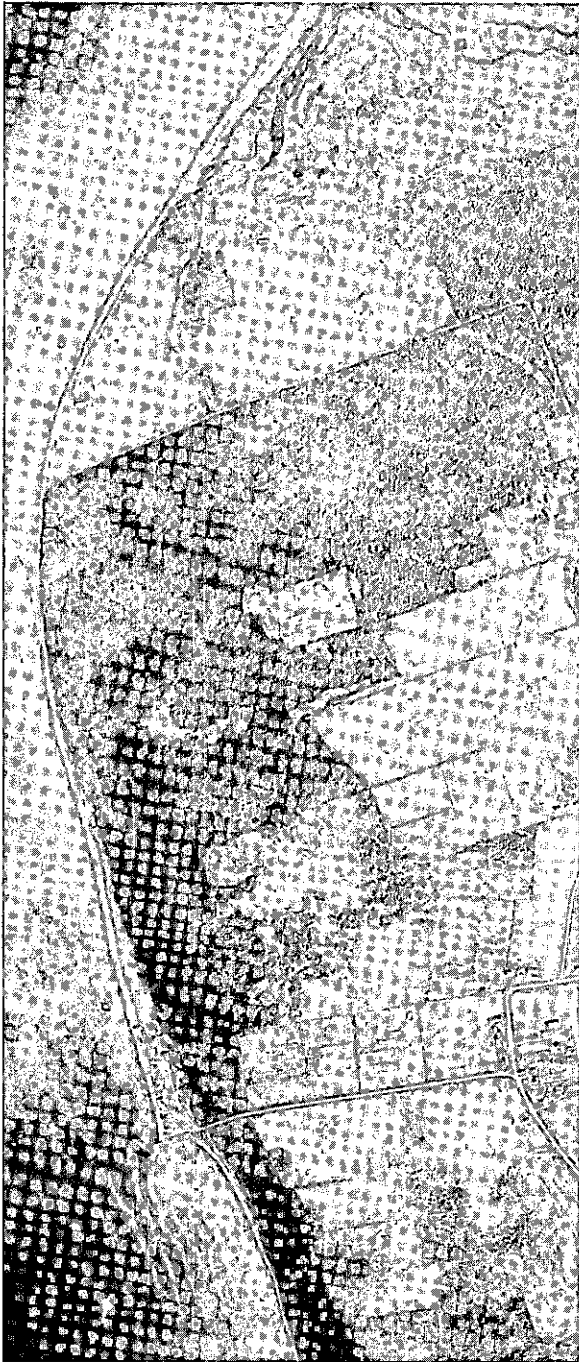
Figures 6 and 7. This rapidly eroding section is composed of a peat exposure 4 to 7 feet in height on the left and a low bank of unconsolidated material on the right. Along the base of the erosion face at left, wave action has exposed a tangled mass of tree stumps that had been covered by several feet of peat. The sea is now encroaching on the cultivated land (centre), and is threatening the nearest house with inundation in a few years' time.



Figures 8 and 9. A striking change in the position of this bar has occurred and a large quantity of sand has been removed. The western end of the bar has moved eastward and much closer to the shore. The curved ends of earlier bars that extended much farther seaward can be distinguished on the right.

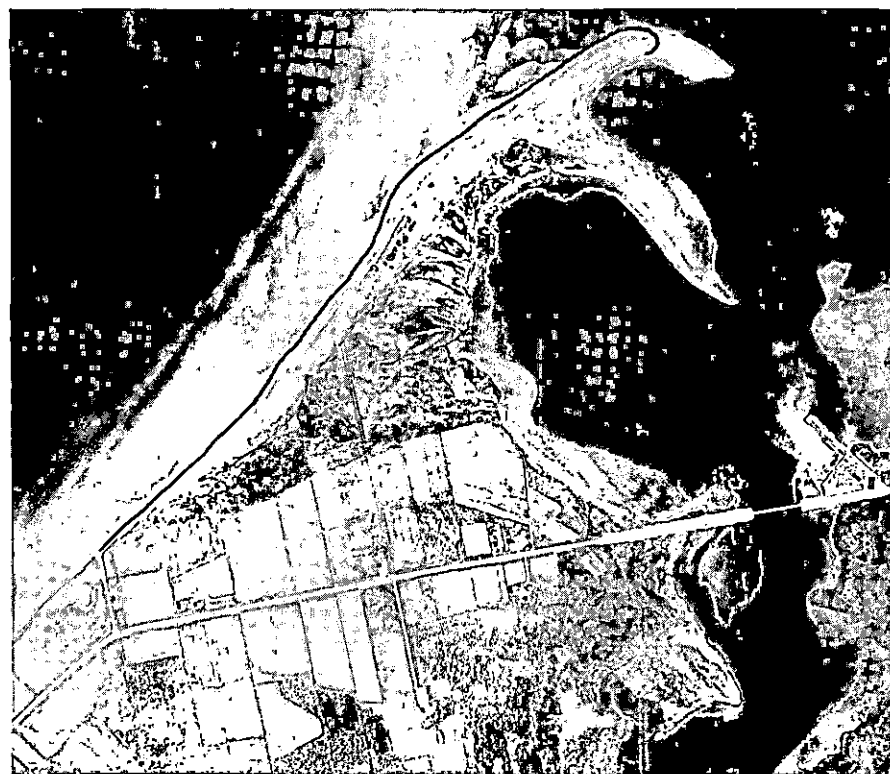


Figures 10 and 11. During the 23-year interval a large part of the bar has been sliced away and sand has been deposited in abundance at the eastern end, joining the bar to the land. That this bar was once much larger is indicated on the 1839 Admiralty chart (Figure 2). At top right, the fact that the barn situated on the point is much closer to the water in Figure 11 than in Figure 10 is evidence of shoreline retreat.



Figures 12 and 13. The coast near St. Chrysostom is composed of unconsolidated material and the erosion face ranges from 2 to 5 feet in elevation. The shoreline has retreated at a rate of approximately 5 feet per year. Sand that had accumulated north of the wharf before 1935 was eroded away during the succeeding quarter century.

When was wharf built?



Figures 14 and 15. Successive sand ridges show that this compound, recurved spit has been altered in shape frequently. Since 1935 rapid erosion has occurred on the seaward side and the secondary point of the spit has curved landward. Only the primary recurved point existed in 1839, as indicated by the Bayfield survey.

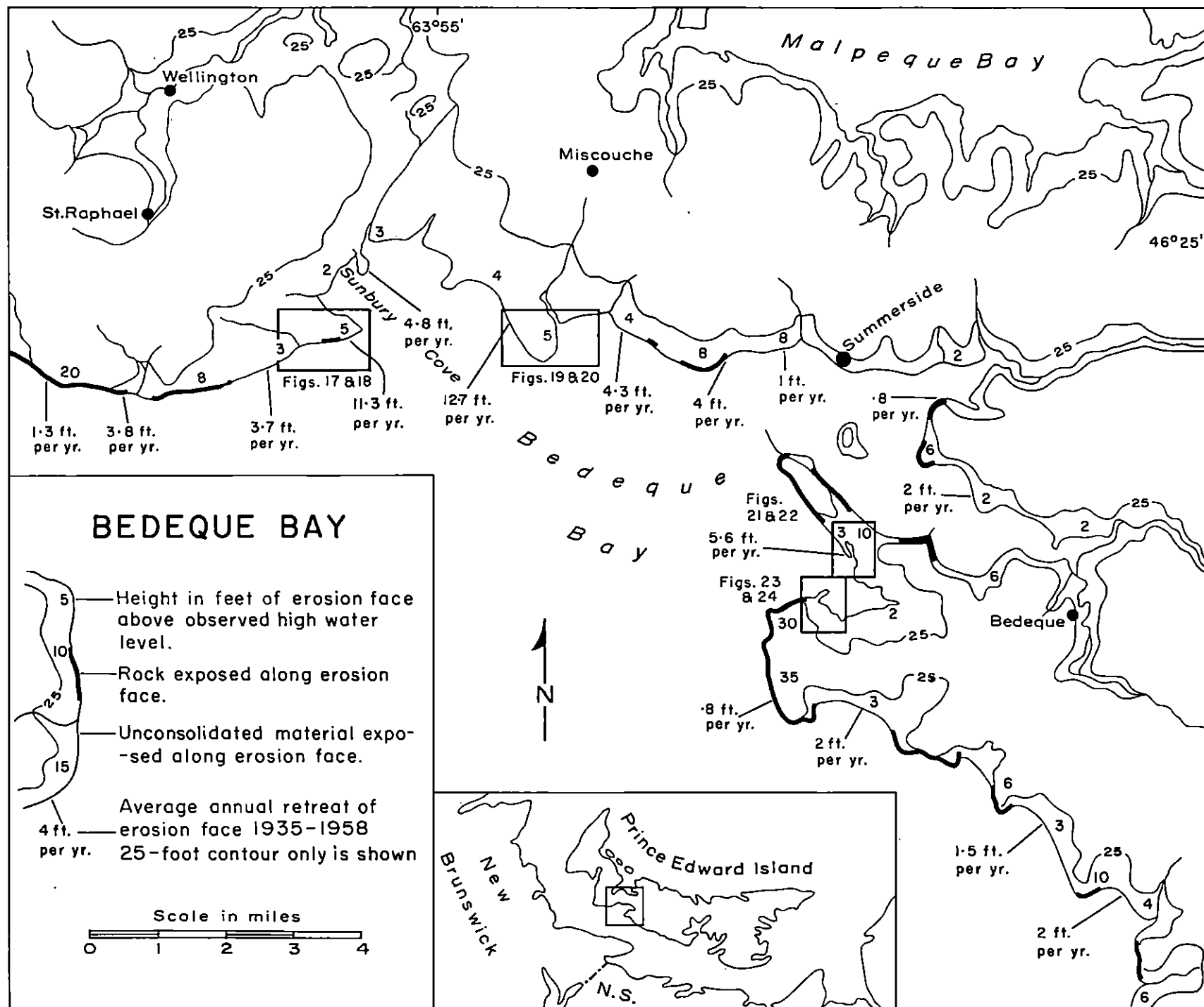
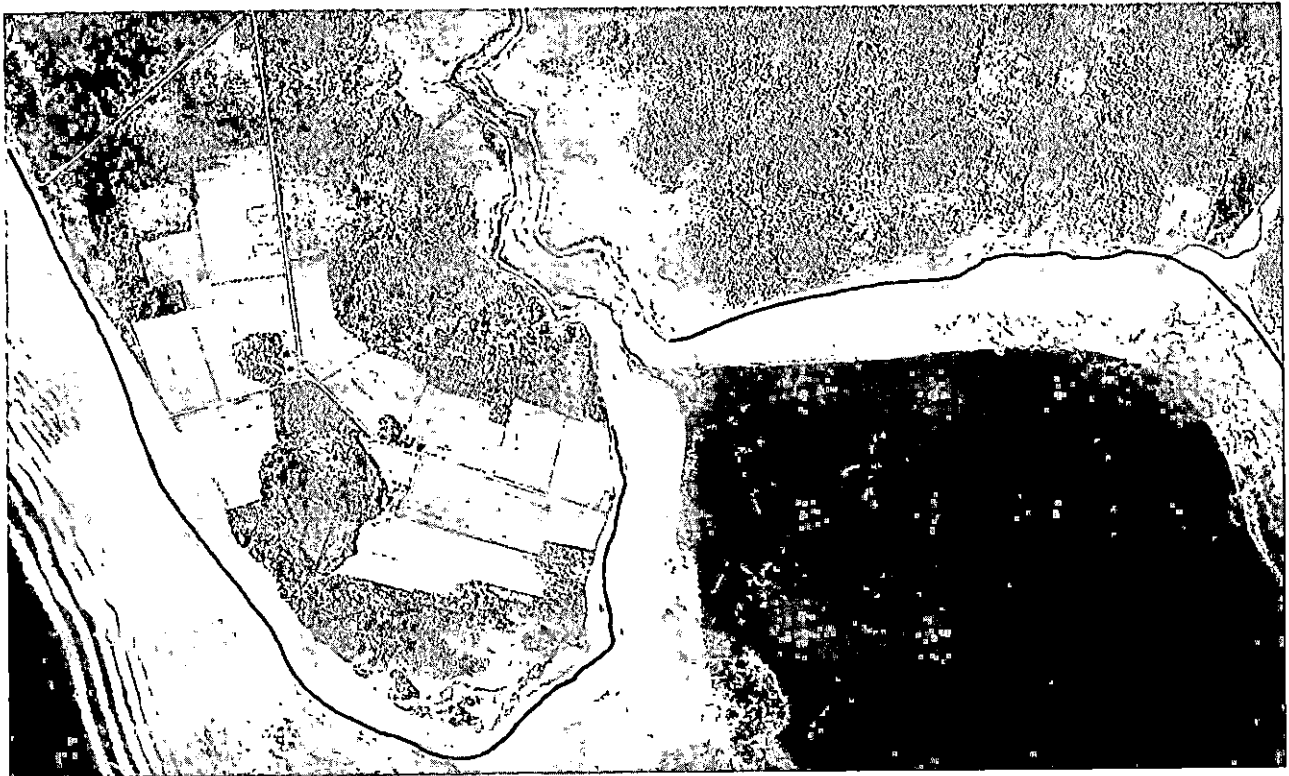


Figure 16. Shoreline character of Bedeque Bay and locations of photographs.



Figures 17 and 18. Sunbury Point is a remarkable example of rapid shoreline retreat. Except for a short section of rock, the coastline is of unconsolidated material. The rate of retreat varies, being slightly lower where the rock offers greater resistance and where deposition has occurred at the stream mouth. Shoreline retreat on the north side of the peninsula has been far less severe. The cusped bar at the end of the point has turned north and taken the form of a spit.



Figures 19 and 20. Miscouche Point has experienced a most alarming loss of land. On the west side of the peninsula the rate of retreat reaches nearly 13 feet per year at some points. The erosion face, of unconsolidated material, varies in height from 2 to 5 feet. During the brief span of 23 years large parts of several cultivated fields have been removed and the acreages of the farms considerably reduced.



Figures 21 and 22. This small spit has been pushed landward and slightly lengthened. The low bank at the base of the spit has also retreated at a rapid rate.



Figures 23 and 24. Situated on the opposite side of Salutation Cove is a spit which was formerly of much greater size. The 1839 chart shows a substantial sand feature that reached almost to the northern shore of the bay, constituting a baymouth bar. Since 1935 the spit has lengthened and become more attenuated.