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MERMAID POND AND ITS RELATIONSHIP TO THE SOUTHEASTERN GREAT LAKE SYSTEM OF SAN SALVADOR

John H. Winter
Department of Chemistry, Physics and Earth Science
Molloy College
Rockville Centre, New York 11570

ABSTRACT

The inland lake system of San Salvador is often characterized as having hypersaline conditions. Yet, subsurface tidal flows permit marine conditions to exist within Mermaid Pond and South Stout's Lake. These marine conditions make the southeastern inland lake system of San Salvador atypical. As a result of these tidal flows, surface water replenishes water levels within the hypersaline areas of Carl's Cove and North Stout's Lake. The existence of the reef silverside (Allanetta), normally a marine coastal species, makes Mermaid Pond and South Stout's Lake unique inland lake systems.

INTRODUCTION

Winter (1990) presented evidence that Stout's Lake consists of three different ecological zones. The northeastern portion, North Stout's, is hypersaline with a historic stone causeway across its southwestern border. To the southwest of the causeway is a red mangrove delta. Beyond the delta, to the southwest, is a body of water with marine conditions, South Stout's. A further survey of the shoreline and marine conditions of and around South Stout's reveals another marine system known as Mermaid Pond (Figure 1).

An overview of the study area is seen in a 1942 aerial photograph (Figure 3). The large dark oval at the bottom left is Mermaid Pond. The white area above it is a mud flat through which surface water cuts a channel. Beyond the mud flat lies South Stout's, the red mangrove delta, and North Stout's, the white area. thisTo the left of the red mangrove delta and parallel to Stout's Lake is a light grey area known as Carl's Cove. Swidden agriculture is evidenced as white patches within the dense vegetation.

MERMAID POND

The pond is oval shaped, about 300 meters long and 200 meters wide. Red mangrove (Rhizohora mangle) surrounds the pond. The pond has a depth of one meter at the mangrove's inner edge. A 4.5 meter depth within a one meter wide solution hole conduit is the deepest point. The pond is funnel-shaped, with the northern slope being the steepest.

The sediment along the inside edge of the red mangrove is a grey/black color. It is underlain by a compact shell layer.

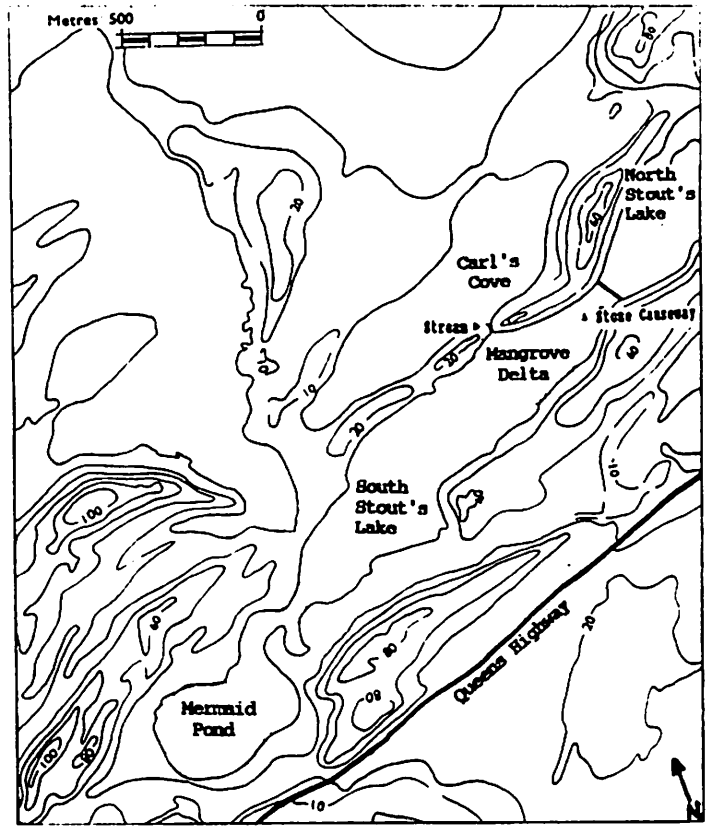

Figure 1. Map of Mermaid Pond, Stout's Lake and Carl's Cove

Away from the mangroves, the bottom becomes covered with beds of Acetabularia (Mermaids umbrella). In the deeper parts of the pond, a rock bottom is visible. This same region reveals two solution hole conduits, as well as lateral cracks in the rock bottom. Sub-surface water has been seen flowing in and out these holes and cracks.

Between January 11th and 14th, 1992, an electrical-capacitance tide gauge recorded the water level in Mermaid Pond. The gauge recorded two daily high and low tides (Figure 2). Pond tides lagged an average of three hours behind the ocean tides.

Using a YSI Model 33 S-C-T meter, salinity readings were taken on July 15, 1991 and January 20, 1992. At the 4.5 meter depth within the one meter solution hole conduit, salinity readings measured 34 parts per thousand. Near the edge of the red mangrove, the salinity measured 35 parts per thousand.

The pond can be very turbid with visibility reduced to less than two meters. A reconnaissance revealed several faunal elements. This is probably only a partial listing and further study may reveal more.

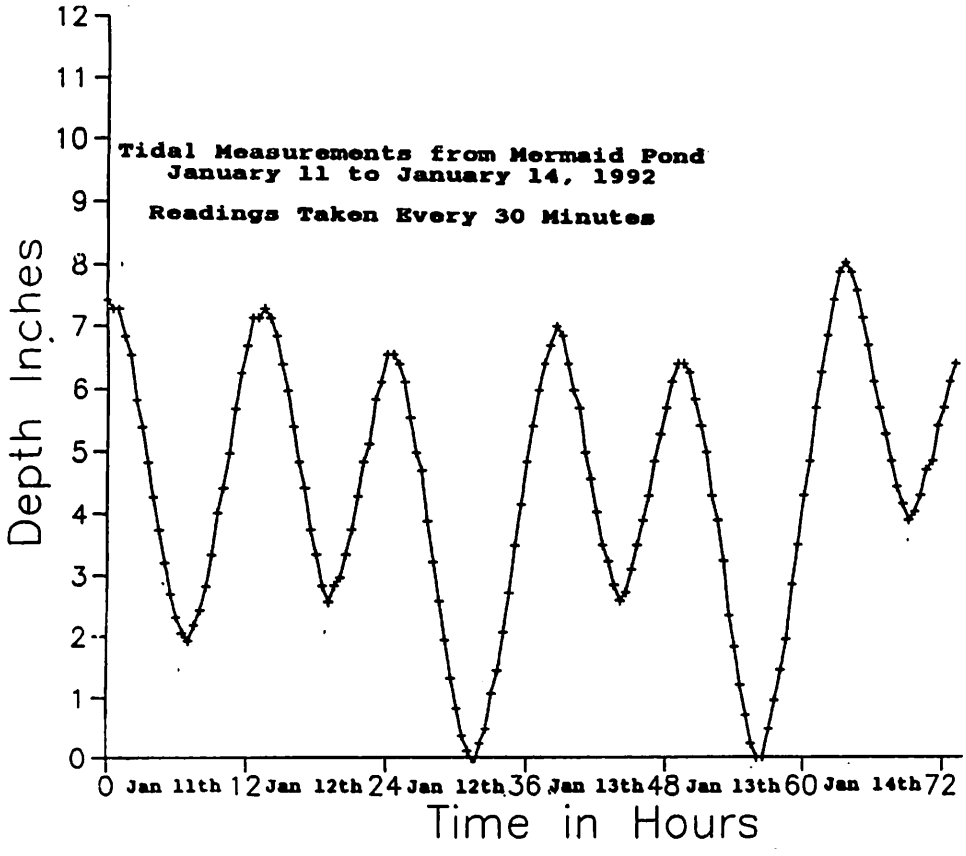

Figure 2. Tidal Cycles in Mermaid Pond - January,1992

Among the red mangrove roots are Aiptasia pallida (pale anemone), Isognomon alatus (mangrove oyster), and Pinctada imbricata (Atlantic pearl oyster). Within the sediment below the mangrove, there is a sponge - Aplysina fistularis (fulva). An unusual sponge also lives in the solution hole conduit. According to Dr. Rob van Soest of the University of Amsterdam, this is a Cinachyra subterranea. Within the Acetabularia beds and soft sediments are the burrows and gelatinous egg masses of Arenicola cristata (lugworm).

There are three varieties of fish in the pond. Two species live near the red mangrove root system and inhabit the bottom sediments: Gambusia puncticulata (mosquito fish) and Cyprinodon variegatus (sheepshead minnow). The third variety makes use of the entire pond's upper surface waters. This is Allanetta harringtonensis (reef silverside). The reef silverside is seen normally in the shallow waters off the San Salvador coast. This may be the first sighting of this fish within the inland water system of San Salvador.

MUD FLAT

North of the red mangroves surrounding Mermaid Pond is a flooded mud flat region. It appears that water flows under and through the red mangrove from Mermaid Pond into the soft sediments of this area. At the northeastern edge of this area, a 78 meter long surface channel cuts through another mud flat area (Figure 5). The channel passes through a small red and black mangrove (Avicennia germinans) region and empties into South Stout's Lake. The salinity within the channel, on January 20th, 1992, was greater than 40 parts per thousand.

SOUTH STOUT'S LAKE

Stout's Lake is an elongated lake running between two lithified dune ridges in a northeasterly/southwesterly direction. Its total length is about 4,500 meters. The southern portion is about 1,000 meters long and 300 meters wide. Red mangrove grows along most of the shoreline. There are some small areas of exposed lithified dune outcrops. The lake appears to have a maximum depth of three meters

Figure 3. Aerial View of Mermaid Pond, Stout's Lake and Carl's Cove

The southeasterly shoreline has a smooth slope, but karstified rock rims much of the northwesterly shore (Figure 6). The bottom sediment of the southern portion of the lake is very compact and shelly in places. In other areas a rock bottom exists below a thin brown sediment layer. Acetabularia and Halodule wrightii (shoal grass) cover much of the shallows.

In the area where the surface channel enters the lake, the bottom is very hard. West of the surface channel, there is a red mangrove region surrounding the lake. Behind the mangrove is a dried mud flat with buttonwood (Conocarpus erectus) trees. On the east side of the channel there is a small lithified dune.

In a cove-like area of the dune, water can be seen flowing into and out of the Lake (Figure 7). Several meters behind and slightly above this area there is an opening in the dune. Within the opening, the water is six centimeter deep. This water flows into the cove-like area. A look inside the opening reveals the presence of rhizomorphs within the lithified dune (Figure 8). Immediately behind the lithified dune ridge is a dense red mangrove forest.

A Ryan temperature recorder was placed in the opening and submerged in the water from January 7th to January 11th, 1992. The chart reveals two daily high and low temperatures (Figure 4). The high was 24° C, while the low varied between 19° and 22°C. It seems that in January the sub-surface water entering the lake is warmer. Then as the lake drains, the cooler lake water enters the sub-surface system. The temperature cycles correspond to those of the tide gauge in Mermaid Pond, but with a 20 to 30 minute lag. The lowest temperature occurs at low tide with the lake draining.

The salinity of South Stout's Lake ranged between 32.5 to 39.5 parts per thousand. The salinity of the water flowing through the opening in the lithified dune was 37 parts per thousand on January 20th, 1992.

Both South Stout's and Mermaid Pond contain similar faunal elements. These include the three varieties of fish and mollusc assemblages. According to Dr. Rob van Soest of the University of Amsterdam, a species of sponge (Hymeniacidon heliophila) is found near the entrance to the sub-surface water flow of the lithified dune. There is also Batophora oerstedi growing below the water level along the lithified dune.

RED MANGROVE DELTA

The delta begins some 1000 meters north of where the surface channel enters South Stout's. The delta is about 400 meters long and 100 meters wide. Along the southern edge, the red mangrove merges into buttonwood forests at the base of the lithified dune. There is a one to three meter wide branching surface waterway that separates the lithified dune from the mangrove on the northern edge (Figure 9).

The waterway begins behind a section of red mangrove at the northern end of South Stout's Lake (Figure 10). One branch makes its way northeasterly until it meets the previously mentioned stone causeway (Figure 11). Here the flow merges with the hypersaline region of North Stout's Lake.

Apparently, the building of this stone causeway during the plantation period in San Salvador Island's history altered the Lake's environment (Figure 12). The causeway blocked the normal flow of water within the lake. This lead to the settling out of sediment to form the platform for the red mangrove delta.

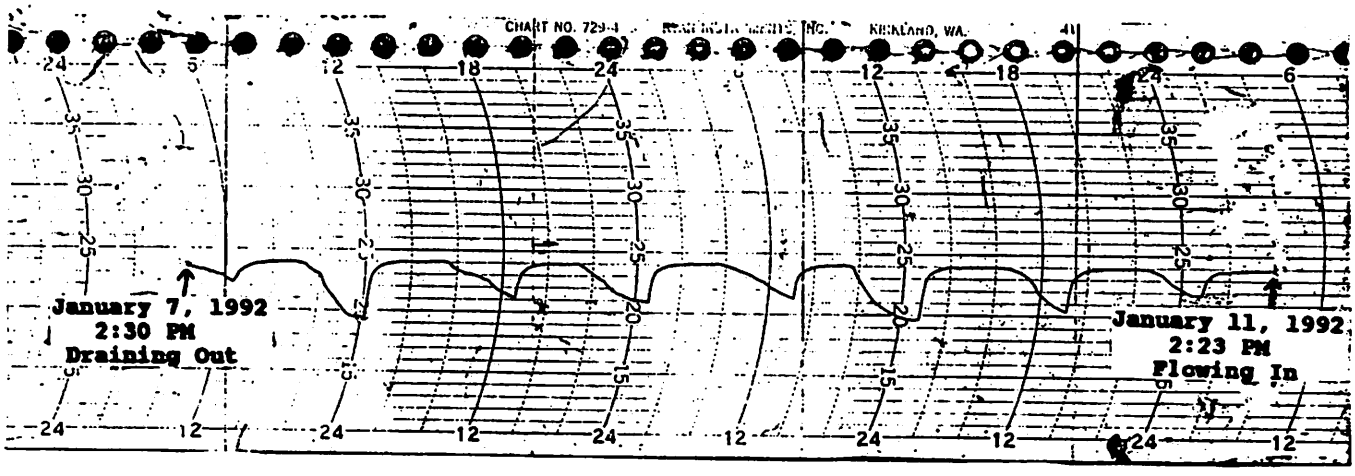

Figure 4. Tidal Cycles at Conduit in South Stout's - January, 1992

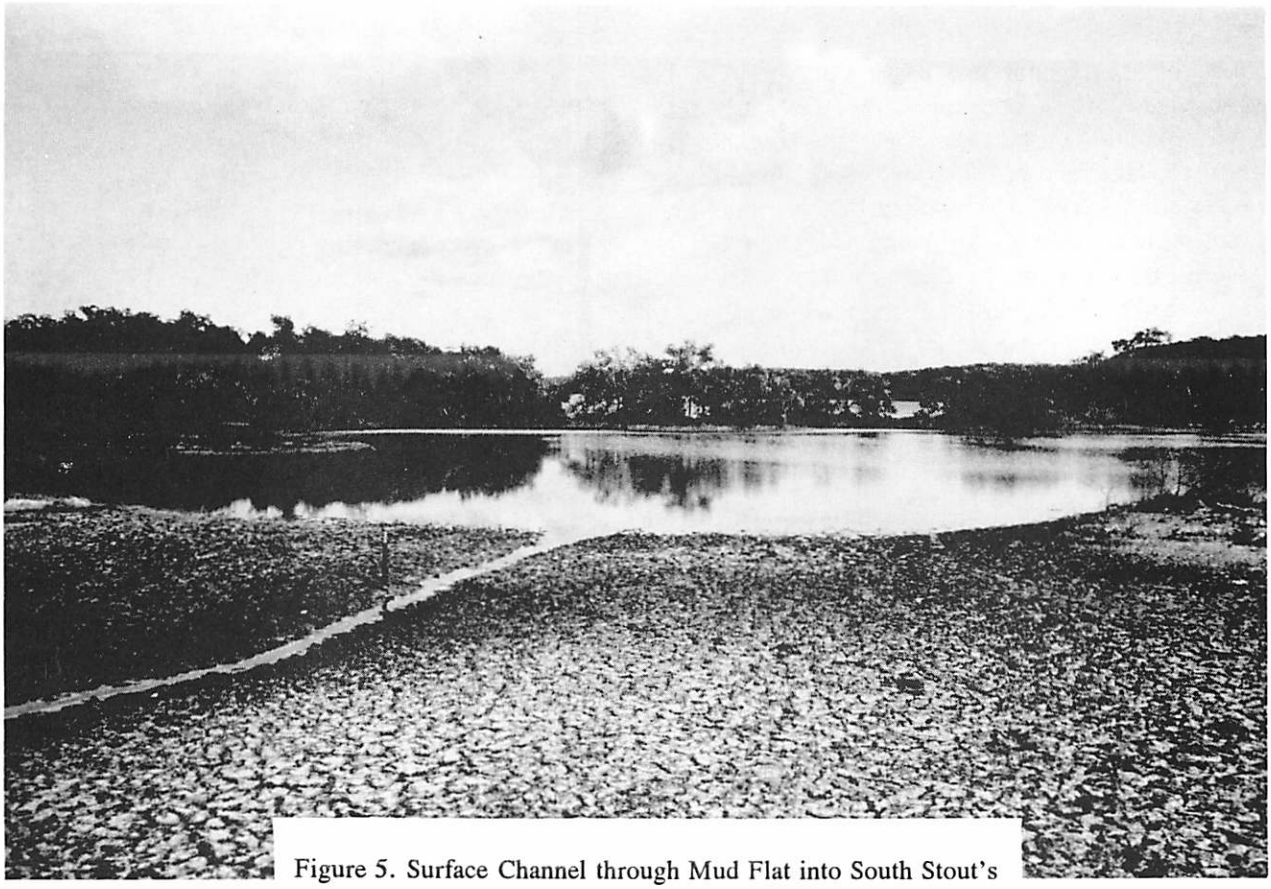

Figure 5. Surface Channel through Mud Flat into South Stout's

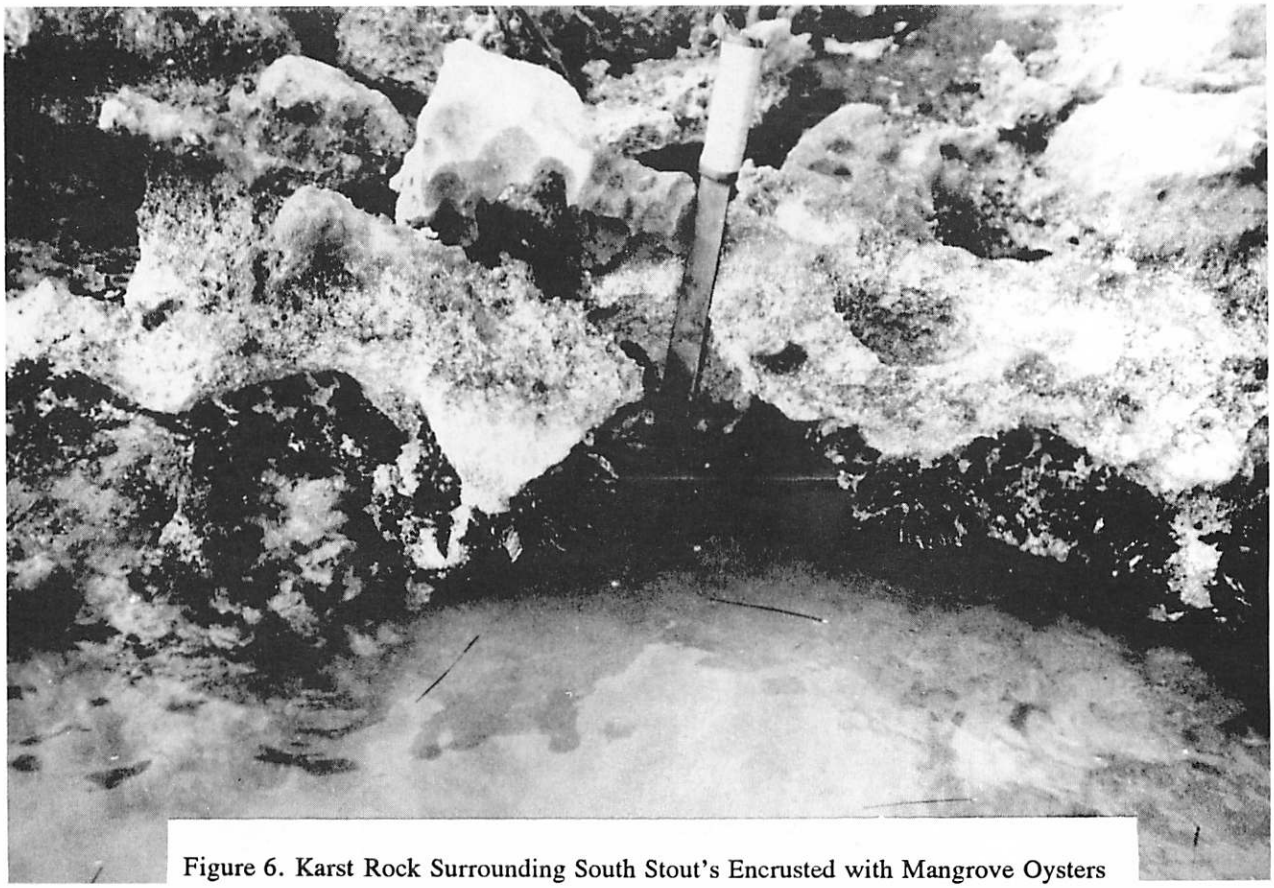

Figure 6. Karst Rock Surrounding South Stout's Encrusted with Mangrove Oysters

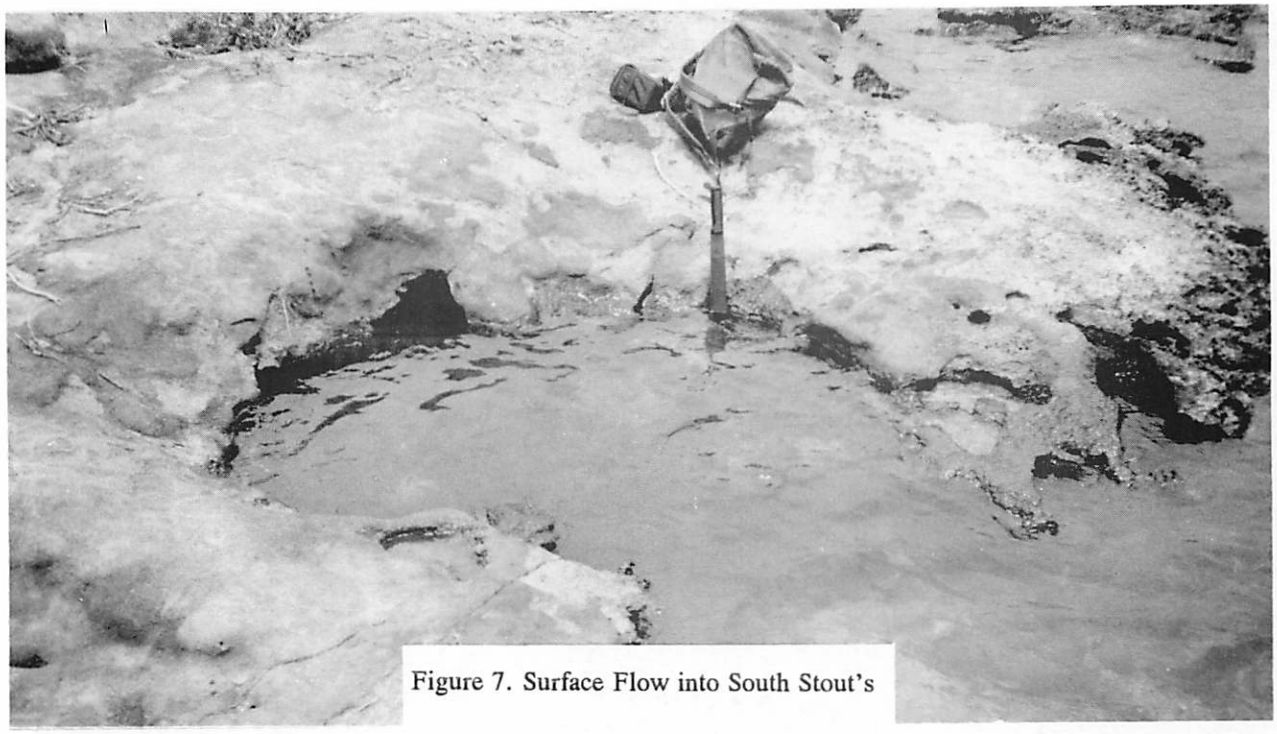

Figure 7. Surface Flow into South Stout's

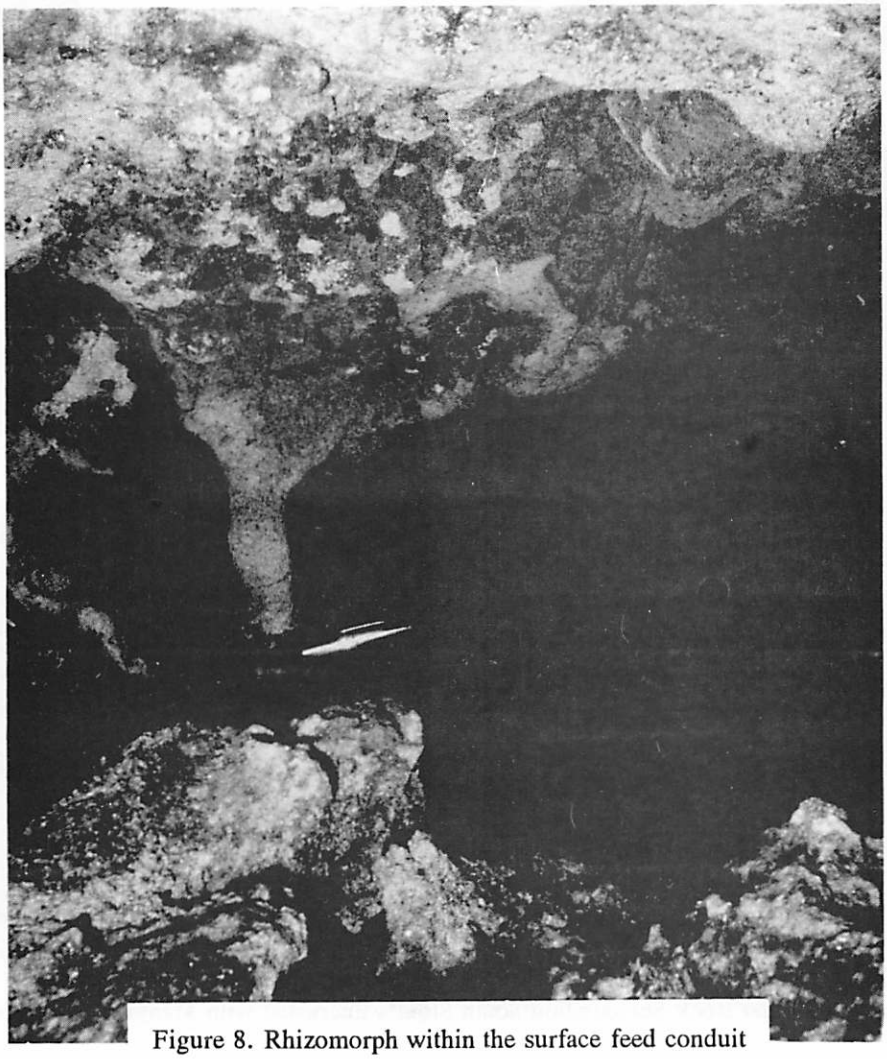

Figure 8. Rhizomorph within the surface feed conduit

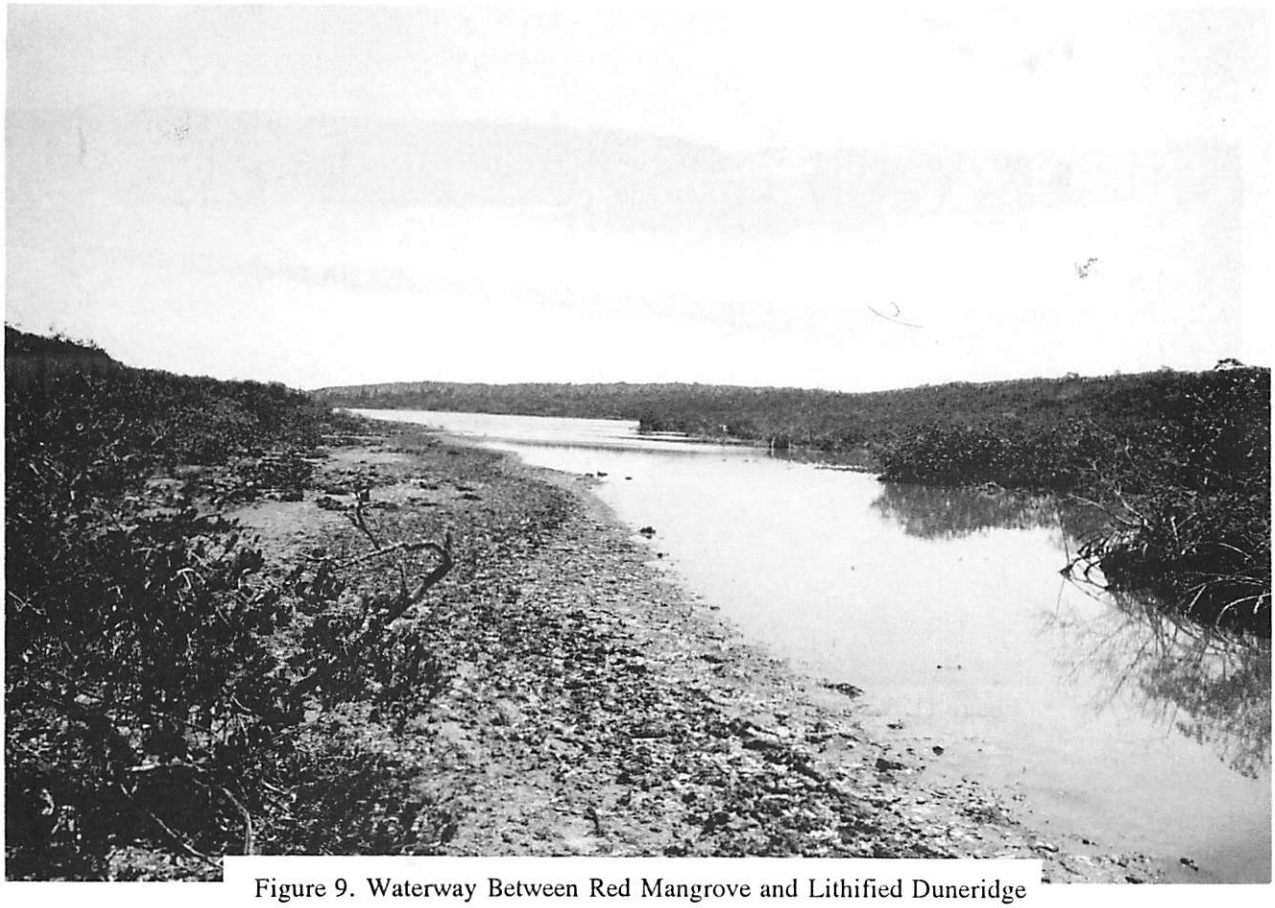

Figure 9. Waterway Between Red Mangrove and Lithified Duneridge

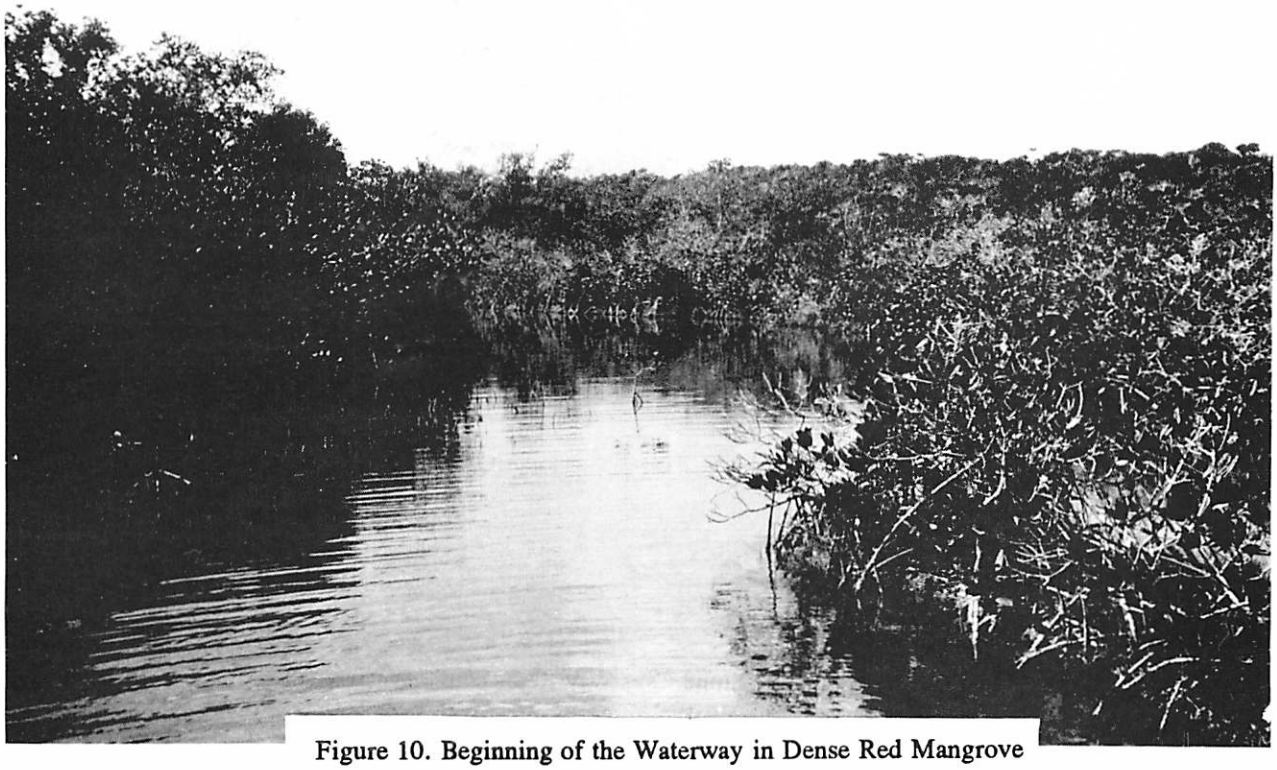

Figure 10. Beginning of the Waterway in Dense Red Mangrove

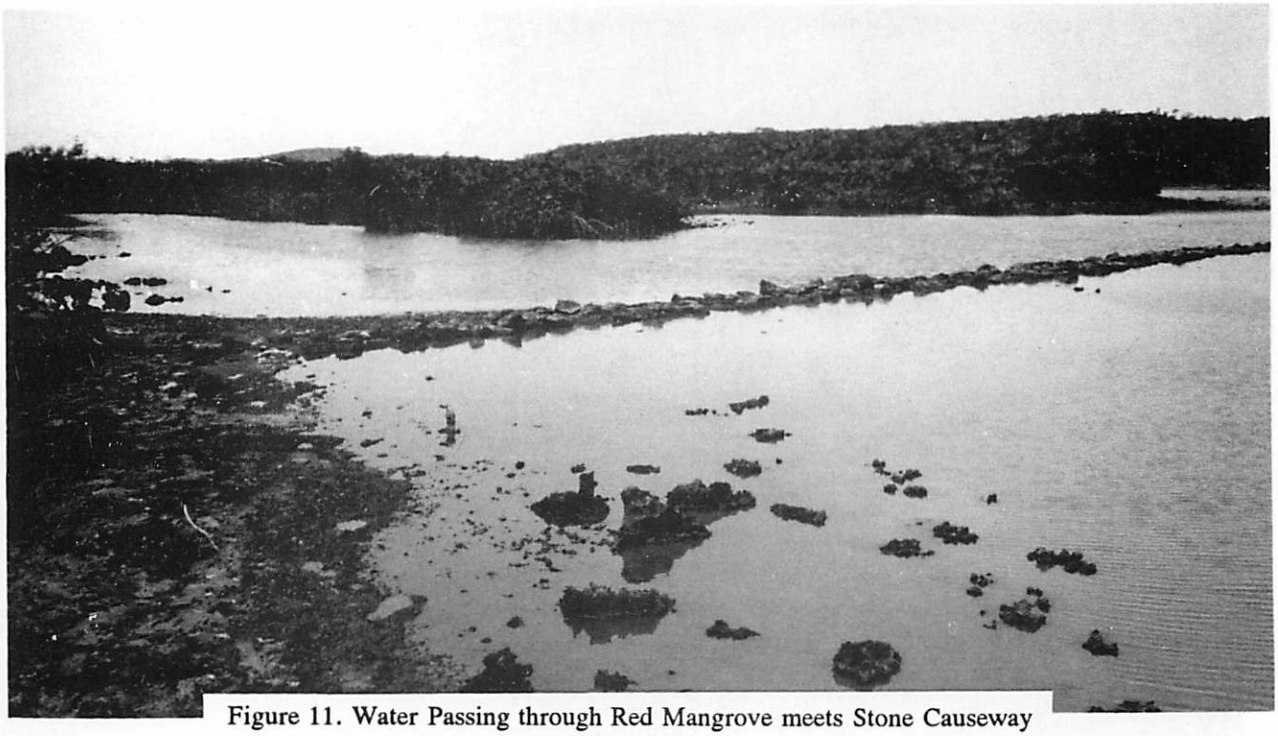

Figure 11. Water Passing through Red Mangrove meets Stone Causeway

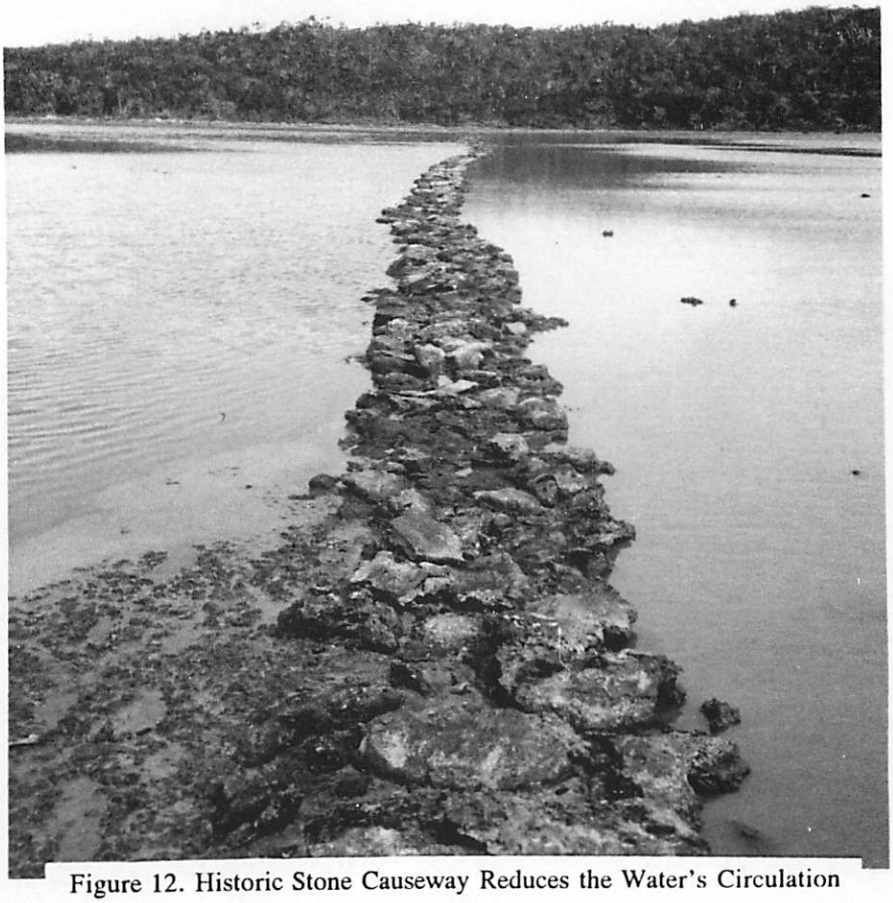

Figure 12. Historic Stone Causeway Reduces the Water's Circulation

Figure 13. Beginning of Surface Stream into Carl's Cove

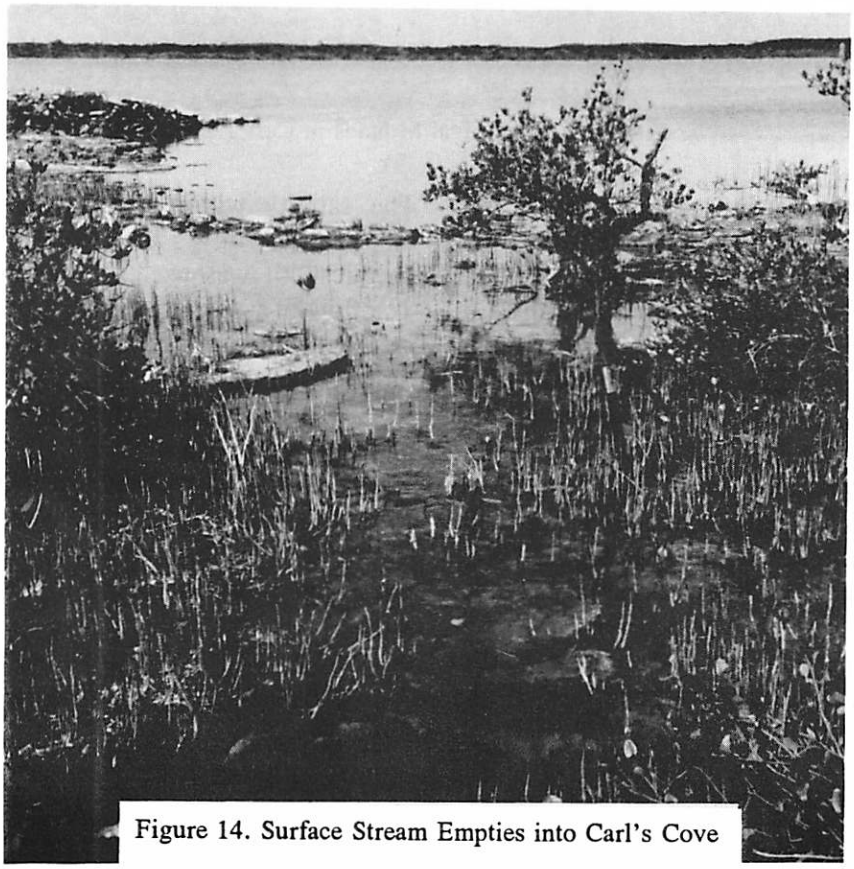

Figure 14. Surface Stream Empties into Carl's Cove

Figure 15. Red Algal Mounds in Carl's Cove

As North Stout's Lake's water exchange rate became reduced,then hypersaline conditions developed.

CARL'S COVE

The other branch of water flowing northward through the red mangrove delta enters into a region known as Carl's Cove (Figures 13 & 14). A plantation period stonewall parallels the western edge of the surface flow into the cove.

Carl's Cove run parallel to Stout's Lake. It is an elongated area about 1000 meters long and 250 meters wide. A long lithified dune separates the Cove from Stout's Lake, except for the wide cut through the dune where the water connects the two regions.

The salinity of the water flowing into Carl's Cove was 46.9 parts per thousand on June 12th, 1991. The salinity within the Cove was 91.6 parts per thousand on July 13th, 1991. A LaMotte chloride chemical kit was used to determine these salinities. The flow of water into Carl's Cove coincided with the recorded high tides of Mermaid Pond and South Stout's.

North of the surface flow and at the other side of Carl's Cove is a plantation period stone wall. This wall is built across a mud flat that separates the Cove from the south central Great Lake. A circumnavigation of the Cove revealed many algal mounds in the water, both blue-green and red (Figure 15). There is also another surface feed into the Cove which originates within a dense red mangrove region.The center of this region appears like a bluehole when viewed from the air.

CONCLUSIONS

Edwards *et al* (1990) classified the inland water systems of San Salvador based upon lake biota and salinity ranges. The Mermaid Pond/South Stout's Lake system would fit into their atypical category (Crescent, Pain, Moon Rock, Wild Dilly and Oyster Ponds).

However, the presence of surface tidal flows between areas of marine salinity (Mermaid and South Stout's) and hypersalinity (North Stout's and Carl's Cove) makes this system unique. In fact, the surface tidal flow, between Stout's Lake and Carl's Cove, is the only natural waterway connecting across a lithified dune on San Salvador. In addition, the existence of a coastal species of fish, Allanetta harringtonensis, makes this system even more "atypical".

Edwards *et al* (1990) say that "there are probably more questions than answers" regarding atypical inland lakes and ponds. The preliminary evidence from the Mermaid Pond/South Stout's region adds even more questions. Further interdisciplinary work is necessary to help solve them.

ACKNOWLEDGMENTS

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