

## Sequential Air Photo Interpretation in Coastal Change Studies

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### Introduction

The use of vertical air photos for mapping coast lines was begun almost as soon as their use in dry land mapping. It was quickly realized that detailed mapping of inaccessible coast lines was possible, and that many features, missed by shore or boat parties, were visible in the photos. Later, it became obvious that exact lines could be obtained at mean tide, or close to it, by special infra-red photo covers taken at exactly the right stage of the tide. The next step was the mapping of underwater detail in the shallow water zone. In Nova Scotia this has been extended to the mapping of seaweed beds, which has materially aided in the establishment of the present seaweed harvesting and processing industry. (Cameron, 1950).

The next step is the study of changes in coast lines brought about by current and wave action over a period of time. This technique is based on the comparison of photo covers of the same areas taken after the passing of a number of years. Because Nova Scotia was one of the first areas in Canada to be photographed we have photo covers going back to 1929 and earlier. By 1939 most of the Province had been covered, after a fashion, by the RCAF, which was then almost the only air photo agency in the country. After the war, the RCAF did a substantial part of west mainland Nova Scotia, but did not finish because of urgent requirements elsewhere in Canada, and the rise of civilian survey companies.

The Province contracted for the unfinished areas which were begun in 1947 and completed in 1948. This was to enable the Topographic Survey to finish the topographic mapping. The entire Province was rephotographed in 1953-55 for forest inventory. It is now in process of being rephotographed again for the same purposes. Both these covers are joint Federal-Provincial projects under the Forestry Act. It is now possible to study photo covers of our coastlines taken at intervals ranging from six to ten years, over a period of thirty-five years.

The present paper deals with two cases where obvious changes in beaches and harbour mouth bars have taken place. In one case the changes may result in benefits to fishing interests along the shore near by. This one is of special interest as it can be pointed out that the beneficial process could have been aided by small coastal works:- in fact may still be aided if the work is carried out. It is

# ROSE BAY AREA

LUNENBURG COUNTY, NOVA SCOTIA

CHANGES IN SHORELINE 1945-1955

SCALE: 1" = 660'

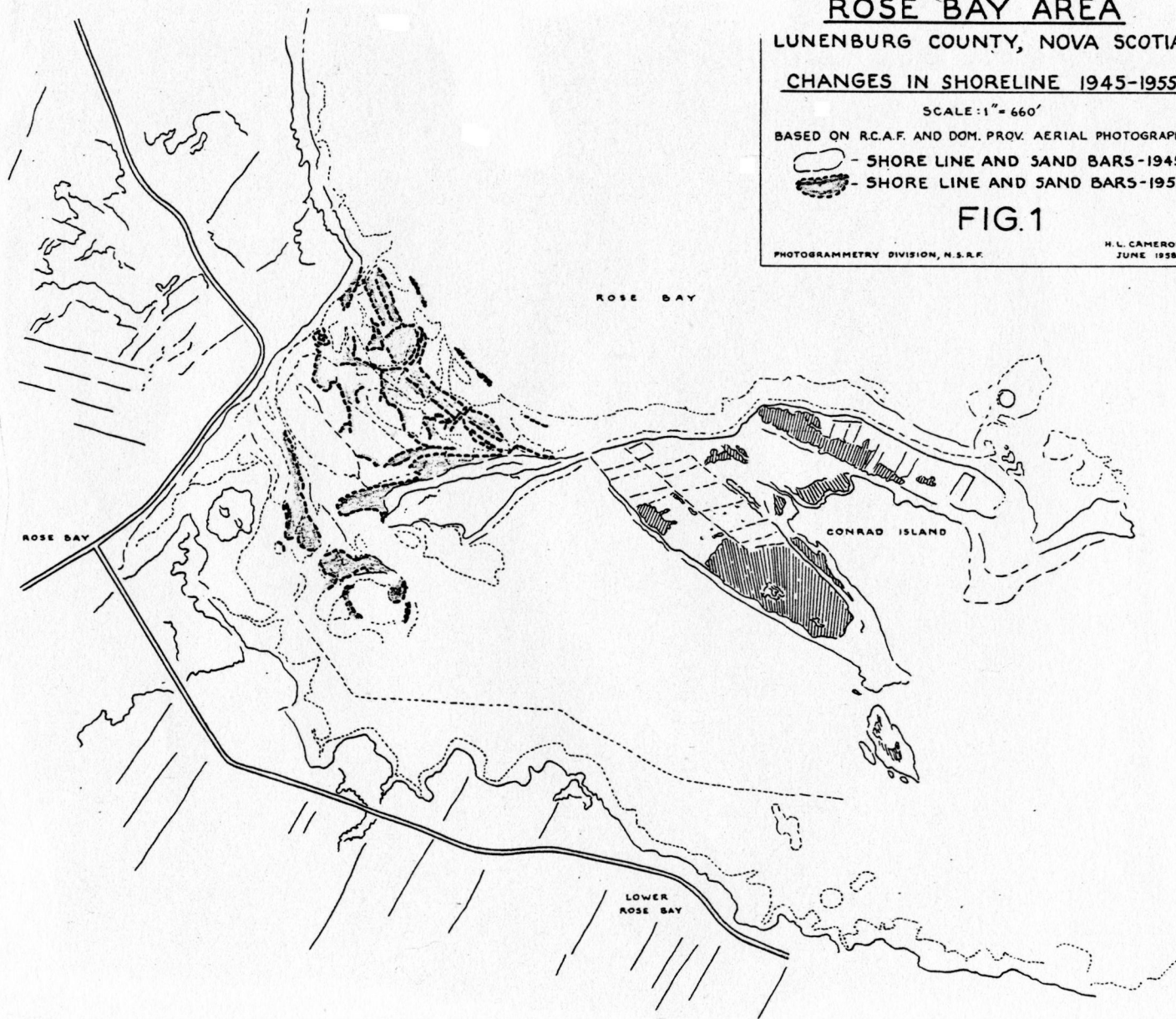
BASED ON R.C.A.F. AND DOM. PROV. AERIAL PHOTOGRAPHY

- SHORE LINE AND SAND BARS - 1945
- SHORE LINE AND SAND BARS - 1955

FIG. 1

PHOTOGRAMMETRY DIVISION, N.S.R.F.

H. L. CAMERON  
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suggested that this work be done as a test case, and, if successful, a complete air photo analysis of the entire coast line would be in order.

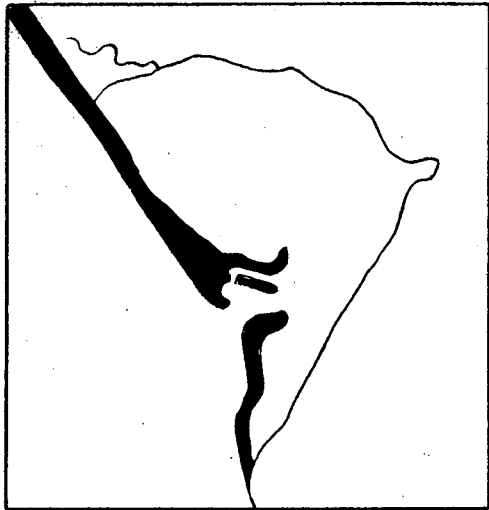
The case of Sable Island will require a separate paper. It is mentioned only because it is the only area in (or off) Canada which has been photographed four times with the deliberate intention of detecting changes in its coastal features. (Cameron, in press). It may be the only area in the world which has been so photographed.

### Rose Bay Area

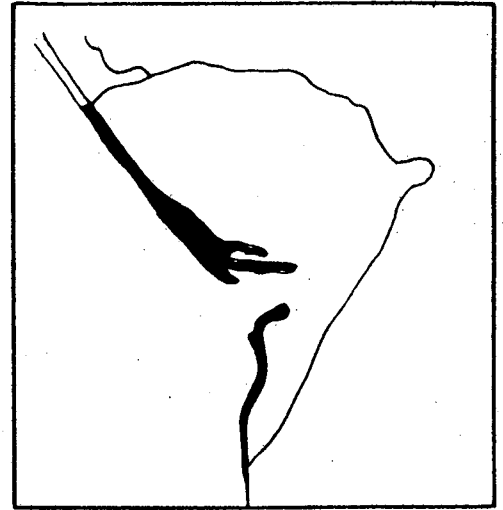
The Rose Bay area is in Lunenburg County, south of Lunenburg. Conrad Island comprises two elongated drumlins joined near their northwest ends. The long axes of the drumlins strike approximately northwest-southwest, which is the direction of major glaciation in this area (see Fig. 1, Sketch Map of Rose Bay). The northern end of the island has been eroded by the tidal currents which sweep in from the east and then southwest to form curved hooks on the east-west sand bar created by the current erosion.

The first cover of this area was taken in 1945 and shows the western extension of the bar. In addition the sweep of a longshore current from the north has brought sand down from the Rose Bay shore and heaped it in masses below the point on the mainland northwest of Conrad Island. It has the distinct appearance of the foundation of a tie-bar which would eventually link the Conrad Island west bar to the mainland. A feature to be noted is the dredged channel with branches to small shore stations, which extends from the village of Lower Rose Bay, along the shore west of Conrad Island. It is obvious from the photos that the sand drift from the west bar was being carried west and south into the dredged channel and would require periodic dredging.

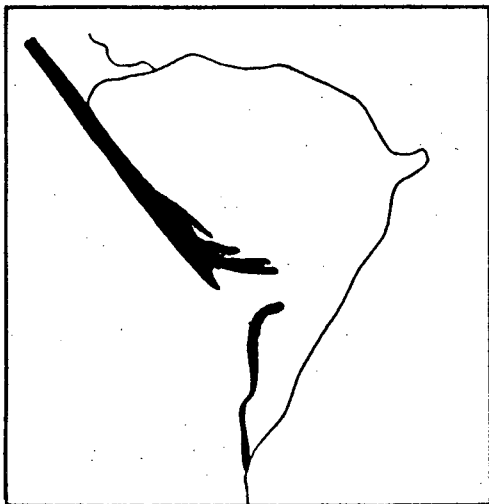
The next photo cover was obtained in 1955 and the extensions of the island bar and the now distinct coastal tie-bar are shown in black in Fig 1. The west bar has been built west-ward approximately 600 feet and curved spits built on the western extremity. The coastal bar has assumed definite shape and the channels through it are distinct and it has definitely connected with the west bar, possibly to the extent of cutting down the west bar drift. If and when these bars coalesce this drift will be entirely stopped and dredging will be unnecessary in the channel west of Conrad Island. It is suggested that this junction could be hastened by dumping a line of heavy rocks along the obvious join line to speed up the completion of the tie-bar. If this relatively minor piece of coastal engineering proves successful then an intensive study of the coast would be indicated to locate other areas where similar works could be carried out.



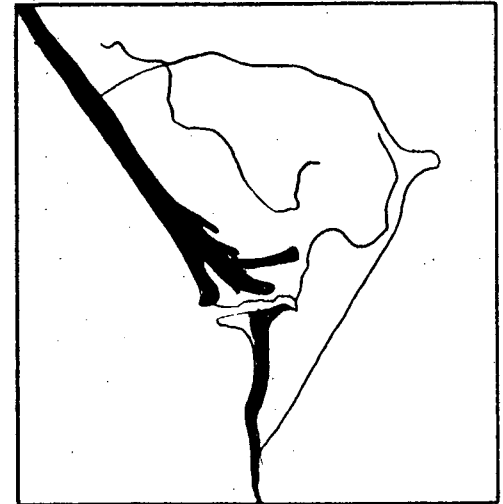
1939



1945



1950



1960

FIG. 2

ADVOCATE HARBOUR AREA  
NOVA SCOTIA

SHOWING CHANGES IN HARBOUR MOUTH BARS  
FROM 1939 TO 1960

The most notable thing about the Rose Bay area is the relative rapidity of erosion and bar extension. From work elsewhere (Carter, 1954) it is believed that present sea level around Nova Scotia was reached by a 25 foot rise about 4,500 years B.P. It would be interesting to extrapolate and reconstruct the Conrad Island drumlins before drowning and current erosion.

### Advocate Harbour

This area is of interest in that it is in the Bay of Fundy zone of extreme tides. The harbour is the result of the growth of a sand bar by long shore drift from near Cape Chignecto toward the headland of Cape D'Or. The west harbour bar is the largest and most important. The south harbour bar is short with a section folded back against the Cape D'Or coast. The harbour entrance is the result of the inability of the shore drift to build a complete wing bar because of the scour created by the great tidal range in this area.

Sequential photo covers begin in 1939 and extend to 1959. The main features of interest are the spits on the ends of the harbour mouth bars. The outlines with dates are shown in the solid outline in Fig 2.

### Conclusion

Two cases of coastal changes have been briefly outlined. Many others have been noted and are now being studied. It appears obvious that Nova Scotia, with its existing sequential photography, offers an excellent proving ground for this method of study. Taken in conjunction with tidal current studies by stereo photography (Cameron, 1952), it would appear that complete coastal phenomena studies are now possible. The writer is now working on a general study of the entire coastline of the Province as a basic foundation for detailed studies of areas of interest to both scientists and engineers.

### References Cited

- CAMERON, H.L., 1950, The use of aerial photography in seaweed survey:  
Photogrammetric Engineering, v. 16, p. 493-501
- 1952, Water current measurement by parallax methods:  
Photogrammetric Engineering, v. 18, p. 99-104
- in press, Sable Island: Geographical Review

CARTER, A.L., 1954, Age determination of a submerged tree stump by Carbon - 14 analysis: Proc. Nova Scotian Inst. Science, v. 23, p. 423

The following recent sediment studies are reported by the GEOLOGICAL SURVEY OF CANADA in Paper 65-1, Report of Activities: Field, 1964, published in 1965:

BARTLETT, G.A., Marine geology studies, Atlantic Provinces: p. 138

BUCKLEY, D.E., Preliminary statement on sedimentology study of beaches at Belledune Point, Chaleur Bay, New Brunswick: p. 138-139

HOOPER, K., Post-Wisconsin microfauas and sediments of eastern Canada: p. 146-147

KING, L.H., Bottom-sediment studies on the Scotian shelf southeast of Halifax, Nova Scotia: p. 147-148

KRANCK, K., Marine geology in Northumberland Strait off Richibucto River, New Brunswick: p. 148

MARLOWE, J.I., Reconnaissance geological exploration on the continental shelf off Nova Scotia: p. 148-149

PELLETIER, B.R., Bottom studies on the Arctic continental shelf (Polar continental shelf project): p. 12

VILKS, G., Bottom sediment and foraminiferal studies in Satellite Bay, Prince Patrick Island, District of Franklin: p. 15-16

VILKS, G., Foraminiferal studies of Gulf of St. Lawrence, St. Lawrence and Saguenay Rivers: p. 160-161