Inlet Migration and Salt Marsh Evolution in the St. Jean Estuary, Gaspe Peninsula, Quebec

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Introduction

The St. Jean River empties into Gaspe Bay, off the Gulf of St. Lawrence, through a sand spit barrier system and salt marsh estuary. The main goal of this project is to illustrate the migration of the barrier system and the general evolution of the Haldiman and Douglastown spits of the St. Jean Estuary, by examining the microtopography, channel morphology, sedimentation, and vegetational zonation of the adjacent salt marsh.

Methods

Janet Yun and I employed field observations, aerial photo interpretation, and topographic mapping in our study of the salt marsh evolution. In the field we used a TOPCON EDM Theodolite for surficial mapping and a Magellan Nav. 5000 Global Positioning System for location determination. We examined several aerial photographs dated 1946, 1961, 1962 and 1976. In addition to surveying and mapping of the entire salt marsh, we chose "dig" sites from various areas within the marsh to produce stratigraphic information as far down as the water level would allow (maximum depth of around 1 meter). In the lab, we analyzed and processed images of the salt marsh and generated contour maps and perspective drawings (figures 1, 2, and 3). A microscopic sediment analysis was performed by Janet Yun on the samples taken from the dig sites. These methods aided us, through comparison and illustration, to a better understanding of the current barrier system and how it may have evolved to its present state.

Observations

We observed three distinct zones within the marsh (figure 3). The youngest zone consists of the current flood tidal delta, ebb tidal shield, and surrounding tidal flats. This area is entirely composed of sand and silty sediments. Few scattered clumps of highly degraded peat were identified and appeared to have floated to their present locations. Except for the topographically high areas on the ebb tidal shield, this zone is primarily under water except during the lowest of spring tides.

The tidal flats are followed in maturity by the low, or young marsh. This zone is subjected to daily tidal inundation, and consists of a variety of features. These include areas of sand, mud, peat, emerging vegetation, tidal channels, scattered salt pannes, and a host of bivalves and other marine and avian life.

The young marsh is followed in maturity by the high, or mature marsh. We define the high marsh with the appearance and frequency of localized areas of *Spartina patens*, dense patches of other grasses (e.g.. *S. alterniflora, Salicornia sp.*), a stable and well established peat, and a variety of stages in salt panne evolution. The salt panne stages are more clearly defined than in the low marsh. Some are dry, while others are filled in and occupied by *Salicornia sp.*

The high, or mature marsh merges into very-mature marsh with terrestrial sediments in the southern-most corner of the estuary.

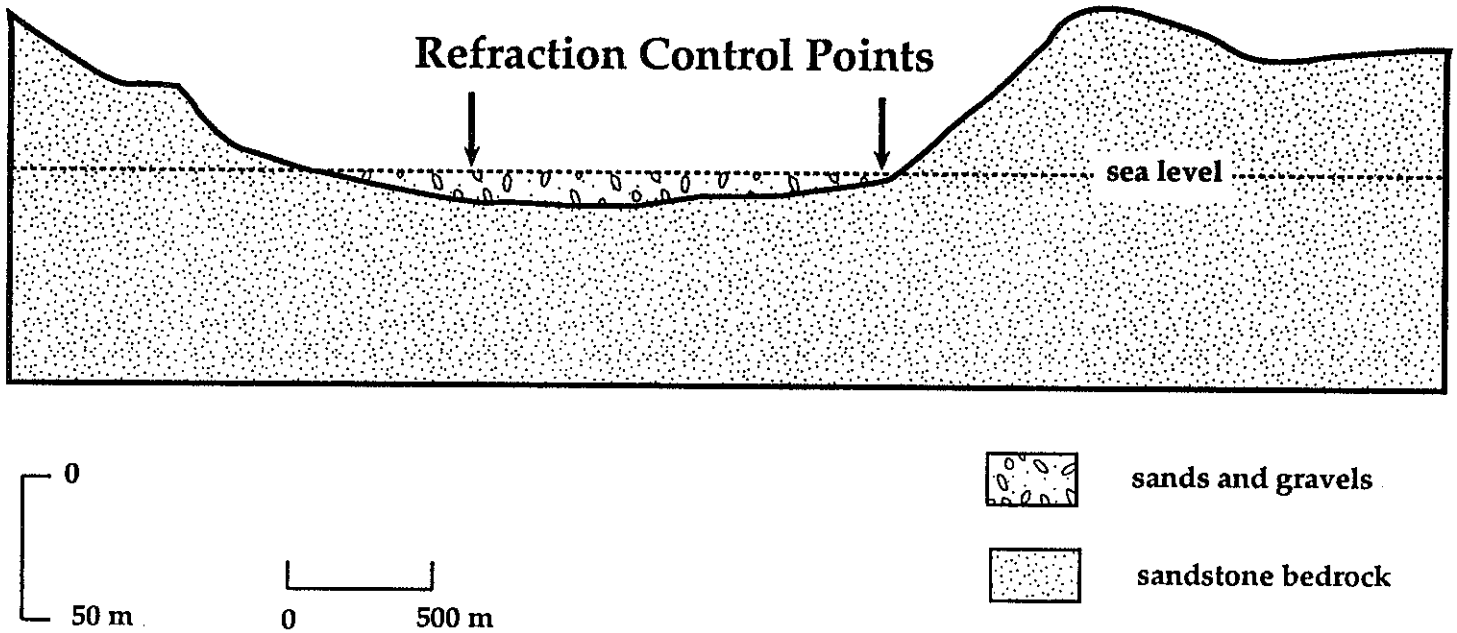


Figure 3. Subsurface geology beneath the St. Jean Estuary at a point three kilometers upstream from the mouth of the estuary based on seismic refraction results.

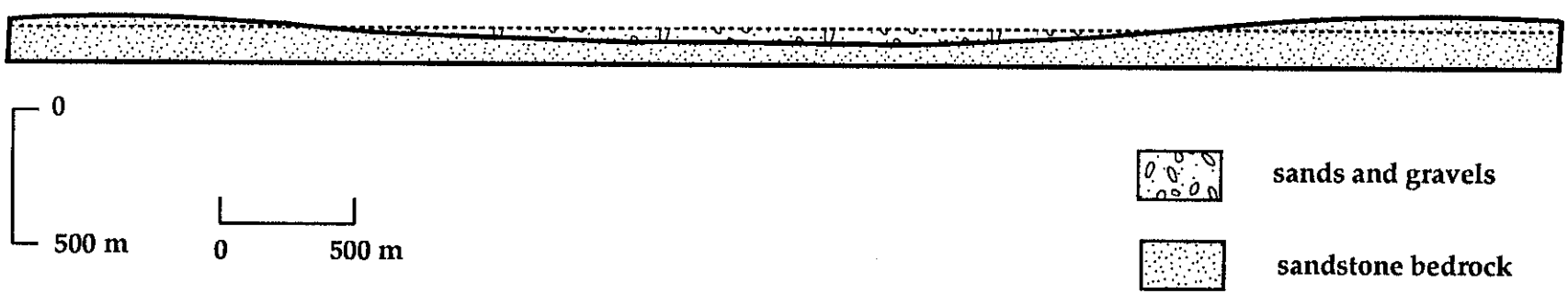


Figure 4. Figure 2 redrawn with horizontal and vertical scales equal. This shows that the true form of the St. Jean River valley is broad and flat-bottomed.

Results

Our results show a complex, northerly channel migration, and southerly marsh maturation, as well as a southerly rise in elevation (over-all vertical relief of 2 meters).

As illustrated in figure 4, we were able to create a simple model showing the northerly migration of the delta system. Figures 4a (at time zero) and 4b show the earlier locations of the inlet and indicate that the inlet did not slowly migrate north along the sand spits, but that it "jumped" from south to north in two stages to its present location (figure 4c). This is based on physical evidence (e.g.. channel patterns) of the possible location of earlier breaches through the Douglastown spit.

Conclusion

We conclude that the St. Jean Estuary and the associated spits have not always been stable and have in the past, looked much different than today. Further investigation of past flooding events and increases in sediment deposition and soil erosion farther up the St. Jean River, may indicate future changes in the pattern of migration. It may also reveal the effects of human interaction with the surrounding environment (i.e. logging and construction), and how this may influence the evolution of the St. Jean Estuary and the ecosystem that thrives there.

Black and white computer image of the 1976 aerial photograph of the St. Jean Estuary

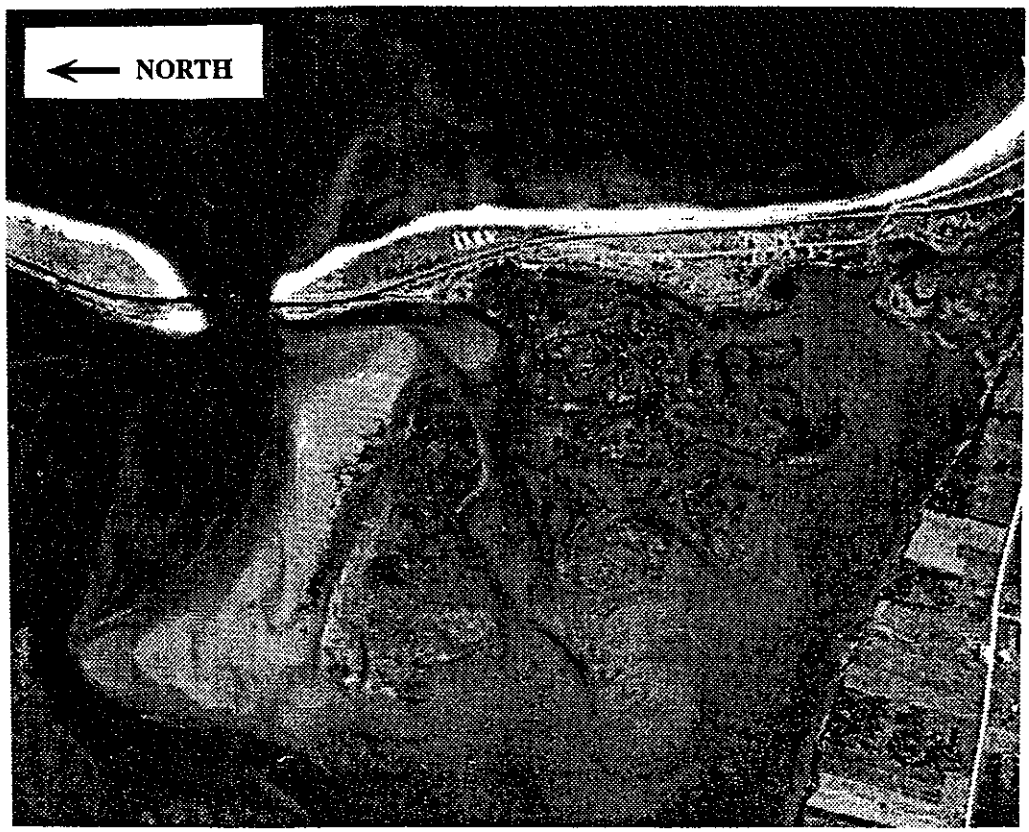


Figure 1 : vertical relief : 2 meters within the marsh

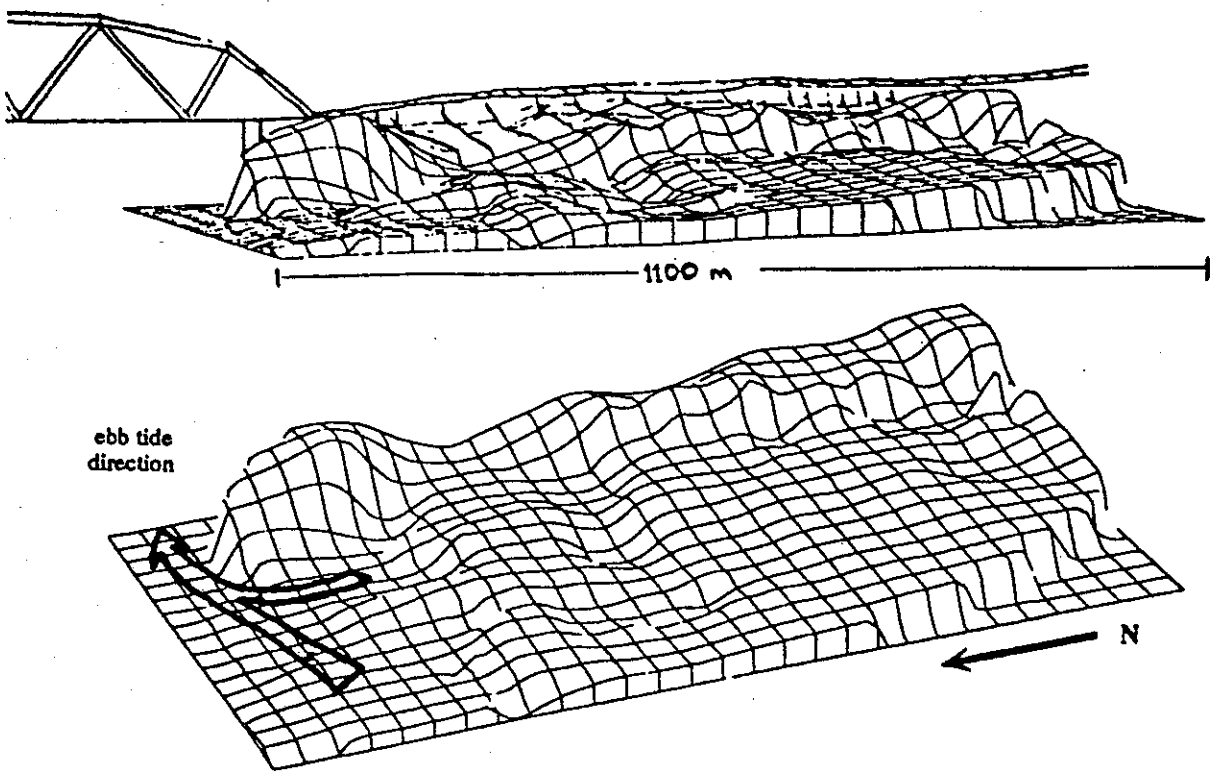
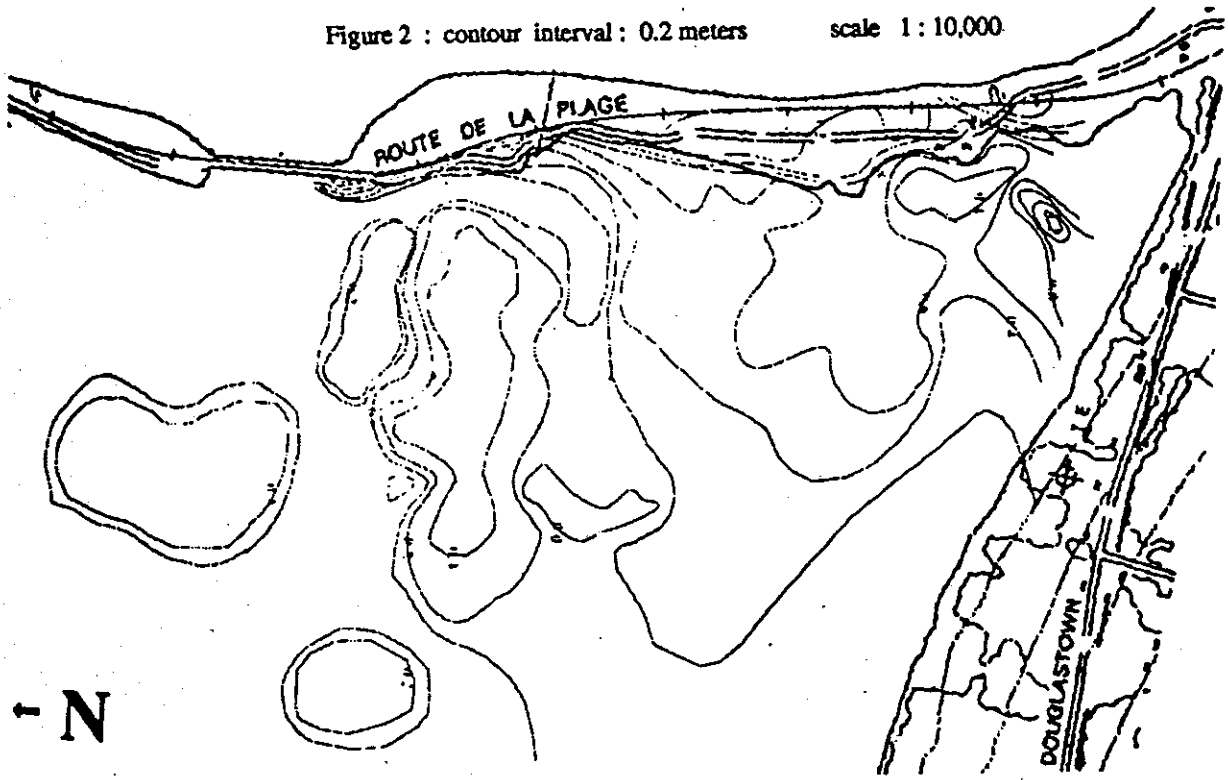


Figure 2 : contour interval : 0.2 meters scale 1 : 10,000



Figures 1 and 2 : Perspective image and contour map showing the microtopography of the salt water marsh.

Figure 3 : map of marsh zonation

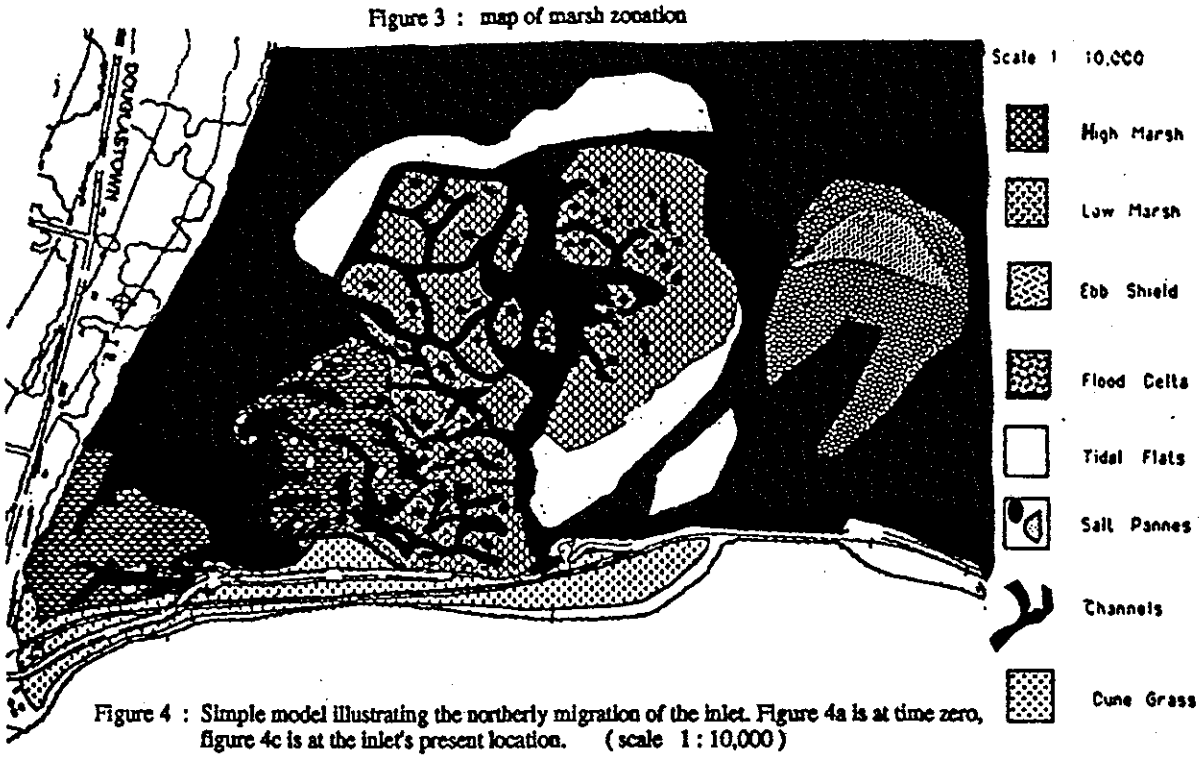
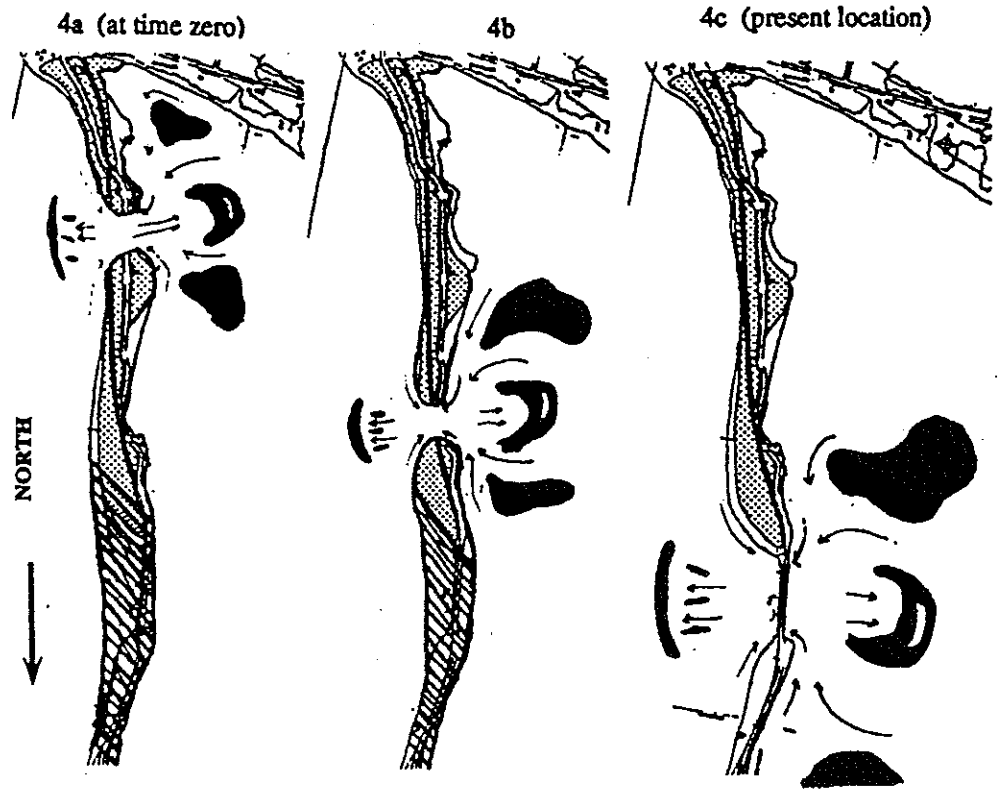


Figure 4 : Simple model illustrating the northerly migration of the inlet. Figure 4a is at time zero, figure 4c is at the inlet's present location. (scale 1 : 10,000)



River Delta Evolution, Water Volume Distribution, and Flood Tide Channel Formation in the St. Jean Estuary, Gaspe Quebec

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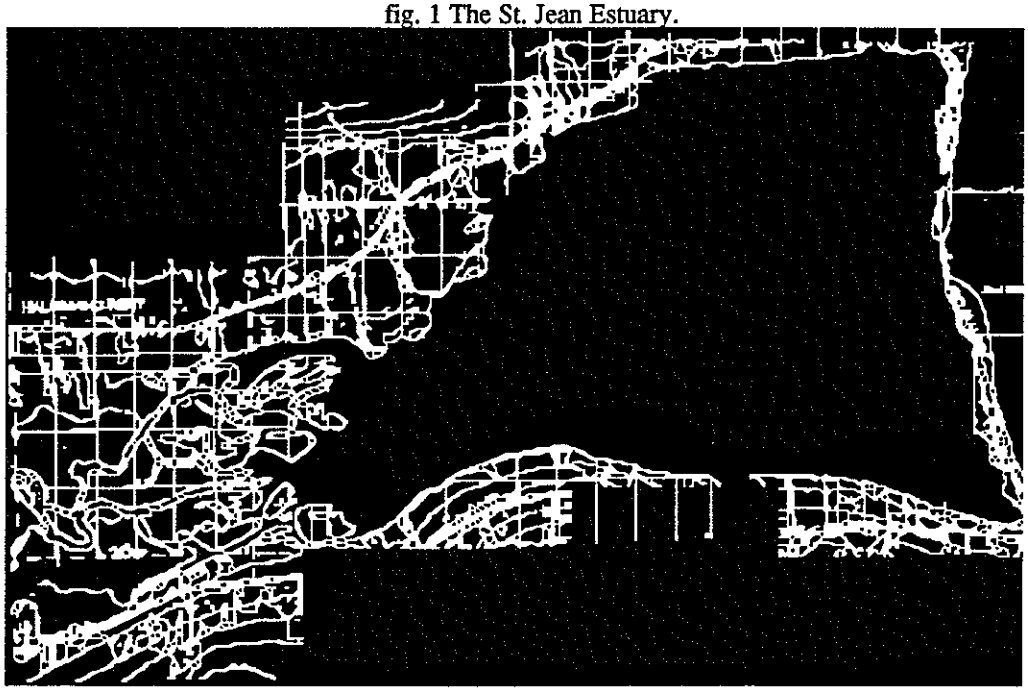
Introduction

The St. Jean River drains much of the Gaspe Peninsula in south eastern Quebec. It is a shallow river, with a width of about fifty meters. The river drains into the St. Jean Estuary located on the south eastern shore of the Bay of Gaspe. The estuary takes up an area of about 5.5 km^2 (Figure 1)

The area has been subject to change due to flooding of the St. Jean River, and the migration of the mouth of the estuary along the Hamilton and Douglastown Spits. Both sediment distribution and debris dam formation are partially a function of river delta evolution and periodic flooding. Flood tide channel position is linked to migration of the estuary mouth along the two spits.

fig. 1 The St. Jean Estuary.



Methods

Water discharge along the St. Jean and its main delta channels were measured to give an estimate of the amount of water the fresh water system was contributing. A Price-AA water current meter was used in these fresh water measurements.

For tidal height fluctuations at the back and north central part of the estuary, two stilling wells were set up, and equipped with Stevens well recorders.

Aerial photographs from 1942, 1961, 1962, 1976, and 1992 were all used to determine evolutionary processes within the estuary. These aerial photos were scanned into a Macintosh computer, then manipulated and studied with Canvas 3.05 (Deneba Software, 1991).

Results

The river delta changing through time is mainly due to sediment distribution and debris dam formation. The main flow channel itself, has moved several times from 1948 to present. Sediment distribution in the form of sand bar growth, tracks progression of delta flow.