

**A Comprehensive Site Profile for the North Carolina National Estuarine Research Reserve**

**August 2008**

Respectfully compiled and submitted by the staff of the  
North Carolina National Estuarine Research Reserve

Corresponding author: John Fear

John.Fear@ncmail.net

101 Pivers Island Rd.

Beaufort, N.C. 28516

252-838-0884

**TABLE OF CONTENTS**

TABLE OF CONTENTS.....ii

LIST OF TABLES.....vi

LIST OF FIGURES.....viii

LIST OF ABBREVIATIONS.....xii

  

Chapter 1: Introduction to the North Carolina National Estuarine Research Reserve.....1

1.1: Document Overview.....1

1.2: National Estuarine Research Reserve System.....1

1.3: North Carolina National Estuarine Research Reserve.....7

1.4: NCNERR Strategic Plan.....14

1.5: SWMP History and Current Framework.....15

1.6: Research Strategic Plan.....15

1.7: North Carolina Coastal Issues.....16

  

Chapter 2: Currituck Banks Component.....18

2.1: Environmental Setting.....18

2.2: Historical Uses.....18

2.3: Climate.....21

2.4: Geological Processes.....24

2.5: Hydrology and Water Quality.....24

2.6: Habitat Types.....32

2.7: Plants.....37

2.8: Animals.....37

## Table of Contents

2.9: Invasive Species.....	40
2.10: Stressors.....	41
2.11: Research Activities.....	47
2.12: Future Research Needs.....	51
Chapter 3: Rachel Carson Component.....	52
3.1: Environmental Setting.....	52
3.2: Historical Uses.....	52
3.3: Climate.....	55
3.4: Geological processes.....	57
3.5: Hydrology and Water Quality.....	57
3.6: Habitat Types.....	62
3.7: Plants.....	67
3.8: Animals.....	69
3.9: Invasive Species.....	71
3.10: Stressors.....	74
3.11: Research Activities.....	81
3.12: Future Research Needs.....	83
Chapter 4: Masonboro Island Component.....	85
4.1: Environmental Setting.....	85
4.2: Historical Uses.....	85
4.3: Climate.....	87
4.4: Geological Processes.....	90

## Table of Contents

4.5: Hydrology and Water Quality.....	90
4.6: Habitat Types.....	101
4.7: Plants.....	105
4.8: Animals.....	106
4.9: Invasive Species.....	109
4.10: Stressors.....	110
4.11: Research Activities.....	116
4.12: Future Research Needs.....	118
Chapter 5: Zeke’s Island Component.....	120
5.1: Environmental Setting.....	120
5.2: Historical Uses.....	120
5.3: Climate.....	123
5.4: Geological Processes.....	124
5.5: Hydrology and Water Quality.....	127
5.6: Habitat Types.....	137
5.7: Plants.....	141
5.8: Animals.....	142
5.9: Invasive Species.....	144
5.10: Stressors.....	144
5.11: Research Activities.....	151
5.12: Future Research Needs.....	152
REFERENCES.....	154
APPENDIX 1: NERRS Strategic Plan.....	

Table of Contents

APPENDIX 2: NERRS Research and Monitoring Plan.....

APPENDIX 3: North Carolina Coastal Habitat Protection Plan- Research  
and Monitoring Needs.....

APPENDIX 4: NERRS Habitat Classification System.....

APPENDIX 5: NCNERR Species List.....

APPENDIX 6: Bibliography of work conducted in NCNERR.....

## Table of Contents

### LIST OF TABLES

Table 2.1: Tropical storms passing within 65 nautical miles of Currituck Banks since 1955.....	22
Table 2.2: Top ten highest and lowest annual precipitation amounts for Norfolk, VA recorded 1892 – 2004.....	23
Table 2.3: Currituck Banks 1994 habitat classifications.....	32
Table 2.4: Currituck Banks 2004 habitat classifications areal statistics.....	35
Table 2.5: Species of special concern in and near Currituck Banks.....	38
Table 2.6: Change in land cover from 1991 to 1997 in the Currituck Banks watershed.....	46
Table 3.1: Climate data for Morehead City, N.C. 5/2/1948 to 12/31/2005.....	55
Table 3.2: Tropical storms passing within 65 nautical miles of Rachel Carson since 1960.....	56
Table 3.3: Enterococci data for the sampling stations near Rachel Carson 2003-2006.....	60
Table 3.4: Rachel Carson 1994 habitat classifications.....	64
Table 3.5: Rachel Carson 2004 habitat classifications areal statistics.....	66
Table 3.6: Species of special concern in and near Rachel Carson.....	68
Table 3.7: Species collected by NOAA Fisheries Service Bridgenet sampling program 1985-2002.....	70
Table 3.8: Other invasive species found on Rachel Carson.....	74
Table 3.9: Change in land cover from 1991 to 1997 in the Rachel Carson watershed.....	77
Table 4.1: Top ten highest and lowest annual precipitation amounts for Wilmington, N.C. recorded 1933 – 2004.....	88
Table 4.2: Tropical storms passing within 65nm of Masonboro Island since 1956.....	89
Table 4.3: SWMP water quality data from Masonboro Island 2002-2006.....	97
Table 4.4: Masonboro Island 1994 habitat classifications.....	101
Table 4.5: Masonboro Island 2004 habitat classifications areal statistics.....	104
Table 4.6: Species of special concern in and near Masonboro Island.....	109

## Table of Contents

Table 4.7: Change in land cover from 1991 to 1997 in the Masonboro Island watershed.....	113
Table 5.1: Top ten highest and lowest annual precipitation amounts for Southport, N.C. recorded 1892 – 2004.....	124
Table 5.2: Tropical storms passing within 65 nautical miles of Zeke’s Island since 1956.....	125
Table 5.3: Lower Cape Fear River water quality data averages from 2005.....	131
Table 5.4: SWMP water quality data from Zeke’s Island from 2002-2006.....	132
Table 5.5: Zeke’s Island 1994 habitat classifications.....	137
Table 5.6: Zeke’s Island 2004 habitat classifications areal statistics.....	140
Table 5.7: Species of special concern in and near Zeke’s Island.....	143
Table 5.8: Change in land cover from 1991 to 1997 in the Zeke’s Island watershed .....	146

## Table of Contents

### LIST OF FIGURES

Figure 1.1: Map of the National Estuarine Research Reserve System.....	3
Figure 1.2: North Carolina geological regions and biogeographic provinces.....	8
Figure 1.3: Ocean currents off of the coast of North Carolina.....	9
Figure 1.4: North Carolina coastal regions and back barrier sounds.....	10
Figure 1.5: North Carolina national and state Reserve component locations.....	12
Figure 2.1: Currituck Banks location.....	19
Figure 2.2: Elizabeth City average monthly precipitation 1971-2000.....	23
Figure 2.3: Water quality monitoring locations at Currituck Banks.....	25
Figure 2.4: Enterococci data from the Tier 1 locations near Currituck Banks.....	26
Figure 2.5 Pasquotank River Basin map.....	27
Figure 2.6: Monthly averaged physical-chemical data from the NCNERR SWMP-like Currituck Sound water quality stations.....	29
Figure 2.7: Nutrient and Chlorophyll <i>a</i> data from the NCNERR SWMP-like Currituck Sound water quality stations.....	31
Figure 2.8: Habitat map from 1994 for Currituck Banks.....	33
Figure 2.9: Currituck Banks 2004 habitat classification presented at the subclass level.....	34
Figure 2.10: <i>Phragmites australis</i> (Common Reed) at Currituck Banks.....	40
Figure 2.11: Feral horse at Currituck Banks.....	41
Figure 2.12: Feral Pig.....	41
Figure 2.13a: Land use classification from 1991 in the Currituck Banks watershed.....	43
Figure 2.13b: Land use classification from 1997 in the Currituck Banks watershed.....	44
Figure 2.14: Changed land cover from 1991 to 1997 in the Currituck Banks watershed.....	45
Figure 2.15: Currituck Banks <i>Phragmites australis</i> extent by year.....	49



## Table of Contents

Figure 2.16: Submerged aquatic vegetation spatial coverage in Currituck Sound.....	50
Figure 3.1: Rachel Carson location.....	53
Figure 3.2: White Oak River Basin map.....	58
Figure 3.3: Yearly averaged data from the SWMP-like monitoring stations at Rachel Carson 1998 – 2003.....	59
Figure 3.4: Water quality monitoring locations at Rachel Carson.....	61
Figure 3.5: Enterococci data from the recreational water quality sampling stations near Rachel Carson.....	62
Figure 3.6: Habitat map from 1994 for Rachel Carson.....	63
Figure 3.7: Rachel Carson 2004 habitat classification presented at the subclass level.....	65
Figure 3.8: Tamarisk Tree at Rachel Carson.....	71
Figure 3.9: Tamarisk locations at Rachel Carson from the 2006 mapping effort.....	72
Figure 3.10: Horse and foal at Rachel Carson.....	73
Figure 3.11: Picture of a Nutria ( <i>Myocastor coypus</i> ).....	73
Figure 3.12: Historical shorelines on the east end of Rachel Carson (Carrot Island) since 1994.....	76
Figure 3.13a: Land use classification from 1991 in the Rachel Carson watershed.....	78
Figure 3.13b: Land use classification from 1997 in the Rachel Carson watershed.....	79
Figure 3.14: Changed land cover from 1991 to 1997 in Rachel Carson watershed.....	80
Figure 4.1: Masonboro Island location.....	86
Figure 4.2: Average, minimum and maximum daily temperatures 1871 – 2004 by month for Wilmington, N.C.....	88
Figure 4.3: Coastal Ocean Research and Monitoring Program sampling stations near Masonboro Island.....	92
Figure 4.4: Water quality monitoring locations at Masonboro Island.....	93
Figure 4.5: Cape Fear River Basin map.....	95

## Table of Contents

Figure 4.6: Yearly averaged physical-chemical SWMP data from Masonboro Island.....	99
Figure 4.7: Monthly nutrient and Chlorophyll <i>a</i> data for Loosin Creek and Research Creek SWMP stations.....	100
Figure 4.8: Habitat map from 1994 for Masonboro Island.....	102
Figure 4.9: Masonboro Island 2004 habitat classification presented at the subclass level.....	103
Figure 4.10: Red Fox.....	109
Figure 4.11a: Land use classification from 1991 in the Masonboro Island watershed.....	111
Figure 4.11b: Land use classification from 1997 in the Masonboro Island watershed.....	112
Figure 4.12: Changed land cover between 1991 and 1997 in the Masonboro Island watershed.....	114
Figure 5.1: Zeke’s Island location.....	121
Figure 5.2: Average, minimum and maximum daily temperatures 1892 – 2004 by month for Southport, N.C.....	123
Figure 5.3: Subtidal sediment percent nitrogen (left frame) and carbon (right frame).....	126
Figure 5.4: Cape Fear River Basin map.....	128
Figure 5.5: Water quality monitoring locations at Zeke’s Island.....	130
Figure 5.6: Daily averaged salinity and precipitation at Zeke’s Basin and East Cribbings before, during (9-13-05 to 9-15-05), and after hurricane Ophelia.....	132
Figure 5.7: Yearly averaged physical-chemical SWMP data from Zeke’s Island.....	134
Figure 5.8: Monthly nutrient and Chlorophyll <i>a</i> data for East Cribbings and Zeke’s Basin SWMP stations.....	136
Figure 5.9: Habitat map from 1994 for Zeke’s Island.....	138
Figure 5.10: Zeke’s Island 2004 habitat classification presented at the subclass level.....	139
Figure 5.11: Seabeach Amaranth.....	141
Figure 5.12: Dune Bluecurls.....	142
Figure 5.13: Diamondback Terrapin on an estuarine intertidal mudflat.....	142

## Table of Contents

Figure 5.14: Beach Vitex.....	144
Figure 5.15a: Land use classification from 1991 in the Zeke’s Island watershed.....	147
Figure 5.15b: Land use classification from 1997 in the Zeke’s Island watershed.....	148
Figure 5.16: Changed land cover between 1991 and 1997 in the Zeke’s Island watershed.....	149
Figure 5.17: The Rocks at Zeke’s Island.....	150

## Table of Contents

### **LIST OF ABBREVIATIONS**

NCNERR	North Carolina National Estuarine Research Reserve
CZMA	Coastal Zone Management Act
NERRS	National Estuarine Research Reserve System
NOAA	National Oceanic and Atmospheric Administration
NERRA	National Estuarine Research Reserve Association
SWMP	System Wide Monitoring Plan
GRF	Graduate Research Fellowship
KEEP	K-12 Estuarine Education Program
NCCR	North Carolina Coastal Reserve Program
DCM	North Carolina Division of Coastal Management
UNCW	University of North Carolina at Wilmington
GIS	Geographic Information System
SAV	Submerged Aquatic Vegetation