



# Narragansett Bay

## *Research Reserve*

Technical Report

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### **The Potential for Salt Marsh Pool Restoration in the Narragansett Bay National Estuarine Research Reserve**

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## Introduction

Since the 1930s, nearly all salt marshes throughout New England have been ditched to drain the marshes of water and in turn eliminate mosquitos. Not only was this process unsuccessful, but since it drained the upper marsh of water from tidal fluctuations, it significantly reduced the number of pools that are found throughout the marsh. These pools are vital habitat for nekton (fish and decapod crustaceans) and in turn, various avian species which feed off of them.

The objective of this project was to evaluate the change in pool density of salt marshes on Prudence Island, Rhode Island by comparing historical with current aerial photographs. The 1997, 1:5000 Digital Ortho-Quads (DOQ) were downloaded from the RIGIS web site (<http://www.edc.uri.edu>) and utilized as a base map. Although no photographs were available prior to ditching, photographs from 1939 were utilized to represent pre-ditching conditions.

## Methodology

The first step in creating the coverages was to load both images into ArcView so that the 1939 photographs could be geo-rectified with the 1997 images. The 1939 photographs were taken in May while the 1997 photographs were taken in March, representing roughly the same temporal characteristics. Once the images were overlaid on top of each other, eight new themes were added to the view so that the total area of the marsh and the number of pools could be delineated from the photographs. The names of the eight themes that were created are Water\_1997, Water\_1939, Outline\_1997, Outline\_1939, Pools\_1997, Pools\_1939, Ditches, and Filled\_Pool. Each of these themes was first created as a Shapefile using the ArcView suite of tools (except for Filled\_Pool which was entirely done in Arc/Info) and then converted to a coverage to create topology.

The polygon coverages “Water\_1997, Water\_1939, Outline\_1997, and Outline\_1939” were utilized to determine the total area of each marsh based off the 1997 and 1939 photographs. The water coverage was subtracted from the outline coverage ( $\text{Outline}_{1997} - \text{Water}_{1997} = \text{Total Marsh Area}$ ) so that total area of marsh could be calculated.

The two polygon coverages “Pools\_1997” and “Pools\_1939” highlight each individual pool that was identified in their respective time period. Decisions were based on the color tones of the pixels and done in a systematic fashion. Every attempt was made to stay as un-biased as possible and to simply identify pools by their gray scale color tone.

The coverage “Ditches” is a line coverage that highlights manually ditched areas delineated from the 1939 photographs. In addition to providing the total length of ditching throughout each marsh, the ditches were also helpful in identifying areas that may have contained pools. Therefore, certain areas could be hypothesized to have had pools by following ditch patterns.

The final coverage “Filled\_Pool” is a point coverage to mark an area in Jenny Creek Marsh that seems to have been a large pool which may have been filled in with ditching material. This hypothesis is based on the rectangular vegetation pattern that is clearly visible in both images as well as the fact that there are a number of ditches that lead into this area.

## Results/Discussion

The results from this project clearly show that there has been a significant reduction in the number of pools contained within each marsh. Pool density (# pools/ha of salt marsh) was nearly five times greater (4.88) in unditched marshes compared to ditched marshes (Table 1). These results are comparable to Susan Adamowicz’s Dissertation (New England Salt Marsh Pools: Analysis of Geomorphic and Geographic Parameters, Macrophyte Distribution, and Nekton Use, 2002) where she found that pool densities were three times greater in unditched marshes. Although my results are slightly elevated, it is important to note that the averages reported only constitute the data from three marshes. After examining the data, two out of three marshes (Jenny Creek and Nag Creek North) are very consistent, both in the unditched and ditched results (Table 1) and are very comparable to the results that she found from her study. The results from Nag Creek South (Table 1 - 20.91 pools/ha) are slightly elevated but are still within the range ( $13 \pm 7$ ) that she found.

Additionally, aerial photography has proven to be a good instrument for identifying pool habitat in salt marshes. Even though aerial photography prior to ditched conditions was not available, the 1939 photographs served as a good means of estimating the number of pools. One of the advantages of using the aerial photography was that it provided a very good vantage point for identifying change. From this vantage point, it was clear that the boundaries of Nag Creek South were much further from the water source than they are today. A quick investigation of the two coverages, outline\_1939 and outline\_1997, will highlight this fact. Due to the age of the 1939 photographs, I was unclear if many of the darker pixels that could be identified in the upper portion of this marsh were pools of water or simply dense vegetation. For this reason, they were not delineated. I am unclear if this boundary change is due to ditching and the decreased amount of water that may be reaching the upper portions of the marsh in tidal fluctuations, or if it is just a natural fluctuation. Although seemingly healthy ecosystems, it is clear from past studies and these historic photographs that ditched salt marshes do not contain nearly the amount of pool habitat that they historically should and it will be very interesting to monitor the change in biota that may occur if a full restoration of these marshes is undertaken.

## Literature Cited

Adamowicz, S. 2002. New England Salt Marsh Pools: Analysis of Geomorphic and Geographic Parameters, Macrophyte Distribution, and Nekton Use.

Table 1. Aerial survey of salt marsh pool density on Prudence Island, RI			
Ditched Marshes (1997 aerial photography)	Pool Density	Unditched Marshes (1939 aerial photography)	Pool Density
	(# of pools/ha)		(# of pools/ha)
Jenny Creek	3.61	Jenny Creek	13.24
Nag Creek North	2.99	Nag Creek North	13.10
Nag Creek South	3.09	Nag Creek South	20.91
Average <i>Ditched</i> Marshes (St. Dev.)	3.23 (0.33)	Average <i>Unditched</i> Marshes (St. Dev.)	15.75 (4.47)
	3.23		15.75
	0.33		4.47