

REVIEW AND APPROVAL

ALLIGATOR RIVER NATIONAL WILDLIFE REFUGE
PEA ISLAND NATIONAL WILDLIFE REFUGE

MANTEO, NORTH CAROLINA

ANNUAL NARRATIVE REPORT

Calendar Year 1993

Acting Robert S. Oppsman 3/31/94 Ruth Galsil 4/11/94
Refuge Manager Date Refuge Supervisor Date
Review

Sam D. Dake Jr. 6-3-94
Regional Office Approval Date

ALLIGATOR RIVER NATIONAL WILDLIFE REFUGE
Manteo, North Carolina

ANNUAL NARRATIVE REPORT

Calendar Year 1993

**U. S. Department of the Interior
Fish and Wildlife Service
NATIONAL WILDLIFE REFUGE SYSTEM**

INTRODUCTION

Alligator River National Wildlife Refuge is approximately 151,000 acres in size and lies at the eastern end of a broad, flat, and swampy peninsula in northeastern North Carolina. Most of the refuge is located in the mainland portion of Dare County, with some land reaching southward into Hyde County. The refuge is part of a five-county region bounded on the north by the Albemarle Sound, on the east by Croatan and Pamlico Sounds, and on the south by Pamlico Sound and Pamlico River.

In the spring of 1984, Prulean Farms, the owner of most of what is now Alligator River NWR, withdrew its permit application for clearing forested wetlands and dissolved its organization. All property was transferred to Prudential Life Insurance Co. After more negotiation, Prudential decided to donate a total of 118,000 acres in Dare and Tyrrell Counties.

Before the donation was made, Prudential requested an "advanced ruling" from the Internal Revenue Service. Originally, the donation was to be made to TNC who planned to transfer the land to the FWS. In order to give an "advanced ruling", IRS required the donation be made to a federal agency so as to become a part of the public domain. Hence, the decision was made to make the donation directly to the FWS. The FWS accepted title to the land on March 15, 1984.

Since the decision to donate directly to the FWS was made rather abruptly, direct Service involvement did not occur until two weeks prior to the actual deed transfer. Although other management options existed, such as managing the area as a "coordination area" with the State, the decision was ultimately made to designate the area as a NWR and to move forward with appropriate funding and staffing. The 1988 acquisition of a functional farming area (approximately 5,100 acres in size) rounded out Alligator River's potential to include waterfowl management on a major level. This area is managed as moist soil units and cultivated fields (using cooperative farmers). Future management will include the restoration of some of the acreage into wooded swamp.

A portion of the original donated acreage (approximately 6,000 acres on the west side of the Alligator River) was transferred to Pocosin Lakes NWR in 1991 due to the close proximity of these lands to that refuge. At the same time, an additional 10,000 acre tract (the Dare Pocosin) was acquired in conjunction with the Pocosin Lakes property and added to Alligator River Refuge. Acquisition goals for Alligator River are to have contiguous land on the east/south sides of the Alligator River.

The vast expanse of undisturbed swamp forest and wetlands on the refuge contains many important wildlife and ecological resources. Since much of the Pamlico peninsula has been developed by clear-cutting, peat mining, and agricultural conversion, this area remains as one of the most remote and diverse swamps in eastern North Carolina. Principal natural communities in the refuge include broad expanses of non-riverine swamp forests, pocosins, freshwater and salt marshes. Its isolation and undisturbed quality add to the value of its rich wildlife habitats. The Alligator River area is part of the northern border of the American alligator's range and remains as one of the last strongholds of the black bear in North Carolina and the mid-Atlantic coast. The refuge also provides habitat for the endangered red-cockaded woodpecker and migrating bald eagle and peregrine falcon.

	INTRODUCTION	<u>Page</u>
	TABLE OF CONTENTS	i
	A. <u>HIGHLIGHTS</u>	1
	B. <u>CLIMATIC CONDITIONS</u>	2
	C. <u>LAND ACQUISITION</u>	
1.	Fee Title.....	3
2.	Easements.....	3
3.	Other.....	3
	D. <u>PLANNING</u>	
1.	Master Plan.....	4
2.	Management Plan.....	4
3.	Public Participation.....	4
4.	Compliance with Environmental and Cultural Resource Mandates.....	4
5.	Research and Investigations.....	4
6.	Other.....	5
	E. <u>ADMINISTRATION</u>	
1.	Personnel.....	5
2.	Youth Programs.....	"NTR"
3.	Other Manpower Programs.....	"NTR"
4.	Volunteer Program.....	9
5.	Funding.....	11
6.	Safety.....	12
7.	Technical Assistance.....	12
8.	Other.....	"NTR"
	F. <u>HABITAT MANAGEMENT</u>	
1.	General.....	13
2.	Wetlands.....	13
3.	Forests.....	15
4.	Croplands.....	16
5.	Grasslands.....	"NTR"
6.	Other Habitats.....	"NTR"
7.	Grazing.....	"NTR"
8.	Haying.....	"NTR"
9.	Fire Management.....	"NTR"
10.	Pest Control.....	17

11.	Water Rights.....	"NTR"
12.	Wilderness and Special Areas.....	"NTR"
13.	WPA Easement Monitoring.....	"NTR"

G. WILDLIFE

1.	Wildlife Diversity.....	"NTR"
2.	Endangered and/or Threatened Species.....	19
3.	Waterfowl.....	28
4.	Marsh and Water Birds.....	"NTR"
5.	Shorebirds, Gulls, Terns and Allied Species.....	"NTR"
6.	Raptors.....	"NTR"
7.	Other Migratory Birds.....	"NTR"
8.	Game Mammals.....	29
9.	Marine Mammals.....	"NTR"
10.	Other Resident Wildlife.....	"NTR"
11.	Fisheries Resources.....	"NTR"
12.	Wildlife Propagation and Stocking.....	"NTR"
13.	Surplus Animal Disposal.....	"NTR"
14.	Scientific Collections.....	"NTR"
15.	Animal Control.....	"NTR"
16.	Marking and Banding.....	"NTR"
17.	Disease Prevention and Control.....	"NTR"

H. PUBLIC USE

1.	General.....	29
2.	Outdoor Classrooms - Students.....	30
3.	Outdoor Classrooms - Teachers.....	31
4.	Interpretive Foot Trails.....	31
5.	Interpretive Tour Routes.....	"NTR"
6.	Interpretive Exhibits/Demonstrations.....	33
7.	Other Interpretive Programs.....	34
8.	Hunting.....	34
9.	Fishing.....	36
10.	Trapping.....	37
11.	Wildlife Observation.....	37
12.	Other Wildlife Oriented Recreation.....	"NTR"
13.	Camping.....	"NTR"
14.	Picnicking.....	"NTR"
15.	Off-Road Vehicling.....	"NTR"
16.	Other Non-Wildlife Oriented Recreation.....	"NTR"
17.	Law Enforcement.....	37
18.	Cooperating Associations.....	38
19.	Concessions.....	"NTR"

I. EQUIPMENT AND FACILITIES

1. New Construction.....	41
2. Rehabilitation.....	41
3. Major Maintenance.....	41
4. Equipment Utilization and Replacement.....	42
5. Communications Systems.....	"NTR"
6. Computer Systems.....	"NTR"
7. Energy Conservations.....	"NTR"
8. Other.....	"NTR"

J. OTHER ITEMS

1. Cooperative Programs.....	"NTR"
2. Other Economic Uses.....	"NTR"
3. Items of Interest.....	43
4. Credits.....	43

K. FEEDBACK

44

L. INFORMATION PACKET - - - (inside back cover)

A. HIGHLIGHTS

AR volunteer program celebrates 10 year anniversary with 115,761 hours! (See Section E.4.)



1994 Outstanding Volunteers -
sisters Marie Vansickle and Bertha Burris BWS 10/93

Non-consumptive public use on Alligator River finally gets a start! Canoe trails opened in March; walking trails in October! (See Section H.4.)



The Milltail Canoe/Kayak Trails opened in March and have proven to be quite popular. BWS 10/93

Red Wolf project expanded west of Alligator River. (See Section G.2.)

Poor conditions limited prescribed burns; 3 wildfires occurred. (See Section F.9.)

Moist soil units responded well to burns - produced excellent plants with no discing. (See Section F.4.)

B. CLIMATIC CONDITIONS

Except for a few occasions, weather for 1993 was fairly average for this area. Seasons are generally mild, with just a week or two of extreme weather in summer and winter. Table 1 shows high and low temperatures and total rainfall for each month. This weather information was obtained from our remote fire weather station which, once a few kinks were worked out and people stopped running over the telephone line, worked just fine! The biggest exception to our fine weather was the March 13 "Storm of the Century" that dumped 3" of rain on the refuge in less than 24 hours. Hurricane Emily was the other major weather event on August 31; however, very little damage was done to this refuge by either event.

TABLE 1
ALLIGATOR RIVER NWR WEATHER DATA

<u>MONTH</u>	<u>TEMP. HIGH</u>	<u>TEMP. LOW</u>	<u>RAINFALL</u>
January	72.5	26.4	7.34"
February	73.2	19.4	2.79"
March	74.8	24.6	6.46"
April	80.2	35.6	3.88"
May	88.3	41.5	3.11"
June	97.2	45.7	4.46"
July	98.6	63.1	2.74"
August	95.9	53.4	1.16"
September	94.6	44.4	4.38"
October	84.4	45.5	10.80"
November	81.0	47.8	2.36"
December	66.7	31.8	2.97"

C. LAND ACQUISITION

1. Fee Title

Appraisal efforts and negotiations during 1992 and the first part of 1993 finally were partially successful with the purchase of 4 tracts. These included the Briar Hall Tract - 24 acres and a club house on South Lake for \$40,000; Briar Hall Conservancy Tract - 7.6 acres along Highway 64 for \$6,100; Stephen Lokata Tract - 0.5 acres along Highway 64 for \$2,500; and the Swan Lake Tract - 3,400 acres along the Alligator River with club house for \$453,500. The Swan Lake Tract in particular is an excellent addition that will solve many administrative problems.

The PPP package to expand the acquisition boundary remained in Region during 1993. The refuge completed an EA for this effort in 1991. It has subsequently been caught up in a larger effort to finalize a single package for all eastern North Carolina refuges.

2. Easements

A 5 year easement, at \$1,000 per year, was finalized during 1993 with the owners of the 4,800 acre Durant Island authorizing the presence of wolves on their property and Service access.

An easement agreement with the owners of the 15,000 acre Mattamuskeet Farms, authorizing wolves on this area and Service access remained in effect during the year.

A Partner's Agreement with the owners of the 10,000 acre Lux Farm property was completed in 1993 authorizing the presence of wolves and Service access for management purposes.

Negotiations were conducted with several other large land owners (timber companies, corporate farms) during the year for easements or agreements authorizing the presence of wolves and Service access. These properties total approximately 150,000 acres and are important to the success of expanding the wolf reintroduction area west of the Alligator River.

3. Other

The Stumpy Point ball field issue remained unresolved during the year. County Commissioner interest in a possible land exchange resurfaced, and the refuge provided county government officials with line prints of possible exchange alternatives.

The East Lake Methodist Church land issue also remained unresolved. This issue has been at the Solicitor's office since 1990.

D. PLANNING

1. Master Plan

The refuge Master Plan was amended to modify areas open to various types of hunting, relax management restrictions placed upon some units, and revise roads open to vehicle use.

2. Management Plan

Annual management planning completed and approved included the water management plan, cooperative farming agreements on 4,500 acres, and prescribed burning prescriptions on 3,500 acres.

Under the authority of an existing MOU, the refuge staff again conducted extensive surveys of select wildlife species on the Air Force Dare County Bombing Range. The Air Force provides funds for this work.

3. Public Participation

A public meeting was held to discuss Master Plan revisions during June. In addition, several media announcements were made to solicit public input during this process.

The hunt information public meeting was held in September.

4. Compliance with Environmental and Cultural Resource Mandates

A USCOE 404 permit was obtained for plowing the 100 acre Little Field Unit during 1993. This old moist soil unit, abandoned in 1988 due to potential bird strikes with the nearby Navy Bombing Range, was site of reforestation efforts in 1993 by USCOE as part of their wetland plant development projects and cedar planting by the NC Forest Service.

USCOE 404 and CAMA permits were obtained for depositing fill in 0.02 acres of wetlands associated with the Creef Cut Public Use development.

USCOE 404 permit for plowing some 10 miles of firebreaks in pocosins was also obtained.

The final headquarters preliminary archaeological survey report was accepted in early summer. The report identifies 2 sites that might possibly be National Register candidates.

5. Research and Investigation

That part of the USDA Forest Service's Fire Science Lab study entitled "Heat Transfer into Duff and Organic Soils" on

Alligator River was put on hold during 1993 when wet weather forced cancellation of all burns.

The cooperative agreement with the University of Tennessee to conduct black bear research on Alligator River was extended through mid-1996. The Air Force came up with \$110,000 to continue this important project - originally initiated with discretionary refuge funding (that means leaving a position vacant!). Over 70 animals were trapped and marked during 1993; efforts are under way to develop reliable census techniques to collect long term trend data; food habitat analysis from literally hundreds of scats is ongoing. The refuge provided housing and logistical support for 3 researchers from April to November.

The NC Extension Service's sustainable agriculture and quail projects got "off-the-ground" during 1993. Refuge co-op farmers modified farming practices on two 500 acre units in order to test impacts of a "clean" farming on quail production/survivability. Over 150 quail were captured, equipped with transmitters, and tracked throughout the summer. The refuge also provided housing for 3 NC State researchers for most of the summer.

The joint refuge/Air Force/NC Forest Resources reforestation of 3,000 acres of clearcuts with Atlantic white cedar continued to progress slowly. A cooperative agreement was issued to the USDA Forest Service Seedtree Lab in Starkville, MS for developing seed extraction techniques. Another agreement was issued to NC State University Forestry Dept. to examine impacts of competition on this shade intolerant species. This 5 year project is "plowing" new ground - no one can even guarantee a reliable seedling source for planting.

Duke University continued their project on sea level rise utilizing a segment of marsh adjacent to Long Shoal River. Soil profile and vegetative transect sampling will continue annually at least through 1995.

6. Other

Numerous requests were submitted for Engineering Services during the year.

E. ADMINISTRATION

1. Personnel

1. Jim Johnson, Refuge Manager, GM-13, EOD 05-05-91
2. Robert Noffsinger, Refuge Manager, GS-12, EOD 04-13-87
3. Steven Fowler, Forester (FMO), GS-12, EOD 06-03-91

4. Michael Phillips, Wildlife Biologist (Red Wolf), GS-12, EOD 06-21-87
5. Bonnie Strawser, Refuge Ranger, GS-11, EOD 12-31-80
6. Vacant, Wildlife Biologist, GS-11
7. Vacant, Refuge Operations Specialist, GS-9 (AR)
8. Vacant, Refuge Operations Specialist, GS-9 (PI)
9. Angela Noffsinger, Range Tech, GS-07, EOD 05-26-85
10. James Beasley, Range Tech, GS-07, EOD 05-26-85
11. Michael Morse, Wildlife Biologist (Red Wolf), GS-07, EOD 04-08-90
12. Arthur Beyer, Bio. Science Tech (Red Wolf), GS-07, EOD 12-02-90
13. Jennifer Dagen, Wildlife Biologist (Red Wolf), GS-07, EOD 06-30-91
14. Jonathan Windley, Range Tech (Red Wolf), GS-07, EOD 02-26-89
15. Beverly Midgett, Office Assistant, GS-06, EOD 10-06-71
16. Janice Lane, Office Automation Clerk, GS-04, EOD 03-25-90
17. J. Bruce Creef, Eng. Equip. Opr., WS-07, EOD 04-21-75
18. Alan Emery, Automotive Worker, WG-08, EOD 05-22-88
19. Jonathan Powers, Eng. Equip. Opr. WG-08, EOD 04-24-88
20. Murphy Peterson, Eng. Equip. Opr., WG-08, EOD 04-22-90
21. Doak Wilkins, Eng. Equip. Opr., WG-08, EOD 03-17-80
(Transferred 3-07-93)
22. Eric Craddock, Eng. Equip. Oper., WG-08, EOD 02-21-93
23. Elizabeth Parks, Student Trainee, GS-05, EOD 01-12-92

Temporary Part Time

24. Edward Zakrajsek, Bio. Science Tech, NTE 1 year, GS-05, EOD 05-05-91
25. Belton Gray, Jr., Forestry Aid, GS-04, EOD 05-05-91
Resigned on 1/26/93
26. Amy Midgett, Forestry Aid, GS-04, EOD 05-05-91
27. Bobby Govan, Forestry Aid, GS-04, EOD 10-06-91
28. Stephen Grant, Forestry Aid, GS-04, EOD 05-05-91
29. Eric Meekins, Forestry Aid, GS-04, EOD 10-04-92
30. Tami Stanberry, Forestry Aid, GS-04, EOD 10-04-92
31. Nolan Ambrose, Eng. Equip. Opr., WG-08, EOD 10-04-92
32. Frank Roepcke, Forestry Aid, GS-04, EOD 02-08-93
33. Hank Reynolds, Forestry Aid, GS-04, EOD 10-04-93

Jonathan Windley began the year as a Supv. Refuge Operations Spec., GS-09 and on 08-08-93 was reassigned as a Range Technician, GS-07, with the Red Wolf Program.

Steven Fowler, Forester (FMO), was promoted to a GS-12 on 1/24/93.

Arthur Beyer, Bio. Science Tech (Red Wolf) was promoted to a GS-07 on 1-10-93.



Left to Right - Front Row (kneeling): 5, 16, 26
 2nd Row: 30, 4, 14, 15
 3rd Row: 13, 32, 17, 18, 24, 22, 1
 Back Row: 12, 2, 3, 27, 20, 19

Jennifer Dagen, Wildlife Biologist was promoted to a GS-07 on 11-14-93. Ms. Dagen was a Bio. Science Tech until 6/23/93 when she was selected for a Wildlife Biologist position with the Red Wolf Program.

J. Bruce Creef, WG-9 Crane Operator, was selected to fill the Supervisory Engineering Equipment Operator position, WS-07, on 11-29-93.

Eric Craddock filled the Engineering Equipment Operator vacancy on 11-29-93. Mr. Craddock was previously with the fire program.

The recruitment action to fill the refuge GS-09/11 Biologist position, vacant since 1991, was completed and awaiting RO approvals as the year ended.

Eric Meekins and Tami Stanberry, Forestry Aids, were each promoted to a GS-04 on 05-30-93. Hank Reynolds, Forestry Aid, was promoted on 11-28-93.

The refuge started out with 11 fire fighters in 1993 compared to 8 in 1992. One fire fighter resigned early January and one was selected to fill a full time Engineering Equipment

Operator in November, leaving 9 firefighters at end of the year.

Doak Wilkins, WG-8, Engineering Equipment Operator, departed on 3-07-94 to fill a vacancy at Pee Dee NWR. Their gain - our loss!

The GS-5/7/9 Refuge Manager position at Pea Island, vacant since 1991, was not filled during 1993.

Robert Noffsinger, Refuge Manager, and Angela Elmore, Range Technician, were married September 18.

Edward Zakrajsek was extended to another NTE 1 year appointment. He is a seasonal fire fighter and the rest of the time monitors wildlife species existing on the Dare County Air Force Range. This funding is provided by a Reimbursable Agreement with Seymour Johnson Air Force Base.

Elizabeth Parks, Student Trainee, came back on board on 5/24/93 and returned to school on 8/27/93. She was converted to a career conditional appointment and was promoted to a GS-05 on 5/24/93.



Engineering Equipment Operator Doak Wilkins get staff send-off when he leaves for Pee Dee NWR. JLL 3/93

4. Volunteer Programs

This was another banner year for the ARNWR Volunteer Program; 1993 marked the end of the first decade of volunteers. The 10 year total of hours contributed was 115,761!! During 1993, 250 individuals donated a total of 22,989 hours in the following categories: 3,479 - maintenance; 13,650 - biological support; 3,800 - public use; and 2,030 - administrative.

The Red Wolf Project has continued to draw a number of college students and/or recent graduates that volunteer blocks of time. During 1993, over 5,000 hours of volunteer time were donated by 3 individuals in red wolf caretaking positions.

Michael Kuhns was recruited through the Student Conservation Association to assist with public use at Pea Island during the summer months. Eight long-term volunteers/interns worked with bear/quail/Atlantic White Cedar/etc. projects throughout the year.

At the AR office in Manteo, most days were covered by a volunteer receptionist answering the phone and assisting with assorted office duties. Some wrote letters and handled public inquiries. The volunteer program also provided volunteer assistance for Pea Island Refuge. For details on these activities see Section E.4. of the Pea Island narrative.

Recruitment activities for 1993 were not major, but spontaneous efforts were made whenever the opportunity presented itself. At this point, most new volunteers are recruited by current volunteers or sent over by the Dare Voluntary Action Center.

The "Take Pride in America" recognition program has given groups more incentive in volunteering their efforts to benefit public lands. WIS Strawser has continued to act as the Dare County Coordinator for Take Pride in America. Though the federal TPIA program was canceled under the new administration, North Carolina vows to continue the program on their own.

During 1993, the AR Volunteer Program and Volunteer Don Perry each received a North Carolina Take Pride in America Award. In addition, the Volunteer Program was inducted into the State TPIA Hall of Fame for receiving the TPIA Award for 5 consecutive years. WIS Bonnie Strawser received the Latham F. Smith Award for Volunteer Coordination for the second consecutive year. The 5 additional refuge nominations received Honorable Mention Awards.

On the regional level, AR Volunteers received 5 of the 8 Regional Director's Outstanding Contribution Awards.

Recipients were the AR Volunteer Program, Don Perry, Outer Banks Surfrider Foundation, Outer Banks Audubon, and Suzanne Tate/James Melvin. ARD Benson and DS Grabill visited the refuge to present the Director's Hall of Fame Award to the Volunteer Program for receiving the Director's Outstanding Contribution Award for 5 consecutive years.



ARD Benson presents the USFWS "Hall of Fame" Take Pride in America Award to the ARNWR Volunteers. JCJ 8/93

Refuge volunteers continued to work through their non-profit organization, the Coastal Wildlife Refuge Society, to benefit the refuge. For details of their accomplishments during 1993, see Section H.18. of this report.

Cumulative hours tallied through September 30, 1993 yielded 66 awards:

100+ hour certificates were presented to: Ralph Buxton, Carlos Gomez, Janice Lane, Brant Wise, Dan Fritsch, Marc Puckett, Derb Carter, Jimmy Hayes, Dave Miller, Ed Zakrajsek, Len Smith, Rob Lowe, Gloria Copeland, Michelle Honeycutt, Paul Rickerts, Mike Sullivan, Todd Allen, Nathan Ripley, Suzanne Tate, Mary Anne Dubressor, Josh Honeycutt, Anna Strawser, Linda Bowers, Dick Fryklund, Charles Howes, John Swecker, Michael Kuhns, and Bill Palmer.

Pins without rockers (250+ hours) were awarded to: Mary Ann Dubressor, Dick Fryklund, Michelle Honeycutt, Josh Honeycutt, Clyde McFadyen, Kirstie Zakrajsek, Michael Kuhns, Dan Fritsch, Len Smith, Todd Allen, Nathan Ripley, Mark Puckett, and Rob Lowe.

Pins with 500 hour rocker were presented to: Hilda Bayliss, Win Copeland, Dick Fryklund, Charles Howes, David Leake, Michael Kuhns, Dan Fritsch, Len Smith, Todd Allen, Nathan Ripley, Mark Puckett, and Rob Lowe.

Pins with 1000 hour rocker were awarded to: Dave Brandenburg and Todd Allen.

Pins with 1500+ hours rocker were awarded to: Ritchie Buckingham, Dave Brandenburg, Mark Puckett, and Todd Allen.

Pins with 2,000 hour rockers were presented to: Warren Davis, Dave Brandenburg, Mark Puckett, and Reada Evans.

The refuge purchased a special 3,000+ hour plaque for Ken Dyar.

The 1993 "Outstanding Volunteer" Award was presented to sisters Burt Burris and Marie Vansickle. Their names were added to the plaque in the office, and they received individual plaques to take home.

Establishing the volunteer program for these refuges required much time and effort in the beginning. Keeping the program going demands ongoing effort and money commitment; however, the refuge receives far more than it gives to the volunteers. As always, we owe a debt of gratitude to our dedicated refuge volunteers. They set a fine example for all who see them. Without them, so much work would be left undone. Without them, the refuges would not be the same. . . .

5. Funding

FY 93, Alligator River received the following funding:
Initial Allocations of 796.6 (1261/1262/1113); Oregon Inlet Groin Study 15.0; Co-op Student Program 6.5; Two Challenge Grants 26.0; Small Maintenance Projects 82.0; Reimbursable Agreements: Survey & Monitoring for AR 9.4 and PI 6.3, Atlantic White Cedar Ecosystem 121.3, PI Beach Disposal 77.2, AR Interpretive Panels 4.3, Seymour Johnson AFB - Black Bear Study 110.5, and Seymour Johnson AFB - Regeneration Alter. Atlantic ECO 380.5; Contributed Fund 9.0; Construction Carryover: Bridge Replacements 50.1, and Maintenance Facility 208.1; Equipment for Presuppression: Radios 12.0, Trailer 20.0, Grader 99.4, Truck/Tractor 72.4, and Engine 25.0; NUS Maintenance 30.0; Prescribed Burning 10.0.

FOUR YEAR FUNDING COMPARISON

	1993	1992	1991	1990
1261	463.2	460.1	390.7	374.0
1262	222.9	182.0	204.1	169.5
1113	240.0	220.0	200.0	185.0
1971	709.5	141.5	95.0	26.8
2821	258.2	362.1	845.8	22.5
7201	9.0			
9110	62.1	52.4		
9120	378.6	327.9	450.4	117.2

6. Safety

Safety Committee members for 1993 were RT Jonathan Windley, WB Michael Morse, and AW Alan Emery. The committee was responsible for organizing and directing monthly safety meetings, identifying unsafe working conditions, habits, and attitudes at the refuge. Topics for monthly safety meetings included cholesterol control, boat safety, chainsaw safety, and ATV training. Employees also completed defensive driving training and CPR certification.

Alligator River and Pea Island Refuges ended the year with 17,000 hours worked since the last lost-time accident. WB Michael Morse and FT Steve Grant each had a lost-time accident in 1993. Morse was bitten while handling a red wolf and Grant received a laceration and a mild back strain when a pile driver slipped off a boardwalk during construction. One accident involving a vehicle was reported this year. RT Windley and EO Powers' vehicle was struck in the rear while stopped at a signal light. No injuries occurred.

7. Technical Assistance

Under a Cooperative Agreement with the U.S. Air Force, the refuge continued to provide technical assistance to the adjacent Dare County Bombing Range on wildlife management. Some of the activities included the black bear study, red-cockaded woodpecker surveys, alligator surveys, and white cedar study (see Sections F. and G.)

Refuge staff continue to work with Dr. Pete Bromley from the NC Extension Office to develop a wildlife management brochure for private land owners (Challenge Grant). An extension allowed more time to complete this project.

RM Johnson made a presentation to 50 consultant foresters at their annual society meeting.

RM Johnson, DRM Noffsinger, and BT Zakrajsek visited Croatan National Forest on 9/14 to exchange ideas on burning in pocosins and RCW management.

Refuge staff provided assistance to graduate students Marc Puckett and Bill Palmer of NCSU as they continued their research projects on quail. Their work is part of the NCSU Low Impact Sustainable Agriculture project.

Refuge fire crew assisted other stations in burns - 3 people to Carolina Sandhills NWR, burned 2,500 acres; 5 people to Cedar Island NWR, burned 300 (\pm) acres.

F. HABITAT MANAGEMENT

1. General

Five categories of natural, vegetated habitat are found on ARNWR: marshes, pocosins, mixed-hardwood pine swamps, hardwood swamps, and white cedar swamps. These are classified as wetlands based on the vegetation present, the degree of soil saturation, and the hydro-period. ARNWR represents one of the last remaining large tracts of pocosin-type habitat along the east coast. Although much of the refuge is relatively unaltered by humans, large portions have undergone changes in vegetation composition and hydrology caused by ditching and canal dredging for access and logging purposes. The purchase of the Prudential farmlands in March of 1988 added agricultural land to the list of habitats.

2. Wetlands

The installation of water control structures (WCS) to restore ditched areas to a more natural hydrological regime continued during 1993. Efforts were limited since the maintenance staff was tied up for most of the summer work season repairing storm damage at Pea Island NWR. This year, the risers at 3 locations were augmented by additional structures. These were in the area that receives the flow from the pumps that drain the Creel Farm Unit. During periods of heavy rain, the additional water entering the units from pumping created an "impounded" high water situation that overtopped roads in the unit and created an artificially high water level. The risers to augment the additional outflow requirements were installed at the intersections of Blueberry Road, Bay Road and Koehring Road with Milltail Road. A WCS was also installed on Koehring road between Cedar Road and Canvasback Road.

The structures and fill allow safe movement over the canals by fire equipment and better water management for fire suppression and prescribed burning activities. The risers replace

severely deteriorated wooden bridges at road intersections. Boards are placed in the risers up to ground level of the adjacent swamp/pocosin. The restoration of the ditched areas will continue with the installation of additional structures in 1994.

Table 2 presents acreage by vegetative community/land use currently under fee title ownership. See previous narratives for in-depth descriptions of the various vegetative types. An additional tract of land in Hyde County is in the process of being added to the Refuge. The tract is approximately 4,000 acres in size and lies east of the Barge Canal, south of Swan Creek Lake and the Alligator River, east of First Avenue and North of Fourth Avenue.

**Table 2
Habitat Types
ARNWR, 1993**

Habitat Type	%	Approximate Acreage		
		Dare	Hyde	Total
White Cedar Swamp	5	6,900	1,000	7,900
Hardwood Swamp	11	11,700	3,700	15,400
Mixed Hardwood				
-Pine Swamp	29	36,000	6,000	42,000
Low Pocosin	12	18,100	--	18,100
Cane Pocosin	2	2,300	--	2,300
Tree Pocosin	19	25,500	2,600	28,100
Lakes/Open Water	1	1,000	--	1,000
Marsh	17	25,200	--	25,200
Farmland and Moist Soil	4	5,100	--	5,100
Totals	100	131,800	13,300	145,100

This year 1,020 acres of moist soil was produced in restored, prior converted farmland on the farm unit. Nearly 660 acres of this was burned in the spring and 546 acres was disced (some areas were burned and disced). This was the first year fire has been used in the moist soil units and the results were very promising. The last 2 years had been poor farm years due to extremely heavy rains resulting in late planting of crops by farmers and as a result, late or no disking of moist soil units. Many of the units were dominated by broomsedge, soft rush, woolgrass, and other undesirable

species. Due to the backlog, there was no way all of it could be treated in one year. Many of the areas that were only burned produced excellent stands of moist soil plants, some were as good or better than areas that were only disced or were burned and disced. Overall the production of desirable plants (wild millet, smartweed, fall panicum, switchgrass, foxtail, etc.) in the moist soil units were greatly improved over the previous 2 years.



Low shrub pocosin south of Pt. Peter Road - the proposed site of the Pocosin Trail. The understory here is approximately 18-18 ft. high! BWS 10/93

3. Forests

The Atlantic white cedar (AWC) regeneration project which is being funded by the DoD Legacy Resource Management Program is progressing more or less on schedule. Partners in this project are the Department of Defense, as represented by the Dare Bombing Range Forester, the North Carolina Forest Service Research Division, and the USFWS.

Locally, 25 acres have been replanted with AWC seedlings, including 5 acres as a genetic study plot. Cone collections were made and the seed will be cleaned and planted in NCFS seed beds this spring. The seedlings derived from this crop will be planted here in the spring of '95.

A related issue is the contract work being done at the Southern Forest Experiment Station in Starkville, Mississippi. This work entails the development of seed extraction and cleaning techniques for AWC as well as germination tests. This work, hopefully, will result in greater availability of

AWC seedlings which has been a major roadblock in the resurgence of this valuable tree.

Preliminary work has also been done to contract for services to inventory old AWC cutover areas. The plan is to determine the current plant communities and associations on these sites and establish permanent plots on the Refuge and USAF Bombing Range for the purpose of monitoring competition, composition, mortality and growth. This is baseline information required prior to making decisions regarding forest development and silvicultural activities to be conducted on each area. A Global Positioning System (GPS) base station and rover units have been acquired as a result of this need.

4. Croplands

The acquisition of the 10,000 acre Prudential Farms inholding in March, 1988 gave the refuge even greater diversity of habitats and a great potential for managed habitat for waterfowl, shore-birds, and wading birds. The tract included 5,100 acres of cropland. Prudential had developed the area from forested wetlands by encircling it with dikes and constructing drainage ditches. The area is drained by 5 pumps located at 2 pump stations. Each pump removes 250,000 gallons of water per minute from the farm fields. Pumping is required to keep the area dry enough to farm. The reconversion of the area to wetland habitat is basically simple - don't pump the areas where plans call for permanent water or reduce pumping on moist soil areas. This action is accomplished by judicious placement of flashback risers in conjunction with existing dikes and building small, permanent cross dikes and temporary rice dikes. To date about 1,400 acres have been converted to permanent water and moist soil units. Ducks Unlimited has committed to a 50:50 cost share to restore another 400 acres in 1994. Total project cost is \$62,000. Work should begin in early summer of 1994.

Refuge cooperative farmers had a better year in '93 after several very bad crop years. The farming agreements were renegotiated to reflect the yields that these lands can consistently produce. The refuge portion of the crop produced for 1993 was 10 bushels of corn per acre farmed. In 1992 the refuge received 18.5 bushels of corn per acre. Since a good corn yield on this land is 100 bushels/acre this was 18.5% of the crop. In 1994, the agreements call for the refuge to receive 12 bushels of corn/acre and for 1995-1997, 13.5 bushels of corn/acre. Crops were planted on 2,508 acres in 1993, primarily soybeans. Other crops included lespedeza and fescue for seed, and some barley and oats. Millet was produced for the refuge on 95 acres, milo on 65.6 acres and corn on 15.9 acres. Farmers disced 546 acres in refuge moist soil units.



Flooded crop stubble and milo grown for the refuge got heavy use by ducks and swans in January. EJZ 12/93

9. Fire Management

Fire Management during the past year began with a number of planned prescribed burns. Unfortunately, as is often the case here, burn conditions fluctuated from being too wet to being too dry, often within a period of 3 days to a week. As a result, the burning was strung out longer than preferred. Approximately 1,500 acres of impoundments, old fields, and dikes were burned from early February to late March. During this period, there were 2 escapes, one of which became the Gremlin Fire. Although small (30 acres), this fire exhibited the typical tenacity of fires in organic soils. One of the interesting elements of this fire was the fact that the mixed timbered block it occurred in was surrounded by canals which had water within 6" of the ground surface and was inundated approximately 1 week prior to the prescribed burn.

The spring wildfire season was fairly quiet with adequate moisture. By early summer fuels were beginning to dry out rapidly and the District began experiencing a number of fires. Three fires occurred at Alligator River during this time with the Belly Pan Fire being the most obstinate by far. This fire occurred in a dense, tall tree pocosin and smoldered around in deep duff and organic soil for 3 or 4 days prior to being spotted by a USN pilot during bombing practice at the Navy Dare Bombing Range.

During the year, fire personnel from Alligator River were dispatched to Carolina Sandhills and Cedar Island NWR's to support prescribed burning and wildfire suppression activities within the Fire Management District. The District FMO was also dispatched with the Southern Interagency Red Team to the Gnatcatcher Fire at Okefenokee NWR in support of the Air Operations Section. OAC Lane was sent to Tallahassee as a support dispatcher, also in connection with the Gnatcatcher Fire. Assistance was also provided by the fire crew to the NPS at Cape Hatteras National Seashore for prescribed burning and help in the aftermath of Hurricane Emily.



Accessing the Belly Pan wildfire was no easy chore - several crawlers and flex tracks (pictured here) "mired" down in dense pocosin habitats. SLF 6/93

New fire equipment acquired over the past year included a truck tractor, John Deere grader, portable bridge trailer, large terra-torch for truck or flex-track carry, small terra-torch to be operated from a boat, and a 200 gallon slip-on unit for the flex-track.

Additional cache items were also ordered to restock depleted items and to get closer to our goal of having a complete 25 person cache.

The remote automated weather station (RAWS) at Alligator River NWR had some down time this year due to a variety of problems, most of which resulted from carelessness around the power/phone cable, telephone service glitches, and rodents with a

fondness for cable shielding. Nevertheless, refuges are continuing to collect valuable weather information which will be of great benefit to fire management, as well as other refuge programs, both for planning purposes and historical records.

The fire cache, which was moved in late 1992 from the Buffalo City area to its present location at the recently completed maintenance facility, was furnished with shelving, storage lockers and cabinets, a workbench, desk, and telephone. The fire crew now has the much needed space to secure equipment and operate from during fire emergencies and prescribed burn operations.

As is typical, much of the season was spent in preparation for wildfire and prescribed burn activities. Personnel from this station were sent to various locations for training assignments. Classes attended included S-211, S-130, S-190, S-205, S-230, S-336, S-390, I-363 and I-365.

As in the previous year, FWS personnel from this District and State Fire Management District 3 participated in the NCFS Region I Fire School. The school this year was similar to last year in that the Unified Command structure was central to the exercise. This is the basis of how we will operate on large fires involving refuge lands in North Carolina.

In addition to the 1,500 acres mentioned above, prescriptions to burn about 1,500 acres of pocosins were written and approved for this year. Included in the pocosin tracts were prescriptions specifically designed to improve and maintain RCW habitat. Although much time and effort went into preparing the pocosin tracts and improving the firelines etc...; they were not burned due to the extremely dry summer and fall and the sudden complete turn around in late October to excessively wet conditions. The Keetch-Byram Drought Index reached 700 during August and was approximately 750 when rainfall eliminated the severity problem in late fall.

The burn associated with the research project "Heat Transfer into Duff and Organic Soil" was scheduled for the second week of November. The prospects for this burn looked very good until 10" of rain fell in the latter part of October and we were forced to scrub. We will attempt this burn again in the fall of this year.

G. WILDLIFE

2. Endangered and/or Threatened Species

Five endangered species have been documented on the refuge. Management programs are in place for the red wolf and red-

cockaded woodpecker. An inventory program is in place for American alligators. There are no plans to manage specifically for or inventory bald eagles or peregrine falcons.

a. Federally Listed Endangered and Threatened Species

American Alligator (Threatened): American alligators reach the northern extent of their range on the refuge and probably were never very numerous in the area. A few have been seen each year in the marshes, ponds, streams, and canals. The U.S. Air Force contracted with the refuge to survey the Dare County Bombing Range for alligators in 1988, 1990, 1991, 1992 and again in 1993. The highest density alligator population was found on Whipping Creek Lake. This route also had the highest density of all the routes surveyed. Information on number of alligators observed per mile for all routes on the refuge and bombing range for 1993 and for all survey years is given in Table 3.

During 1991, the staff was very pleased to finally document successful 'gator nesting and was able to mark young alligators on Whipping Creek and Lost Lake by notching tail scutes. Young from both locations were recaptured during 1992 and young from Whipping Creek were recaptured this year. Table 4 gives the changes in total length and weight from the young alligators that were recaptured. Night surveys in September to locate the young followed by daylight searches of specific locations where young were found resulted in improved success locating young alligators.

TABLE 3
NUMBER OF ALLIGATORS OBSERVED PER MILE FOR ALL ROUTES
(1988-1993)

<u>Survey Route</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>
Whipping Creek	1.6		.6	1.0	1.00	1.4
Air Force Target Area	.07		-0-**	.14	-0-	-0-
Navy Target Area	.07		.12	.12	-0-	-0-
Lake Worth	-0-					
Milltail Creek	.39	.13	.13	.13	.26	.26
South Lake				-0-	.19	-0-
Swan Creek				.18	.55	.36
Sawyer Lake			-0-	-0-	-0-	.45
Laurel Bay Lake				-0-	-0-	-0-
Lost Lake				.88	3.5	.87
Callaghan Creek					-0-	.33

** This is not to say that there are no alligators present, only that none were observed on the survey.

Nest searches and mark-recapture searches for young will continue to improve knowledge of growth rates, survival rates, and movements. Marking additional alligators next year and recapturing those marked this year will improve data and may provide some insight as to the effects of winter on growth and survival of young alligators.



Bio Tech Beasley with
5 year old 'gator.

MS 8/93

TABLE 4
GROWTH RATES OF ALLIGATORS CAPTURED IN 1991
AND RECAPTURED IN 1993

<u>Alligator # & location</u>	<u>Date Captured</u>	<u>Age (days)</u>	<u>Length (in.)</u>	<u>Weight (oz.)</u>
#5 Whip.Cr.	10-18-91	30	11.75	4.0
	06-03-92	258	13.25	3.5
	08-03-93	684	30.00	36.0
	increase	654	18.25	32.0
#7 Whip.Cr.	10-18-91	30	11.50	3.7
	08-05-93	686	27.13	28.5
	increase	656	15.63	24.8
#8 Whip.Cr.	10-18-91	30	11.50	4.0
	06-23-92	280	13.00	3.3
	05-18-93	607	19.13	11.0
	increase	577	7.63	7.0
#5, #7, #8 avg. increase/year			7.90	12.0

Bald Eagle (Endangered): Refuge staff sighted a mature bald eagle on November 27. The eagle was feeding on a snapping turtle carcass along the shoulder of Borrow Pit Road. An immature was seen several times over the farmfields in the Creef and South Twiford Units in October.

Peregrine Falcon (Endangered): Peregrine falcons are known to move through the refuge during migration. A refuge volunteer sighted a peregrine on January 17, 1994 near Brier Hall Road.

Red-Cockaded Woodpeckers (Endangered): A new method was tried this year to accomplish the difficult task of finding cavity trees on the ground after locating them from the helicopter. A radio transmitter (black bear radio collar) was flagged with tape (to make location easier) and dropped from the helicopter near a cavity tree. Flagging tape was also dropped as before. Later, standard radio telemetry techniques were used to guide staff; machete in one hand, antenna in the other, to the cavity tree. This is now known as the "bear collar" cluster.

All known cavity trees (recently located and known from past surveys) were observed and monitored for recent activity to determine status (Table 3). Five of 8 known clusters had active cavity trees. One cavity restrictor was installed this year. The production of young was documented in the Whipping Creek West cluster. Eight clusters that we have spotted from the air remain to be visited by ground.



Impending doom for this RCW cavity.
EJZ 7/93



Co-op student Liz Parks
investigates RCW cavity
tree. EJZ 7/93

Once the colonies are located, the understory/midstory vegetation must be controlled. Currently the understory beneath all the colonies is too thick to even walk through, and the midstory is too thick to see through. Also the midstory is at or near cavity level in all of the active colonies. Historically, this is known to cause cavity abandonment.

Prescribed fire was planned for the Whipping Creek colony and other areas on ARNWR to control this hardwood understory/mistery encroachment. This prescription, however, has not yet been carried out. This will again be a priority for next year.

TABLE 5
RED COCKADED WOODPECKER STATUS ON ARNWR AND
DARE COUNTY BOMBING RANGE - 1993

<u>CLUSTER NAME</u>	<u>YEAR LOCA.</u>	<u># OF CAVIT TREES</u>	<u># ACT. CAVIT TREES</u>	<u>FORAG- ING RCW'S SEEN</u>	<u>YOUNG DOCU- MENTED</u>	<u>ADD'L TREES LOC. IN '93</u>
ARNWR						
Whipping Creek West	1992	3	2	X	X	X
Whipping Creek East	1993	1	1			X
Chip Road	1989	3	0			
DCBR						
North Faircloth	1989	6	3	X		X
South Faircloth	1989	7	2	X		X
West Jackson	1989	1	0			
East Jackson	1989	2	0			
Bear Collar	1993	5	3	X		X

Red Wolves (Endangered): During 1993, staff released 15 wolves: 2 families that consisted of 8 and 5 wolves, respectively, and 1 adult pair. The family of 5 wolves and the adult pair represented the first 2 releases of wolves in the Pocosin Lakes NWR. Because of its large size, remoteness, and abundant prey populations, Pocosin Lakes NWR should support 15 to 30 wolves. More releases are planned for Pocosin Lakes and Alligator River during 1994.

During 1993 a minimum of 4 litters were produced that contained a minimum of 16 pups. These births were offset by the death of 6 wolves that had survived in the wild for an average of 8.1 months.

TABLE 6
RED WOLVES THAT DIED DURING 1993

Wolf	Date of Death	# Mos in wild	Cause of Death
518M	10/17/93	14.5	unknown
445M	10/23/93	1.3	killed in collision with vehicle
580F	03/01/93	9.9	demodectic mange
581M	03/29/93	10.1	demodectic mange
659M	10/26/93	6.3	killed in collision with vehicle
672F	11/12/93	6.4	mistaken for coyote and shot

As a result of releases, birth, deaths, and some management actions, the free-ranging red wolf population fluctuated on nearly a monthly basis (Table 7).

TABLE 7
MONTHLY RED WOLF POPULATION (FREE-RANGING)

Month	Population		Month	Population	
	Low	High		Low	High
January	27	27	July	31	32
February	27	27	August	26	34
March	25	27	September	33	38
April	26	26	October	37	41
May	26	26	November	39	42
June	30	31	December	36	40

As of 31 December the population included a minimum of 39 wolves that had been in the wild for an average of 22.6 months (Table 8).

Throughout 1993, red wolves made greater use of private land than refuge land. Currently wolves have legal access to about 60,000 acres of private property. During 1993 we began developing agreements with Weyerhaeuser, Georgia-Pacific, and 5 individuals that would provide red wolves access to an additional 150,000 acres of private land. We are hopeful that the agreements will be consummated during 1994.

TABLE 8
FREE-RANGING RED WOLVES IN EASTERN NORTH CAROLINA
AS OF 31 DECEMBER 1993

Wolf#	Birth & sex	Age ^a location	# (mos)	Mos. in wild	Location of home range (mos) ^b	Comments
300F	captivity	91.5	62.4	federal land	consorting with 319M	
319M	captivity	79.0	39.1	federal land	consorting with 300F	
331M	captivity	67.2	54.7	federal land	consorting with 394F	
344F	wild	67.7	67.7	private land	consorting with 392M	
358M	captivity	56.0	0.5	private land	consorting with 377F	
372M	captivity	54.8	16.9	private land	consorting with 382F	
377F	captivity	55.8	0.5	private land	consorting with 358M	
382F	captivity	54.4	16.9	private land	consorting with 372M	
392M	captivity	55.1	47.5	private land	consorting with 344F	
394F	captivity	55.1	46.8	federal land	consorting with 331M	
408F	captivity	44.7	4.3	private land	consorting with 464M	
442M	wild	43.8	42.6	private land	consorting with 500F	
443F	wild	43.8	41.7	private land	lone wolf	
444F	wild	43.8	41.2	federal land	pack member	
464M	captivity	32.2	3.7	private land	consorting with 408F	
496F	wild	32.5	28.6	private land	probably consorting with unknown male	
500F	wild	32.0	31.0	private land	consorting with 442M	
503F	wild	32.0	31.0	private land	consorting with 670M	
504M	wild	32.0	28.5	private land	lone wolf	
505F	wild	32.1	32.1	private land	lone wolf	
506M	wild	32.1	32.1	private land	lone wolf	
507M	wild	32.1	32.1	federal land	pack member	
508M	wild	32.1	30.5	private land	probably consorting with unknown male	
519M	captivity	19.5	16.9	private land	lone wolf	
523F	captivity	19.5	16.5	private land	lone wolf	
582F	wild	19.8	19.8	federal land	pack member	
583M	wild	20.1	20.1	private land	pack member	
586M	captivity	8.5	4.5	private land	pack member	
588F	captivity	8.5	4.5	private land	pack member	
589F	captivity	8.5	4.5	private land	pack member	
591F	captivity	8.5	4.5	private land	pack member	
660F	wild	8.5	8.5	federal land	pack member	
661M	wild	8.5	8.5	federal land	pack member	
662M	wild	8.5	8.5	federal land	pack member	
663M	wild	8.5	8.5	federal land	pack member	
668M	wild	8.0	8.0	private land	lone wolf	
670M	wild	8.0	8.0	private land	consorting with 503F	
671M	wild	8.0	8.0	private land	pack member	
673F ^c	wild	8.0	8.0	private land	status unknown	

^a - Age was calculated relative to 31 December 1993.

^b - Number of months in the wild did not necessarily span the period from the date of release for animals born in captivity or from birth for animals born in the wild, as some wolves were placed in captivity for varying periods of time and subsequently re-released.

^c - 673F's presence was known from capture on 01/14/93.

During February 1994, staff expects about 8 red wolf pairs to breed in the wild. These breedings should result in the production of about 25 to 30 pups that mature to an age of self-sufficiency. Thus, by December 1994, the red wolf population should include 60 to 80 animals, of which about 75% will have been born in the wild.

During 1993, 12 to 34 captive wolves were maintained at the Alligator River breeding facility. As of December 31, 21 wolves resided at the facility.

Captive breeding at the refuge has become an increasingly important component of the restoration effort: since 1986, 108 wolves have been maintained at the facility for varying periods of time. Additionally, 29 captive adult pairs have been maintained through breeding seasons. Ten of these pairs bred successfully and produced 44 pups.



Eight week old pup.....
one of several produced at the captive
breeding facility on the refuge. CC 8/93

3. Waterfowl

Historically, large numbers of waterfowl have not utilized ARNWR, but the refuge does support a substantial year-round population of wood ducks utilizing the numerous ditches, canals, creeks, lakes, natural openings, and swamps. Diving species such as scaup, canvasback, redhead, bufflehead, and mergansers can be found on the Alligator River and the associated sounds.

This year's management of the farm fields showed increased waterfowl use. Peak numbers were 346 blacks, 1432 mallards, 5109 pintails, 6770 green-winged teal, and 3221 ring-necked ducks. Peak total was 16,734 from the aerial survey done on January 14. Total swan use was down from last years record high numbers. However the peak numbers rose by almost 300 to 760. The results of this year's surveys are given below in Table 9.

Table 9
Waterfowl Survey, ARNWR Fall 1992 - Spring 1993

Waterfowl Type	Nov 17	Dec 1	Dec 9	Dec 16	Dec 31	Jan 8	Jan 14	Jan* 14	Jan 22	Feb 18	Feb* 18	Mar 4
Mallard	64	408	205	385	304	236	220	1432	622	233	834	98
Black Duck	89	346	115	226	118	116	9	121	339	62	134	95
Pintail	107	3445	1210	2150	1080	150	1867	5109	2478	2050	1170	654
Widgeon	0	64	30	80	15	8	0	0	64	40	0	27
Gr. Winged Teal	145	5000	3650	3350	4789	290	4075	6405	6770	2025	1770	798
Wood Duck	80	512	164	223	0	86	174	27	551	121	11	145
Ring Necked Duck	25	130	570	1122	1343	220	2332	3221	2145	2095	1770	798
Gadwall	0	0	0	0	0	0	0	0	0	0	6	0
BW Teal	0	26	17	0	2	0	0	0	8	0	0	4
Shoveler	0	0	0	0	0	0	12	0	24	12	0	25
Coots	0	0	0	0	0	0	4	0	2	57	0	12
Canada Goose	0	0	0	0	0	0	0	0	4	0	0	0
Tundra Swans	0	7	22	6	56	93	442	150	762	131	182	44
Unknown	0	1290	470	1054	10	725	0	263	1439	845	56	290
TOTALS	655	11228	6453	8596	7717	1924	9131	16734	15478	7674	5733	2367

*Aerial Survey



Creef Unit - moist soil at it's best!
BWS 12/93

8. Game Mammals

In 1993, the refuge continued the cooperative black bear research study with the University of Tennessee (UT). The Air Force (Dare County Bombing Range) became a partner in the effort and transferred funds to help continue and expand the project. Information such as sex and age distribution, age at primiparity, birth rate, survival, and density of the bear population will continue to be gathered. This years progress report has not been received at this time. (See Section D.5.)

H. PUBLIC USE

1. General

Certainly, 1993 can be considered the new beginning for the public use program on Alligator River. With planning completed during 1992, 1993 was the year to get on with projects that will provide the basics for a public use program. The year's efforts focused on the planning, construction and interpretation for the Creef Cut Wildlife Trail and Fishing Area (completely handicapped accessible) and the Milltail Creek Canoe/Kayak Trail and Sandy Ridge Wildlife Trail. Challenge grants were received for each project, and by year's end, each was nearly complete. (See Section H.4 for details). Alligator River finally has non-consumptive public use!

Three new entrance signs were erected early in the year and seem to have survived the year nicely! (Only 1 or 2 small bullet holes!!)

Historically, the public use program has primarily been consumptive in nature, with the hunting program being most active. In the past, little, if any organized non-consumptive public use occurred on the refuge. The staff neither anticipates nor desires Alligator River to develop a large public use program; however, plans specifically target providing a very limited number of sites and a very high quality experience at those sites. With the completion of the 2 trail projects described above, Alligator River will have but 1 trail remaining in the planning stage. It will most probably be several years before that project will be tackled.

Total visits to the refuge in 1993 were estimated to be 11,369.

Administrative offices for the refuge remained in the GSA leased office space in Manteo. A few visitors continue to locate the office, but most information was disseminated by telephone, correspondence, and through the news media. During 1993, the refuge continued to focus on providing a greater number of media contacts while keeping the messages short and simple. One method that proved successful was taking a number of black and white photographs with film provided by the local newspaper. Shots of wildlife, as well as refuge staff performing regular duties, volunteers receiving awards, etc. were provided as exposed film. The photos were run regularly with short, informative captions. A total of 21 news releases and 6 radio/TV spots were done.

2. Outdoor Classrooms - Students

Many teachers have established regular patterns in their utilization of the marshes of Pea Island for independent use with their classes. More recently, classes have begun to show an interest in visiting Alligator River NWR. More independent use by classes is anticipated once the trails, kiosk, and interpretive panels are in place. Volunteers are currently being trained to lead groups on both AR trails.

To encourage contact between the classes and the refuge and to ensure a reasonable level of "wildlife literacy" in the local public schools, a core group of volunteers have prepared and stand ready to present in-classroom programs on assorted wildlife and refuge topics. Programs on the Red Wolf, Birds, Mammals, Amphibians, Reptiles, Fish and Animals without Backbones and Bird Banding and Migrations were available. These educational programs were presented to 1051 students (see Table 8, Section H.6.).

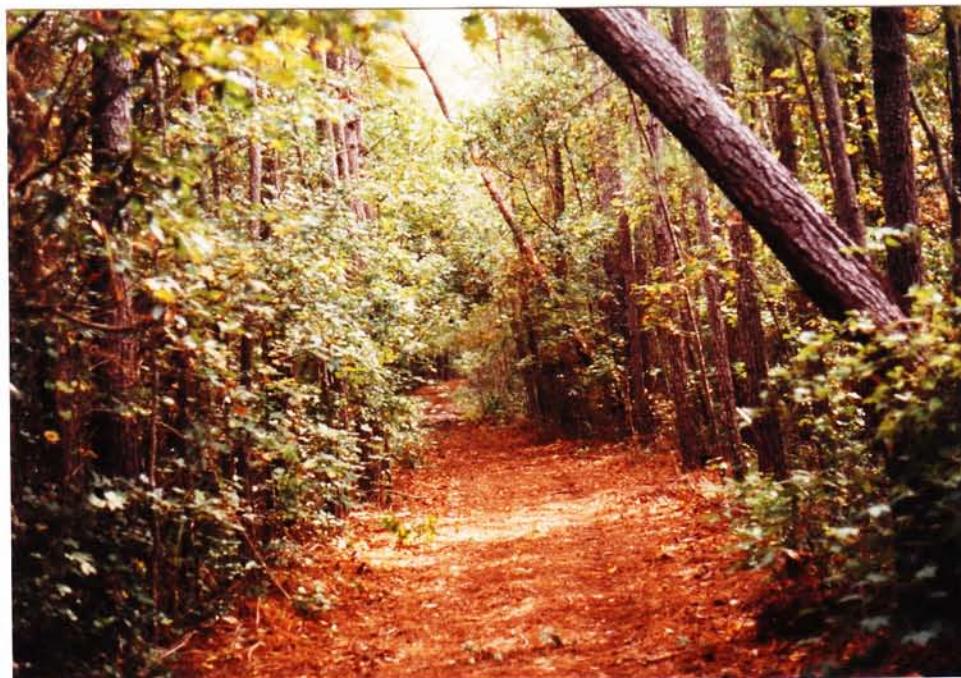
To encourage educational endeavors in the community, refuge staff served as judges for both the Manteo and Cape Hatteras High School Science Fairs and assisted, on request, with special projects.

3. Outdoor Classrooms - Teachers

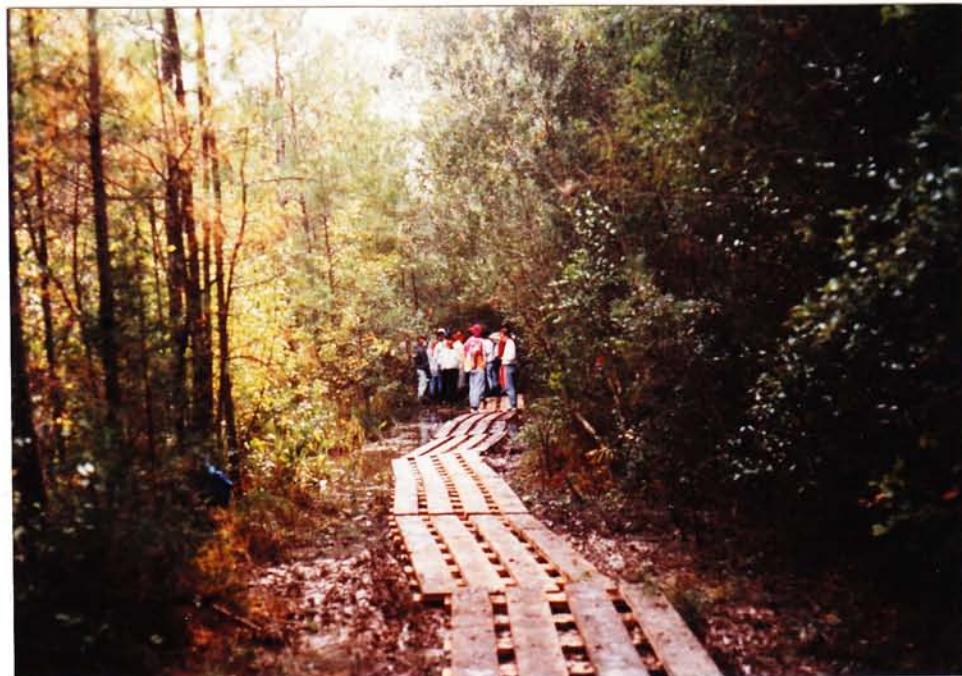
There were no local requests for teacher training workshops in 1993. Since Alligator River and Pea Island Refuges are located in an area rich in conservation education/interpretation agencies, these refuges do not receive the requests common on other stations that are often the sole sources available. The North Carolina Aquarium, Jockey's Ridge State Park, Nags Head Woods Ecological Preserve, and Cape Hatteras National Seashore offer environmental education and teacher training activities. Teachers here are hounded constantly to attend such functions. For this reason, the refuge has chosen to focus more on other educational needs rather than attempt to compete with other conservation agencies. A joint leaflet has been produced to provide teacher assistance in planning field trips (see informational packet).

4. Interpretive Foot Trails

As mentioned earlier, prior to 1993, no official trails have existed on ARNWR. However, the approval of the Public Use Management Plan during 1992 paved the way for the development of several trails. The highest priority project was the Creef Cut Wildlife Trail and Handicapped Fishing Area. The project involved converting an abandoned section of Highway 64 into a handicapped accessible trail with handicapped accessible bank fishing. The half-mile roadbed lies between a beautiful freshwater marsh and a moist soil management unit. A USFWS Challenge Grant (\$13,000), monies from the DoD (both Air Force and Navy- \$5,000 each), assistance from the NCDOT (parking lots and vegetative planting), a grant from the Outer Banks Community Foundation (\$3,000), donated work by Barnhill Contracting, and assistance from NPS construction crews allowed the accomplishment of this project during 1993. Cold weather prohibited NCDOT from paving in the late fall. As soon as the weather warms in 1994, the paving and vegetation planting will be completed by the NCDOT. The CWRS will then hire a private contractor to build the kiosk and the project will be complete. Total cost of the Creef Cut Project is estimated to be \$64,750 (including in-kind services).



The beginning of Sandy Ridge Trail is high and dry.....
BWS 8/93



.....Wetter sections of the trail were "bridged" with green
oak pallets.
BWS 8/93

A second public use area has been developed at the south end of Buffalo City Road. Milltail Creek Canoe/Kayak Trails provide 13 miles of marked wilderness-like water trails. This system was completed and open to the public in March, 1993. (See map in informational packet.) From the same parking area, Sandy Ridge Wildlife Trail utilizes a washed-out roadbed (Sandy Ridge Road) which parallels Milltail Creek. The area is excellent habitat for neotropical migrants and wetlands education. A USFWS Challenge Grant (\$13,000), NC Adopt-a-Trail Grant (\$2,000), and a tremendous amount of contributed services made this project possible. The total cost was \$39,485.

Both of the above projects have proven to be excellent "partners" projects for the refuge. Local, State, and regional support has been outstanding.

6. Interpretive Exhibits/Demonstrations

Refuge staff manned displays and exhibits at the usual annual events around Dare County and eastern North Carolina. Table 10 represents the Outreach Exhibits/Shows and Off-site Educational Programs for the refuge during 1993.

**TABLE 10
ALLIGATOR RIVER PUBLIC USE PROGRAMS***

<u>Program Type</u>	<u>On/Off Refuge</u>	<u>#Programs</u>	<u>Total</u>
<u>#Part.</u>			
General Refuge for Adults	Off	7	475
General - for Public	On	3	60
School or School Related Gr.	On	13	215
Teacher Groups	Off	1	20
School Groups	Off	60	1051
NC PTA Convention Booth	Off	N/A	650
Englehard Seafood Festival	Off	N/A	2000
Keynote Speaker-Governor's Awards Banquet	Off	1	150
Dixie Deer Classic	Off	N/A	350
NC Boy Scout Jamboree Booth	Off	N/A	150
Norfolk Air Show Booth	Off	N/A	100
Paper Presented - Nat'l. Wildlife Convention	Off	1	75
Environmental Fair - USCG	Off	N/A	30
NC Wildlife Sportsman's Show Booth	Off	N/A	125
Scuppernong River Festival Booth	Off	N/A	15

*All off-refuge programs for complex; plus AR on-refuge programs.

7. Other Interpretive Programs

Red wolf howlings have proven to be popular programs on the refuge. A half dozen public howlings were advertized and conducted during 1993. In addition, refuge staff made an extra effort to provide howlings for community groups who requested them and involved other refuge staff, volunteer, and families in the programs, as well.

A number of off-refuge programs were conducted during 1993 by staff and volunteers. Many dealt with the Red Wolf Program; others addressed specific and general refuge related topics. These programs and other related off-refuge programs are also shown in Table 8.

8. Hunting

With approval of the master plan shortly after establishment, the refuge was divided into 3 basic public use areas, with several additional safety or management zones closed to all hunting. As new areas have been acquired, they have been added to 1 of the 3 existing categories, or (in the case of the farm fields) put into a newly created category. The farm fields were designated as open to all authorized uses during September and October (except waterfowl hunting), but closed to public entry during all other times. With additions and deletions of land in the refuge, the ratio of land designated for hunting with chase dogs and land designated as closed to use of chase dogs has remained relatively constant (1:1). The 5-year review of the master plan took place during 1993. Some changes in the hunting area designations resulted; however, the ratios remained approximately the same. Public reaction to the changes were favorable.

For the second season, refuge hunting permits were required for all hunts. The permit system has also been accepted readily by hunters. Again this year, the hunt leaflet contained the permit; signing the permit acknowledged having read and understood the leaflet.

White-tailed deer continued to be the most sought after game species on refuge lands. Since Alligator River contains over 150,000 acres of habitat traversed by more than 150 miles of logging roads, and because many of these roads share junctions with State roads, it is difficult to establish effective hunter check stations. The NCWRC again required hunters to register hunter-killed deer with a local wildlife cooperator agent; however, they assume that an estimated 40% go unreported. In past years, the figures reported by the State have been utilized and extrapolated to provide more realistic estimates. The best estimate indicates approximately 280 deer were harvested on the refuge during the 1993-94 season.

In September, the annual hunter information meeting was held at the Manns Harbor Community Center. Approximately 10 people attended; most folks know what to expect and have exhausted their questions. Those attending offered ideas for consideration when the Master Plan was reviewed; many of the ideas were adopted in the review process later during the year. This year was Dare County's third annual bear season since the NCWRC and County Commissioners reinstated a bear season. The 5 day bear season ran November 8-13; no bears were documented as taken in Dare County during 1993.

Most of the brochure boxes labeled with signs stating "Hunter Information" survived the winter and needed just a bit of sprucing up and stuffing. The new hunt leaflets arrived on time and were clear and correct. Again this year, extra effort was made throughout the seasons to ensure that leaflets were always available, since the brochure contained the required hunting permit. The effort was minimal, since routine patrols took refuge officers by the boxes frequently.



Hunting white-tailed deer with chase dogs
is ever popular! BWS 11/93

September 13, bow season began along with the usual weekend patrol assignments for refuge officers. Muzzle loader season came in on October 11, a 3 day duck season occurred October 7-9, and regular gun season started on October 18. On November 1, the farm field gates were closed and locked. For the rest of the year (and through September, 1994), this area was closed to all public entry.

Waterfowl seasons were October 7-9, November 25-27, and December 27 - January 19. A limited amount of waterfowl hunting took place on the refuge, but most occurred over open water in the sounds and in Milltail Creek. The farm fields were open to public use during October; however, the area was closed to waterfowl hunting.

Though the new regional hunting policy for youths has been difficult to enforce, the fact that Dare County Schools already had the State Hunter Safety Course as a part of the seventh and eighth grade curriculum certainly helped. Beginning in 1991, North Carolina now requires all first-time hunters to successfully complete the Hunter Safety Course. In addition to the courses offered in the public schools, NCWRC Officer Brinkley and Volunteer Jeff Nycze conducted several extra classes to enable other youths in the area to qualify to hunt on the refuge. The refuge staff has yet to hear of a person who has needed the course and was unable to find a class.

Estimated public hunting activity appears below:

<u>Activity</u>	<u>Visits</u>
Duck	249
Deer (gun)	1,622
Deer (bow)	350
Small Game	350
Upland Game Birds	125

There are very few places to quail or rabbit hunt on the refuge. Small game hunting is primarily for raccoon, squirrel, and rabbit.

9. Fishing

The heaviest recreational fishing effort in the vicinity on the refuge is in the surrounding sound system from October through April. Fishing pressure on the refuge is relatively low and is a reflection of the isolation of the area and limited access rather than of low catch per unit effort. Angling for bluegill, crappie, chain pickerel, channel catfish, flier, largemouth bass, and yellow and white perch is considered good.

During 1993, there were an estimated 1,904 fishing visits to the refuge. The construction of the handicapped accessible fishing dock at Creef Cut is expected to increase fishing numbers during 1994.

10. Trapping

Furbearer trapping was allowed under North Carolina regulations. Since trapping is considered a commercial use of the refuge, neither visits nor activity hours are normally recorded under public use. For the 1993 trapping season, no special use permits were issued for refuge trapping.

11. Wildlife Observation

Canoeists enjoyed paddling on Milltail and Whipping Creeks and observing an occasional alligator, wood duck brood, or other wildlife in the area. The Milltail Creek Canoe/Kayak Trail has encouraged folks to come to the refuge for wildlife observation.

Wildlife photographers utilized the refuge to some extent for a chance at bear, deer, or any number of birds and other animals. General habitat scenes were popular for an adventuresome few.

The following figures represent wildlife/wildlands observation during 1993:

<u>Activity</u>	<u>Visits</u>
Foot	2,319
Vehicle	5,382
Boat	1,103
Photography	189

17. Law Enforcement

Refuge collateral duty officers continued to participate in considerably more LE patrols during the 1993-94 season than in the past. For the most part, each hunting day had at least 1 officer working. Heavy use days involved all officers.

As stated earlier, extra attention was paid to keeping refuge hunt leaflets/permits in the leaflet boxes. Prior to the opening of the seasons, regulatory signs were checked and replaced where needed.

During 1993, Bio Tech Elmore (until September; then name became Noffsinger!) completed basic LE training at FLETC, bringing the total number of refuge officers to 6. All refuge officers attended refresher training and successfully qualified semi-annually, as required.

NOV's for 28 violations were issued on the refuge during 1993, including the following charges:

- 2 transporting loaded firearm
- 4 no hunter orange
- 6 no refuge hunt permit
- 4 hunting from a permanent stand
- 4 hunting over bait
- 4 possession of untagged deer
- 2 possession of unchecked deer
- 1 hunting in closed area
- 1 no duck stamp (federal)

In addition, the following State NOV's were issued on the refuge:

- 2 no hunter orange
- 1 no big game license
- 3 no fishing license

In September, the refuge recovered approximately \$4,000 worth of tools, binoculars, spotting scopes, etc. that had been stolen via vehicle break-ins last year. Co-op farmers also recovered about \$3,000 worth of tools and a portable welder. It's amazing the thieves held on to the property for so long!

18. Cooperating Associations

1993 was a good year for the Coastal Wildlife Refuge Society. Membership in September 1993 was 216. For financial information, see Table 11.

Sales activities for the Society were fairly good considering the lower number of visitors and their conservative spending. In addition to the net sales income show, the Society had approximately \$10,500 worth of inventory on hand at the end of the year. Sales items added this year included children's binoculars and bug boxes and the new Janet Walker red wolf shirt.

The Creel Cut Handicapped Fishing Area and Wildlife Trail was one of the 2 major projects for 1993. This project included 250' of boardwalk, 2 observation platforms, a fishing dock, a 9 car paved parking area with 2 additional handicapped spaces and 2 bus spaces, a kiosk, and a 1/2 mile paved trail (8' wide). Many grant proposals were written and many phone calls made to find partners for this project. In the end, sponsors

included USFWS (Challenge Grant), Dept. of Defense (both Air Force and Navy), Barnhill Contracting, Outer Banks Community Foundation, NC Dept. of Transportation, Wilderness Graphics, Manns Harbor Sand Corp. and CWRS. The project's final cost was figured at \$64,750. The Society was instrumental in handling some of the funds and supplementing funding where/when necessary. Completion of the trail is anticipated by March, 1994. All materials are on hand, construction of boardwalk, overlook, and fishing dock is complete; paving for trail is done and the rest should go like "clockwork". The CWRS will pay a local contractor to build the kiosk at the trailhead, once the parking lot paving is done.

Another project at Alligator River is the Milltail Canoe/Kayak Trail System and the Sandy Ridge Wildlife Trail. Kitty Hawk Kayak laid out, tested, and marked approximately 15 miles of trails and helped to design and pay for tear-off maps for the area (CWRS assisted in funding these 8,000 maps). The canoe/kayak trails have been in operation since May, 1993. Sandy Ridge Trail has been cleared; oak mats have been purchased and were laid by a group of volunteers from Duke University and the Manteo High School football team. An Eagle Scout project is lined up to re-deck the bridge and construct the overlook over Milltail Creek before February, 1994. The NCDOT will improve and enlarge the marl parking area at the south end of Buffalo City Road. Marl has been purchased to upgrade the parking area on Milltail Road (take out for boats). Total cost will be \$39,485 when completed. Other partners include Wilderness Graphics, NC Adopt-A-Trail Program, Outer Banks Audubon, Times Printing Company, and the CWRS.

The Society purchased a MacIntosh LC III, one of the newest and faster computers, and additional software for the refuge public use program and Society use. This computer, with large color monitor, is a much more efficient and comfortable machine.

During 1993, the Society accepted designated donations for the Red Wolf Project (\$1,175), the Pocosin Lakes NWR dedication (\$130), the RUN Project (\$2,000), and the Turtle Project (\$400). Most designated funds were dispersed; what remains will be carried over to 1994.

The CWRS has certainly been an asset to the USFWS during 1993, and plans greater things for 1994!

TABLE 11
COASTAL WILDLIFE REFUGE SOCIETY - Financial Report - FY 1993

Income

Donations and Dues	
Designated Red Wolf	\$1,175.00
Designated PLNWR	130.00
Designated RUN	2,000.00
Designated Turtles	400.00
General	6,110.18
Total - Donations	\$9,815.18
*Net Income - Sales Unit (See Sales Report below)	4,565.90
Other	
Interest	278.14
Adjustment	7.52
Total - Other	285.66
Total Income	
\$14,666.75	

Expenses

USFWS Expenditures	
PLNWR	130.00
Red Wolf	1,175.00
Turtles	94.41
AR/PINWR - General	10,187.78
Total USFWS Expenditures	11,587.19
Administration of CWRS	
General	353.85
Membership to DVAC	25.00
Total	378.85
Total Expenses	
\$11,966.04	

Total Income/Expenses	\$2,700.70
Balance Forward - 10/01/92	2,979.78
Balance to be Forwarded 10/01/93	5,680.48

Sales Unit Report

Income	
Taxable Sales	\$7,160.84
Non-taxable Sales	2,629.69
Total Income	\$9,790.53
Expenses	
Cost of Goods	\$4,749.34
Sales Tax	475.29
Total Expenses	\$5,224.63

*Net Income from Sales
\$4,565.90

I. EQUIPMENT AND FACILITIES

1. New Construction

A water treatment system costing approximately \$10K was installed on the well system supplying water to the new maintenance facility at East Lake. The system, consisting of water softner, solid iron filter, and aerator has worked well since installation in August.

A contract was issued to Powerhouse Construction, Wilmington, NC, to construct metal equipment storage buildings totalling 220' L x 40' W. Total contract amount was \$143,980. and included repainting the "red shed", site work, gravel over roughly 1 acre, 1500' of chain link fence, purchase and erecting the buildings. The contractor began work on 11/15 and immediately encountered problems - organic soils and ground water levels virtually at the surface. Very little work had been completed as the year ended.

2. Rehabilitation

Very little progress was made on the bridge replacement/wetland restoration project during 1993 since virtually the entire maintenance staff spent the summer working at Pea Island repairing storm damage. Two structures, River Road X Hwy. 64 and Koehring X Bay Roads, were completed. This project will take at least another 3 years to complete and will replace 28 unsafe wooden bridges (30-50' in length) with water control structures and fill. These efforts will eventually restore natural hydrology on 60,000 acres of drained wetlands.

Two water control structures, controlling about 200 acres of moist soil units, were repaired by digging out, backfilling, pouring concrete, etc. This project turned out to be time consuming - proximity to the perimeter canal system prohibited direct equipment access. Lots of shovel work!

Refuge staff disced roughly 200 acres of moist soil units to set back plant succession (using Mattamuskeet NWR's farm tractor).

3. Major Maintenance

Boundary posting continued to be a high priority item with another 30 miles completed during '93. Approximately 100 miles of exterior boundary remains to be posted.

Improvements to the primary refuge road system continued to be a high priority item. Most refuge roads have become impassible even to 4x4's and lack of access severely impacting the refuge's ability to conduct management and public use programs. The work began during 1992 on Koehring and Blueberry Roads was completed in early summer '93 and

consisted of removing road shoulder vegetation with "KG" blade, recrowning with dozer, hauling fill, installing culverts, etc. The end results were excellent - these roads remained accessible to 4x2 vehicles throughout the rest of the year. This work was completed just in time to provide access to a wildfire. Roughly 20 miles of road has been completely reworked in the past 2 years - another 30 miles scheduled for repair.

Work also began on 6 miles of Milltail Road late in the year and consisted of removing road shoulder vegetation by crawler and/or "boom axe", hauling rock to fill holes, hauling fill. Onset of wet weather prohibited completing this work.

Approximately 80 miles of secondary roads had to be worked with crawler tractors and chainsaws removing downed trees following storms.

A Major part of the maintenance work accomplished during 1993 involved storm damage repair at Pea Island. Virtually all of Alligator River's maintenance staff spent 3-1/2 months completing this force account work. The end result was very little progress on major projects at Alligator River.

Equipment repairs were a never ending problem during the year, partially due to a lot of hard work and partially to using some old equipment. In addition to using all of our rather large supply of "hay bailing" wire, every penny we could find was spent trying to keep stuff running. I'll not bore you with all the details other than to say it was a very trying, hectic year!

4. Equipment Utilization and Replacement

Many thanks to Mattamuskeet and Pocosin Lakes Refuges for the loan of equipment during the year for storm damage repair efforts. Without their willingness to share, the repairs would not have been completed. Equipment borrowed included dragline and D-7 from Mattamuskeet (for 3 months), front-end loader and crawlers from Pocosin Lakes. Cape Romain loaned us a pickup for 6 months.

Several pieces of equipment were purchased during the year. These included: 4x4 tractor and boom axe (\$43K); 16 yard tandem axle dump truck (\$72K); truck tractor (\$70K); and John Deere 770 grader (\$101K). Most of this equipment was purchased with construction account funds or cost shared with fire funds.

Refuge obtained 2 identical all-terrain forklifts from excess and cannibalized one to make one usable machine. Refuge provided trade-ins for other stations in order to get access to the vehicles they were replacing - their junkers better than a lot of ours!

J. OTHER ITEMS

3. Items of Interest

Project leader cluster meeting for NC refuges was held at Manteo March 16-18 and November 16-17.

DOI Secretary Babbitt visited the area - see Pea Island section.

RM Johnson and DRM Noffsinger briefed Congressman Lancaster's aids on numerous subjects pertaining to refuge management.

Refuge revenue sharing check of \$362,143. distributed to Dare County.

Five refuge staff completed equipment operator training during the year.

DRM Noffsinger and ROS Windley completed the required 80 hours of supervisory training during the year.

Dave Smith, Frank Cole, and Jim Durrwachter conducted fire inspection on 6/1-4.

District Biologist Florschutz and DU Project Coordinator Ray Whittimore visited on 6/3 to look at a DU Marsh proposal site.

RM Johnson, DRM Noffsinger, and BT Zakrajsek visited Croatan NF to exchange ideas on burning pocosins and RCW management.

FMO Fowler served as the Region 4 representative for developing FirePro.

NC Wildlife Resources District Biologist meeting held at refuge on 9/17.

Numerous Air Force personnel visited the refuge during the year to discuss various items - ranging from water management to endangered species management.

A seemingly endless string of university professors, graduate students, state agency and other federal agency personnel visited to discuss research projects, environmental compliance issues, etc.

4. Credits

The Narrative Report was a joint effort by the entire staff. Special credit goes to WIS Strawser for editing and OAC Lane for typing.

K. FEEDBACK

I confess that it's been 3 years since I've taken the time to write a feedback section. Somehow I just never seemed to have the energy when the rest of the narrative was finally completed. I cannot let this year pass, however, without commenting on a very real oversight somewhere in the "system" (yeah, I know - it's one among many).

Pea Island Refuge was severely battered during the year by several major storms. Two of these storms in particular caused extensive damage to refuge buildings and impoundment units. Damage assessments submitted by the refuge over the year totaled almost \$600,000, and I assure you, these estimates were conservative. The refuge received virtually no additional funding or assistance in trying to repair these damages other than loans of equipment from neighboring stations. Due largely to a dedicated and skilled staff, we were successful in repairing most of the damage to the impoundment units by completely abandoning all other priority projects. Most other damage was at least "band-aided" over. This is not an unfamiliar scenario to many of you - I personally know of several other Region 4 refuges alone that have experienced the same dilemma.

The purpose of sharing this is to relate the response obtained by our neighbors, the National Park Service. For those of you that don't know, Pea Island Refuge is literally an inholding within Cape Hatteras National Seashore, has the same barrier island habitat, and receives even more per acre visitor use. Many of the damages from these storms were similar - other than the fact that one area is administered by Park Service and the other by the Fish and Wildlife Service. The Seashore submitted damage estimates of about \$1 million and received over \$800,000 add-on funding for storm damage - the refuge \$0. Letters detailing this gross discrepancy were unsuccessful - as I expected I guess. Let me defend Region 4 ARW staff - they truly tried to procure additional funding, but to no avail.

I'm not sure what the moral of this story is - maybe some section responsible for this area of budgeting can think of one or those reading this can insert one in the margins. I do know one thing - it's becoming very difficult to maintain a high morale level and sense of dedication among a staff that sees vividly such differences between two sister agencies. With funding levels that cannot provide discretionary funds except by leaving authorized positions vacant at already chronically understaffed field stations, this type of discrepancy deserves to be called to everyone's attention.

PEA ISLAND NATIONAL WILDLIFE REFUGE

Manteo, North Carolina

ANNUAL NARRATIVE REPORT

Calendar Year 1993

**U. S. Department of the Interior
Fish and Wildlife Service
NATIONAL WILDLIFE REFUGE SYSTEM**

INTRODUCTION

Pea Island National Wildlife Refuge was established in 1938 by Executive Order 7864 as a wintering area for the greater snow goose and other migratory waterfowl. At the last survey, the refuge contained 5,915 acres of beach, dunes, high marsh dikes, salt marsh, impoundments, ponds, and salt flats; however, severe ocean overwash and beach erosion has caused the loss of a portion of the beach/dune acreage. Presidential Proclamation #2284 closed 25,700 acres of adjacent waters in the Pamlico Sound to migratory waterfowl hunting.

The refuge is located on the north end of Hatteras Island, a coastal barrier island which is part of a chain of islands known as the **Outer Banks**. These islands are separated from the mainland by a series of marshes and/or sounds which are up to 25 miles wide.

Located within the boundaries of Cape Hatteras National Seashore, Pea Island is approximately 175 miles east of Raleigh, NC and 225 miles southeast of Washington, DC.

Pea Island's climate is generally moderated by the ocean, thus it is cooler in the summer and warmer in the winter than the NC mainland. The average daily maximum temperature is 69 degrees and the minimum is 56 degrees. Due to heavy and prolonged storms, the average rainfall is 55.6 inches, most of which occurs during the winter and summer. It is frequently windy during both day and night with 11 mph as the annual mean wind speed. The prevailing summer wind is from the southwest, and winds are usually from the northeast in the winter.

The diversity and abundance of bird life on Pea Island explains its reputation of being a "birder's paradise". The refuge is an important wintering ground for tundra swans, Canada geese, snow geese, and over 25 species of ducks. Many other interesting bird species can be found at Pea Island during the winter months and during spring/fall migrations. During the summer months, several species of herons, egrets, ibises, terns and gulls, along with American avocets, willets, black-necked stilts, other wading and shore birds and a few species of ducks nest on the refuge. Peregrine falcons, bald eagles, piping plovers, and loggerhead sea turtles are among the endangered or threatened species that utilize the refuge.

	<u>INTRODUCTION</u>	<u>Page</u>
	TABLE OF CONTENTS	i
	A. <u>HIGHLIGHTS</u>	1
	B. <u>CLIMATIC CONDITIONS</u>	1
	C. <u>LAND ACQUISITION</u>	
1.	Fee Title.....	"NTR"
2.	Easements.....	2
3.	Other.....	"NTR"
	D. <u>PLANNING</u>	
1.	Master Plan.....	"NTR"
2.	Management Plan.....	2
3.	Public Participation.....	"NTR"
4.	Compliance with Environmental and Cultural Resource Mandates.....	2
5.	Research and Investigations.....	5
6.	Other.....	"NTR"
	E. <u>ADMINISTRATION</u>	
1.	Personnel.....	"NTR"
2.	Youth Programs.....	"NTR"
3.	Other Manpower Programs.....	"NTR"
4.	Volunteer Program.....	6
5.	Funding.....	"NTR"
6.	Safety.....	"NTR"
7.	Technical Assistance.....	"NTR"
8.	Other.....	"NTR"
	F. <u>HABITAT MANAGEMENT</u>	
1.	General.....	6
2.	Wetlands.....	7
3.	Forests.....	"NTR"
4.	Croplands.....	9
5.	Grasslands.....	"NTR"
6.	Other Habitats.....	"NTR"
7.	Grazing.....	"NTR"
8.	Haying.....	"NTR"
9.	Fire Management.....	10
10.	Pest Control.....	"NTR"

11. Water Rights.....	"NTR"
12. Wilderness and Special Areas.....	"NTR"
13. WPA Easement Monitoring.....	"NTR"

G. WILDLIFE

1. Wildlife Diversity.....	10
2. Endangered and/or Threatened Species.....	10
3. Waterfowl.....	13
4. Marsh and Water Birds.....	14
5. Shorebirds, Gulls, Terns and Allied Species.....	15
6. Raptors.....	16
7. Other Migratory Birds.....	16
8. Game Mammals.....	16
9. Marine Mammals.....	16
10. Other Resident Wildlife.....	17
11. Fisheries Resources.....	"NTR"
12. Wildlife Propagation and Stocking.....	"NTR"
13. Surplus Animal Disposal.....	"NTR"
14. Scientific Collections.....	"NTR"
15. Animal Control.....	17
16. Marking and Banding.....	17
17. Disease Prevention and Control.....	"NTR"

H. PUBLIC USE

1. General.....	18
2. Outdoor Classrooms - Students.....	18
3. Outdoor Classrooms - Teachers.....	"NTR"
4. Interpretive Foot Trails.....	19
5. Interpretive Tour Routes.....	"NTR"
6. Interpretive Exhibits/Demonstrations.....	19
7. Other Interpretive Programs.....	20
8. Hunting.....	"NTR"
9. Fishing.....	20
10. Trapping.....	"NTR"
11. Wildlife Observation.....	21
12. Other Wildlife Oriented Recreation.....	22
13. Camping.....	"NTR"
14. Picnicking.....	"NTR"
15. Off-Road Vehicling.....	22
16. Other Non-Wildlife Oriented Recreation.....	23
17. Law Enforcement.....	23
18. Cooperating Associations.....	23
19. Concessions.....	"NTR"

I. EQUIPMENT AND FACILITIES

1. New Construction.....	24
2. Rehabilitation.....	24
3. Major Maintenance.....	26
4. Equipment Utilization and Replacement.....	"NTR"
5. Communications Systems.....	"NTR"
6. Computer Systems.....	"NTR"
7. Energy Conservations.....	"NTR"
8. Other.....	"NTR"

J. OTHER ITEMS

1. Cooperative Programs.....	"NTR"
2. Other Economic Uses.....	"NTR"
3. Items of Interest.....	"NTR"
4. Credits.....	"NTR"

K. FEEDBACK "NTR"

L. INFORMATION PACKET - - - (inside back cover)

A. HIGHLIGHTS

March 13th "Storm of the Century" leaves path of destruction. (See Sections B., F-2, and I.2.)

Hurricane Emily dumped 7.51" of rain; refuge survives with minimal damage. (See Section B.)

NC Highway 12 continues to occupy staff time. (See Section D.)

North Pond Trail - one step closer to perfection! (See Sections H.4. and H.18.)

B. CLIMATIC CONDITIONS

Pea Island NWR enjoys fairly mild temperatures most of the year. The March 13 "Storm of the Century" inundated the refuge with water from the sound and a 24 hour rainfall total of 2.53". The northern refuge kiosk had a water mark of about 4'. The force of the water demolished most of the South Pond levee and resulted in a lot of destruction to the impoundment area (see Section I.2.). Hurricane Emily hit Pea Island on August 31, dumping 7.51" of rain, but miraculously a minimum amount of damage was incurred, especially considering the devastation of the Hatteras community just down the road.

Table 1 shows the monthly weather information.

TABLE 1
PEA ISLAND NWR WEATHER DATA

<u>MONTH</u>	<u>TEMP. HIGH</u>	<u>TEMP. LOW</u>	<u>RAINFALL</u>	<u>RAIN DEP FROM NORMAL</u>	<u>TEMP DEP FROM NORMAL</u>
January	71	38	5.96"	+0.66	+6.8
February	67	21	5.15"	+1.03	-1.1
March	73	25	6.67"	+2.38	-1.1
April	76	40	3.96"	+0.43	-1.7
May	82	48	0.63"	-3.37	+1.3
June	92	55	3.15"	-0.96	+1.4
July	92	68	2.03"	-2.95	+3.6
August	92	63	9.00"	+3.00	-0.3
September	90	51	2.99"	-2.28	+2.2
October	84	46	11.54"	+6.56	+3.5
November	79	41	4.04"	-0.93	+3.7
December	71	27	4.14"	-0.40	-1.3

C. LAND ACQUISITION

2. Easement

The saga of the Oregon Inlet Coast Guard station continued through 1993. This 10 acre inholding and old station building was quit-claim deeded to the county in 1992. Early in 1993, a group of individuals claiming to be heirs of the original owner (who sold the land in 1878 to the Coast Guard) filed a deed to the property based upon a "reversionary clause" in the Coast Guard title, posted the site and moved a caretaker into the building. They threaten to sue if the county attempts to exercise it's quit claim deed. The group now has placed the property on sale - for \$1 million. Rumor has it local developers are considering purchase and construction of condominiums - in the middle of a National Wildlife Refuge. That part of the site that was refuge property under easement to the Coast Guard has now reverted back to refuge management. Efforts are underway to get the physical improvements (buildings, pier, etc.) removed by the Coast Guard.

D. PLANNING

2. Management Plan

The annual water management plan for all impoundment units was completed and approved.

A prescribed burning prescription and Section 7 covering 2,500 acres was written and approved.

4. Compliance with Environmental and Cultural Resource Mandates

USCOE 404 permit, CAMA permit, and state 401 water quality certification obtained for installing 3 water control structures - 1 in each of the 3 refuge impoundments.

USCOE 404 permits, CAMA permit, and water quality certification obtained for emergency repair of South Pond levee (storm damage).

Approvals obtained from Park Service and SHPO to remove remnants of old Coast Guard station from beach (immediately east of the headquarters site). Remnants exposed following a storm.

EA, Section 7 Consultation, R-O-W amendment, FONSI, and compatibility determination for Cape Hatteras Electric Co-op to upgrade electrical service crossing the refuge submitted to RO.

Numerous SUP's were issued to USCOE and NCDOT authorizing various actions during the year. Compatibility determinations were completed for these actions.

Several pages of text could easily be written summarizing the activities/actions associated with Oregon Inlet Jetties, beach nourishment, dune construction, relocating parts of NC Highway 12. Refuge staff participated in many, many meetings with USCOE, NCDOT, FWE, other state agencies, and local officials over the course of the year. For brevity's sake, only a very brief synopsis will be presented here - in bullet form:

-NCDOT requested authorization to install additional sandbags to protect NC Highway 12 from ocean overwash in January - request denied. After several meetings with State, COE, and County officials, DOT followed refuge recommendations to implement beach nourishment. Their initial proposal to dredge from Sound dropped following stiff opposition from refuge; 325K yards eventually mined from behind groin and trucked to trouble spot.

-NCDOT, with assistance from refuge, developed plans to have USCOE move 1.0 million yards of dredge material from Oregon Inlet (during their annual maintenance of the navigation channel) another 4 miles south to provide additional nourishment. USCOE eventually refused to do this due to lack of material in Inlet; DOT proposed then to reroute section of NC Highway 12. Refuge proposed to develop it's own realignment plan, eventually did so in October, and submitted same to DOT. DOT in planning phase to realign 3 miles as the year ended. Refuge got USCOE and FWE Division to assist in our proposal for realignment.

-NCDOT requested permission to install 4,000 linear feet of sand fence in areas along NC Highway 12 where dune line severely eroded. Refuge issued permit for 1,200' of fence. Project completed in March.

-NCDOT developing plans for replacing Oregon Inlet Bridge - draft EIS out in November showing realignment of south approaches on refuge.

-NCDOT requested emergency approval to reconstruct 1,800' of dune line in November - refuge issued SUP for this work with condition that the area would not be revegetated. Project ongoing as year ended.

-USCOE completed disposal in October of 400K yards of dredged material from Oregon Inlet onto refuge beaches. COE transferred \$91K to refuge to continue monitoring program ongoing for last 2 years. The March storm apparently removed over 1/2 of the material that was scheduled to be dredged - the reason COE eventually decided not to move this material on down the beach for DOT.



NCDOT hauled 325,000 yards of sand from the groin
fillet south 4.5 miles to.....



.....the beach to protect a section of Highway 12 near the Pea Island HQ threatened by the ocean. Sandbags put in place to protect Highway 12 during storms had to be breached to get sand onto the very narrow beach.

JCJ 4/93

-DOI Secretary Babbitt visited Oregon Inlet and refuge on May 15 for briefing on USCOE Oregon Inlet Jetty Project and issues associated with NC Highway 12. He eventually canceled the "conditional" SUP issued by prior DOI Secretary Lujan for construction of jetties. COE still working on Jetty EIS and FOM on sand bypassing.

-Under Secretary of Army for Public Works requests meeting with refuge, FWE, and Wilmington USCOE staff in September to discuss Jetty sand bypassing FDM (part of Jetty EIS). Washington USCOE refuses to accept some of the provisions in FDM developed by DOI/USCOE Task Force report to DOI Secretary in '91/'92. Wilmington COE reworking FDM - will submit it to refuge and FWE in '94. Some issues will not be resolved - back to Washington for sure!

-USCOE/NCDOT called major meeting - all regulatory agencies (some 8-10 agencies and Governor's office represented) - to discuss Dare County Beach Project. Plan is to use offshore dredging to provide millions of yards of beach nourishment along Outer Banks. DOT proposes to pay for part of this as a method of protecting NC Highway 12 south of Oregon Inlet. This entire process has evolved to developing a joint FWS/NPS/DOT/COE Task Force for long range planning to address maintaining a travel corridor on the Outer Banks south of the Inlet (the first 15 miles are on the refuge).

More to come in '94, for sure! These and other issues will continue due to proximity of refuge to Oregon Inlet, presence of NC Highway 12 - the only road to 5 villages south of Nags Head, and strong political clout by Outer Banks politicians.

5. Research and Investigation

Refuge staff continued indepth data collection along refuge beaches throughout the year as part of the monitoring plan examining effects of USCOE disposals of dredge material. This plan, developed by the refuge, was modified this year to cover 6 miles of beaches. Exhaustive sediment sampling (over 3,000 individual samples), along with beach slope, composition, scarp, and fauna data were collected on some 80 transect lines. All data samples, etc., were delivered to Coastal Research Associates, UVA, for completing analysis and report writing. Coastal was issued a contract for this project using USCOE transfer funds.

Dr. Robert Dolan continued to serve, under contract, as the Service's technical representative on the NCDOT Groin Monitoring Team.

Refuge has begun process of taking compaction readings at each turtle crawl to develop baseline data for use in imposing special conditions on SUP's issued to USCOE and NCDOT.

E. ADMINISTRATION

4. Volunteer Programs

During 1993, volunteers at Pea Island again formed the hub, both in spirit and in numbers, for the entire Alligator River volunteer program. The Host/Hostess program began in April and continued through early October. Again, as in past years, a few Saturdays and Sundays were covered. The Visitor Contact Station was covered all weekdays during that time period.

The turtle patrol was also a popular volunteer program during 1993. Turtle patrollers participated in an 8 hour training program, then conducted the patrol 1 day each week from mid-May through the end of August. The "turtle watch" program was initiated to provide better opportunities for hatchlings to successfully reach the water. During 1993, the "turtle watch" program was initiated in the beginning and followed throughout the nesting season. (See Section G.2. for details.)

Summer and fall bird walks and summer Children's Wildlife Discovery programs were conducted by volunteers. Special programs requested by schools and other groups were also conducted by volunteers. In fact, essentially all public programs conducted during 1993 at Pea Island NWR were conducted by refuge volunteers.

The September "Big Sweep" occurred again in 1993. This activity continues to be the single event that involves the most volunteers during the year. At the 1993 Pea Island "Big Sweep", 87 volunteers participated and succeeded in cleaning 11 of the 13 miles of refuge beach. Each group was asked to clean up the beach on their first pass and walk back along the highway, cleaning road shoulders on their way back to their vehicles.

For additional information about the Volunteer Program, see Section E.4. of the Alligator River NWR Annual Narrative Report.

F. HABITAT MANAGEMENT

1. General

Pea Island, a coastal barrier island, consists of 7 basic habitat types. The most recent survey revealed 456 acres of ocean beach; 518 acres of barrier dunes; 630 acres of sand ridge, brush, and grassland; 3,024 acres of irregularly flooded salt marshes; 328 acres of salt flats; and 3 brackish water impoundments totaling 940 acres. Beach and dune acreages change from year to year.

2. Wetlands

North Pond has continued to produce good submerged aquatic vegetation since the drawn down in 1991 (the first drawdown in at least 9 years). Sago pondweed and widgeon grass occurred in 32% of the sample points in 1993. (See Table 2). These 2 excellent waterfowl food species had comprised only 19% and 16% of the plants in 1990 and 1991, respectively.

Table 2
Summary of Vegetative Transect Line Sampling
Pea Island NWR, 1993

Line	Feet Sampled	Sample Stops	Sampling Points	Percent Vegetated	Percent Bare	Plants per Pt. Sampled
New Field	3,210 ft.	107	535	87.8%	12.2	1.2
North Pond	2,400 ft.	80	400	87.0%	13 %	1.1
Salt Flats	3,390 ft.	113	565	74 %	26 %	.98
TOTALS	11,370	379	1,895			
AVERAGES	---	--	---	82.9%	17 %	1.09

Combined Food Values * Major Plants (% Occurrence)

Good - 21.7 (23.8)

Fair - 32.5 (31.4)

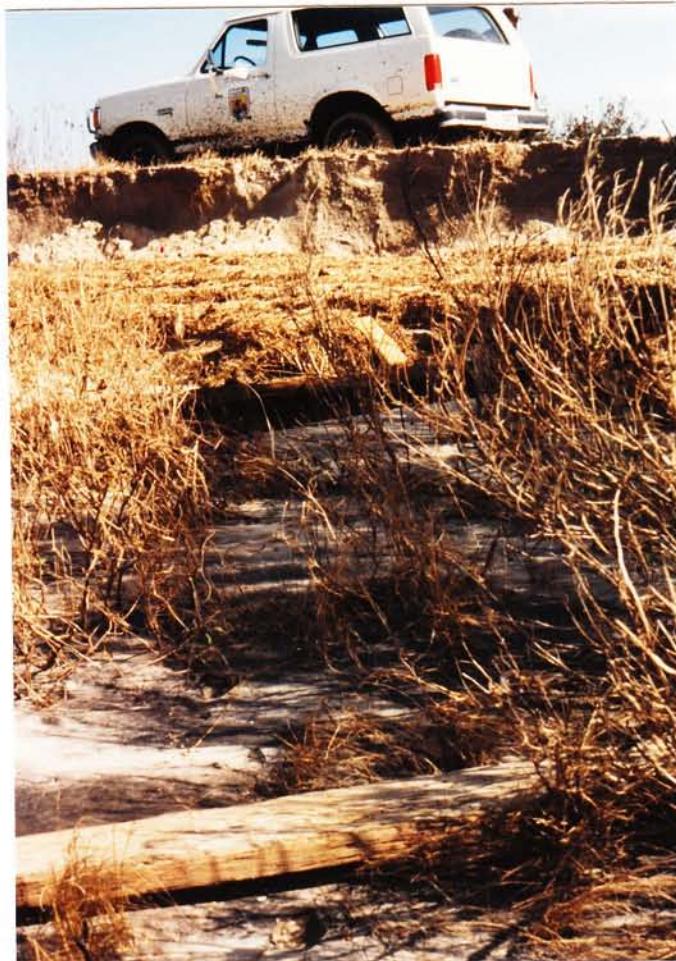
Non - 44.8 (32.7)

New Field - Patens 26% (1.5%)
 Widgeon 24% (0.0%)
 Muskgrass 12% (35%)

North Pond - Muskgrass 49% (44%)
 Sago 21% (34%)
 Widgeon 10% (7.9%)

Salt Flats - Salicornia 23% (21.6%)
 Patens 14% (15.6%)
 Sea oxeye 13% (10.5%)

New Field impoundment produced a good crop of widgeon grass (24%). Salt grass (*Distichlis spicata*) dropped to .4% from an all time high of 29.9% last year after New Field was inundated with ocean water during a severe Northeaster. Salinity levels have returned to normal ranges.



The March storm seriously eroded most
of the 3 miles of dike on Pea Island,
especially New Field dike (pictured here).
A few more inches..... JCJ 3/93

The South Pond dike was breached in the March storm. The pumphouse and pump were lost and about a hundred foot section of the dike was lost. The area was dry most of the summer. A portion of the area was planted to millet but the area then flooded from rain. Little or no vegetation was present and the vegetation transect was not run.



The March storm cut a 190' wide breach in South Pond dike.
Bulkheading remnants in background was site of pump
station (pumphouse and 8 cyl. diesel engine). JCJ 3/93

Wetlands in the Salt Flats are flooded and dewatered by natural ebb and flow in wind/tides and by rainfall/runoff. Vegetation has remained relatively unchanged for many years in this area. The predominant vegetation is glass wort (Salicornia sp.), sea oxeye and patens.

The 2 small mitigation ponds created by NCDOT again produced good widgeon grass. The pond fringes also continued to produce stands of Bacopa sp., Scirpus sp., and Cyperus sp. Waterfowl use remained low and continued to be limited to the days when the adjacent sound waters were rough. No use occurred once construction began on the additional wetland creation by NCDOT around the ponds. Once this construction is completed the new wetlands (about 5 ac.) will be planted to saltmarsh bulrush.

4. Croplands

Much of the plantable area of New Field has been impacted by sand deposited by overwash. Approximately 35 acres were planted in late August. The wheat came up very sparsely. This may have been due to bad seed, however salt in the soil from inundation could be the culprit. Additional soil tests are scheduled prior to next years planting.

9. Fire Management

No prescribed burning was done at Pea Island during 1993.

A human caused fire did occur on Pea Island in late December which resulted in the total loss of the North Pond pumphouse. Our cooperators at the NPS Cape Hatteras National Seashore and the VFDs from Rodanthe and Avon responded and quenched the blaze.

G. WILDLIFE

1. Wildlife Diversity

Pea Island has a high natural diversity of habitat types. Habitat management practices, such as prescribed burning, moist soil management, disking, brush removal, and green browse planting, serve to enhance habitat and wildlife diversity. Pea Island provided habitat for a wide variety of mammals, birds, fish, reptiles, amphibians, mollusks, and crustaceans during 1993. This diversity was especially evident in birds; more than 315 species of birds have been identified in the area.

2. Endangered and Threatened Species

a. Federally Listed and Endangered Species

American Bald Eagle (Endangered): Bald eagles, Haliaetus leucocephalus, often pass over Pea Island. However, no eagles were reported on Pea Island by permanent staff or volunteer bird walk leaders. Only 2 were sighted last year. No eagles were seen during the mid-winter eagle survey this year.

Peregrine Falcon (Threatened): The Arctic Peregrine, Falco peregrinus tundrius, is the subspecies of peregrines most often seen at Pea Island. Ten peregrine sightings were made by the refuge staff during the year. All sightings were associated with the impoundment areas of the refuge.

Piping Plover (Threatened): The Atlantic coast population of Piping Plover, Charadrius melodus, was listed as a threatened species under the Endangered Species Act in January 1986. This species occurs all along the coast of North Carolina. Refuge staff conducted bi-weekly shorebird counts from May through October. Eight piping plover sightings were recorded in the impoundments.

On the morning of July 15, Volunteer Don Perry saw 2 mature piping plovers feeding in the water's edge in South Pond. August 1, one was seen in North Pond by NCSU student Steve Dinsmore. August 18, Angela Noffsinger reported 2 plovers

again in South Pond; Dinsmore reported 1 piping plover in South Pond on August 24. No plover sightings were reported for the Pea Island beach, especially in the area behind the groin where there was use last year. A major borrow pit and sand hauling project was in operation on the beach this summer. This probably discouraged the plovers from using that area.

Atlantic Loggerhead Sea Turtle (Threatened): The sea turtle season of 1993 on Pea Island NWR was very similar to last year. Since dune and beach erosion and ocean overwash continued to be major problems, only 1 small stretch of beach was designated "safe" for relocation purposes. Thus, instead of relocating nests to sites up and down the beach, 7 nests from Pea Island and 3 from NPS were relocated to the "safe" area. Two additional Pea Island nests were left in their original place. Beach erosion and high tides were not a problem on the selected area until Hurricane Emily blew our way. Storm surges overwashed all the unhatched nests and rotted out the bottom layer of eggs in several of these incubating nests. Even with Emily, the hatch rate of USFWS and NPS nests on Pea Island was 72%. Another big problem this year (as previously) was ghost crab predation - these crabs were the number one enemy of hatchlings. In previous years, many turtles hatched out of nests but never made it to the water. "Reinforcement" crabs actually formed a line along the uprush zone to capture the few turtles that had managed to crawl safely through a beach covered with hungry, hunting ghost crabs.

Once again, the Turtle Watch Program was implemented. It entailed digging a 10" deep by 10" wide trench from each nest to the ocean. Volunteers started watching each nest at day 55. They arrived just before dusk and swept the trench smooth; wire cones were placed around the nest with a "sliding board" emptying into the crab free trench. Turtles followed flashlights (which volunteers leap frogged) to the end of the trench and arrived safely at the ocean. Monitoring the nests took an intensive effort; however, it played a vital role in greatly increasing the percentage survival of the hatchlings from the nest to the ocean.

At the season's end, it appeared that the decision to relocate all but 2 of the nests was a good one. The decision was made only after input from other biologists and much deliberation. Most, if not all, of the nests would have been lost to salt water inundation from high tides and storm surges. The Turtle Watch also greatly increased the number of hatchlings reaching the ocean. Observations in past years indicated that, on some nights, as many as 75% of hatchlings were lost to ghost crabs (prior to trenching). Survival rates to the ocean after trenching approached 100%. If the same narrow beach is evident next year, a similar program will again be implemented.

Several stranded turtles washed up on Pea Island's beaches in 1993. At least 5 dead loggerheads were measured and recorded.

Green Sea Turtles (Threatened): In addition to the usual Loggerheads nesting on Pea Island, we had 1 nesting Green Sea Turtle (*Chelonia mydas*). Her crawl, with the deeply cut symmetrical diagonal marks made by her front flippers, was different from all other crawls. Her nest was relocated and had a 90% hatch rate. NPS also relocated a Green Sea Turtle nest to Pea Island. It had a 93% hatch rate. This is the first Green Sea Turtle nest recorded for Pea Island.

b. State Listed Endangered and/or Threatened Species

Of the other species that occur on the refuge, the State of North Carolina lists 7 as threatened and 26 as species of special concern. Although the refuge is not managed for all these species, present practices do provide benefits for many of them. Species specifically managed for are:

Osprey (Special Concern): The number of adult ospreys observed on Pea Island increased during 1993. Total recorded production was 7 young (6 in 1992). There were 7 nesting pairs, but every pair was not successful. Three nesting pairs were unsuccessful; 2 pairs produced 1 young each; 1 pair produced 2 young; and the pair on the west side of North Pond produced 3 young. One old osprey tower blew down before nesting season. We plan to erect a new platform in it's place.

Least Tern (Special Concern): Least terns came back to Pea Island again this year. Surprisingly, they did not choose the historic site 1.5 miles south of the headquarters. Only 46 black skimmers and 10 common terns nested there. The least terns chose the area behind the groin. Our survey documented 256 least terns, 16 common terns, and 4 oyster catchers nesting in that new area of the north beach. The north point was posted and closed to foot traffic and all special use vehicular traffic. Near the end of nesting season, before many chicks had begun to fly, the Army Corps of Engineers drove their huge Lark with big tires between 2 Tern Nesting/Area Closed signs and proceeded up the middle of the nesting area. The full extent of their damage is unknown. Area Closed even means to the Corps - they were contacted! Another nesting area, created by the South Pond dike blow out, was utilized by 151 least terns and a variety of other nesting birds (4 oyster catchers, 46 common terns, 1 gull billed tern, and numerous black necked stilts). The South Pond area was closed to the public. Refuge maintenance crew working on the reconstruction of South Pond dike was able to avoid most of the nesting area. A sandy fringe around the foot of the dike was left for future nesting birds.

3. Waterfowl

Overall duck and goose use on Pea Island NWR was up 12.4% from the preceding wintering year (see Table 3). The peak waterfowl populations, 21,000, occurred during November 23-29.

Table 3
Wintering Waterfowl Occurrence, Pea Island NWR
1992-1993

Group	Percent	Number of Use Days	% Difference 1991-1992	Peak Number	Peak Period
Tundra Swans	9.1	145,397	- 13.8	2,250	Nov 23-29
Canada Geese	1.4	21,664	- 58.9	200	Nov 2-15
Snow Geese	6.1	97,069	- 43.9	1,300	Dec 21-27
Brant	0	0	0	0	
Ducks	75.1	1,197,294	+ 22.3	16,750	Dec 7-13
Coots	8.4	133,665	+182.3	2,450	Nov 23-29
All Waterfowl	100.1	1,595,089	+ 12.4	21,000	Nov 23-29

Table 4
Composition of Wintering Ducks, Pea Island NWR
1992-1993

Species	Percent	Number of Use Days	% Difference 1991-1992	Peak Number	Peak Period
Widgeon	43.7	523,201	+ 79.5	10,450	Nov 23-29
Pintail	23.4	279,615	+ 18.4	3,400	Nov 23-29
Black Duck	7.6	91,455	+ 8.8	900	Nov 23-29
G.W. Teal	6.2	74,690	+ 3.7	850	Jan 31-Feb 13
Shoveler	5.7	67,844	- 10.8	600	Nov 23-29
Gadwall	4.4	52,696	- 53.1	600	Nov 23-Dec 13
Unidentified Ducks	2.6	31,094	+162.1	900	Feb 7-13
Mergansers	2.4	28,238	+ 54.4	350	Jan 10-16
Ring-necked Ducks	1.5	17,507	+454.5	450	Feb 7-13
B. W. Teal	1.0	11,564	+701.9	1,100	Sept 22-28
Ruddy Duck	0.6	7,294	- 72.2	130	Dec 21-27
Mallard	0.4	5,159	+ 2.9	50	Nov 23-29 & Jan 10-Mar 6
Bufflehead	0.3	3,766	- 84.7	75	Feb 7-13
Scaups	0.2	2,737	- 82.3	35	Jan 31-Feb 13
Redhead	Trace	406	- 18.3	15	Dec 7-13
Canvasback	Trace	28	+100.0	4	Dec 21-27
All Ducks	100.0	1,197,294	+ 22.3	16,750	Nov 23-29

Tundra swan use days were down 13.8% from last year. The peak number was 2,250, during November 23-29.

Canada goose use days dropped, and the peak number dropped drastically (from 1,000 in 1991-92 to 200). The peak is the lowest in the 28 years of data collection.

Snow goose use and peak also dropped to the lowest in 28 years.

Duck use was up 150,000 use days from last year. The peak was up 5,000. Use days and peaks for individual duck species are given in Table 4.

Brood counts were conducted on Pea Island again this year. A total of 9 counts were made; all of these were ground counts - no aerial counts were flown this year (no money). A total of 200 broods were counted during the surveys (see Table 5). Again, the majority were black duck broods. Brood numbers were down for South Pond since it was dry from the March dike blow out. Canada goose broods were up to 21 this year compared to 5 last year. Two mallard broods were counted in North Pond this year. Since money was not available for aerial brood counts, the formula to obtain yearly estimates was adjusted to exclude aerial counts. The estimate of broods produced on Pea Island NWR for 1993 is 282.

Table 5
Brood Count Totals, Pea Island NWR
1993

Species	South Pond	New Field	North Pond	Sound M.Ponds	Species Total	Species % of Total
American Black Duck	3	37	81	2	123	62
Gadwall	0	16	38	0	54	27
Canada Goose	0	5	15	1	21	10
Mallard	0	0	2	0	2	1
Area Total	3	58	136	1		
Area %	2%	29%	68%	1%		

4. Marsh and Waterbirds

Refuge beaches, marshes, and impoundments were heavily utilized by many species of marsh and waterbirds for both nesting and feeding. Although no active management occurred exclusively for these species, an upward trend in use days has been observed in recent years. Habitat management practices for waterfowl and other species have had a positive influence on marsh and water bird use of the refuge. For example, there was evidence of small heronries on several islands in both North and South Ponds during 1993.

On July 9, a quick check on 2 small herony islands in South Pond revealed the remains of about 11 nests. These were yellow crowned night heron nests of this year. Activity around several of the finger islands in North Pond indicated possible nesting sites; however these were never confirmed. Dredge spoil islands in Oregon Inlet were another favorite nesting site for a variety of colonial nesting waterbirds.

Marsh and waterbird counts were extended to the end of August instead of ending the beginning of August. Peaks were recorded for a variety of marsh and waterbird species found in the impoundments at Pea Island. These included: pied billed grebe - 290; double-crested cormorant - 115; eastern brown pelican - 47; white ibis - 267; glossy ibis - 83; great blue heron - 17; common egret - 372; snowy egret - 159; tri-color heron - 97; little blue heron - 51; cattle egret - 36; green heron - 1; black-crowned night heron - 2; yellow-crowned night heron - 8; clapper rail - 4; and common loon - 3.

The trend toward increased use of the refuge may have been due to the dramatic loss of habitat along the Outer Banks (including erosion of the spoil islands during the March storm). Increased human disturbance continually forces birds to smaller and smaller areas, many times utilizing habitat that's less than optimal.

Brown pelican numbers have increased steadily over the past few years as the species has expanded northward into coastal North Carolina and Virginia. These birds were once considered a threatened species in this state and were rarely sighted. They have since been de-listed in North Carolina and are quite common. During 1993, pelicans utilized the spoil islands in and around Oregon Inlet extensively.

5. Shorebirds, Gulls, Terns, and Allied Species

Shorebird surveys were conducted from April through mid-October. The 2 highest peaks were in May and July when 5,847 (May) and 5,767 (July) gulls, terns, and shorebirds were recorded! This peak was lower than last year's peak of 6,997 and 1991's peak of 12,526 birds. It is possible that increased erosion and public use on the refuge have made Pea Island's beaches less attractive. The dredge spoil islands in Oregon Inlet provide excellent nesting habitat for the birds; however, even these islands have begun to suffer from human encroachment and have required posting by the NCWRC to protect nesting shore and marsh birds. Terns and other colonial nesting waterbirds have continued to nest on the islands in spite of the disturbance.

The busted dike/levee on South Pond's west side produced a dry pond for most of the summer. Small amounts of water in the deepest channels of the pond attracted unusual sightings (along with thousands of other shorebirds). These unusual sightings drew birders who obtained special tours of the closed area via volunteer leaders. American avocets and piping plovers were great, but the curlew sandpipers were the STARS of the show! The dry pond also attracted nesting terns as discussed earlier (approximately 200). Numerous oyster catchers nested on the beach and several pairs nested in the

islands of the impoundments. The nests on the beach were very productive with many reports of young seen by turtle patrol volunteers and staff. Numerous black necked stilts with young were observed in the 3 impoundments and salt flats.

6. Raptors

Carolina Raptor Center did not band this year. Also see Section G.2. for information on peregrine falcons and bald eagles.

7. Other Migratory Birds

The diversity of bird life on Pea Island is so great that it is sometimes referred to as a "birder's paradise". This is especially true when considering the passerines. Some 115 different species of song birds migrate through Pea Island.

8. Game Mammals

Rabbits are the only game mammals that occur in any numbers on Pea Island. Cottontail and marsh rabbit numbers have declined in recent years.

Raccoons are fairly common on Bodie Island to the north. In recent years, raccoon tracks have been observed on Pea Island with higher and higher frequency. The staff even sees raccoons on occasion and often catches them in cat traps.

Evidence has been found to indicate an influx of foxes and opossums. The immigration of foxes and the presence of feral house cats may be one of the causes for the decline in rabbit and pheasant populations.

Two deer have been observed on Pea Island. Tracks have been found on numerous occasions in the salt flats and South Pond area. Staff members have seen both doe and buck on Pea Island. Watch out for more - oh deer!

Otter have been observed playing (and mating on several occasions) in the impoundments. Still have plenty of muskrat and nutria and a few mink. "Rat" numbers seem to be on the decline.

9. Marine Mammals

On June 2, a pigmy sperm whale beached on Pea Island. One attempt was made to get it to return to the water - it again beached. Volunteers stayed with the whale and kept it moist while the vet was called. Later in the day, the whale was euthanized.

10. Other Resident Wildlife

Ring-necked pheasants were occasionally observed in the salt marsh, brushland, the browse area in New Field, and in the dunes in years past. Sightings of pheasants have dropped drastically in recent years. Occasionally, 1 or 2 have been observed feeding in New Field (both male). No females were observed during 1993. The exact status of the pheasant population is unknown. There were no pheasant sightings the last half of 1993.

15. Animal Control

Feral cats continued to be a problem with nesting birds, waterfowl, turtles, etc. Cat tracks were found from the beach to the sound. A total of 8 cats were trapped in 1993 - 4 were male and 4 were female (traps were set early and late in the year). Observations reported by the public and NPS rangers increased dramatically this year. Trapping efforts will continue during 1994.

16. Marking and Banding

Pea Island was directed to cooperate with North Carolina Wildlife Resources to band and neck collar Canada geese as part of the special sub-species Atlantic Flyway Canada Goose study during the 1992-93 season. Rocket net trapping was plagued by frustrations usually linked to "tourists" scaring geese off sites. By the end of the season, 40 geese were banded - the most in the last 3 years!

This year, on July 6, a group of refuge staff and volunteers assisted Dr. John Weske of the Smithsonian Institute in banding 1,132 royal terns, and 307 sandwich terns on Bonner Bridge Island. A return trip on July 27 to that island and Weller's Island resulted in 402 royal terns and 197 sandwich terns being banded. On July 28 on the trip to Pelican Island, 1,358 pelicans were banded. It's a smell you never forget!!

NCSU student Steve Dinsmore conducted a weekly census of shorebirds with special focus on sanderlings. Several attempts were made to capture and band sanderlings on Pea Island. Resighting efforts of banded birds continued through the fall. The data will be a part of a study of the population, migration, and movement patterns of sanderlings within the seashores (North Core Banks).

The Gypsy Moth Pheromone Trapping Program continued on Pea Island during 1993. Ten traps were set near heavy traffic areas and checked periodically. Last year's final result of 10 traps was the capture and verification of 9 gypsy moths. This year's final result was the capture and verification of

97 gypsy moths! The USDA responded that trapping a few moths does not necessarily indicate that there is an infestation. A single catch could be the result of a visitor from an infested area to the north inadvertently transporting an egg mass onto the refuge. Artificial introduction do not always develop into infestations but are reason for increased attention. What a jump in numbers for just 1 year! It'll be interesting to see if next year's traps burst at the seams!

H. PUBLIC USE

1. General

Based on the National Park Service vehicle counter at Bodie Island, estimated visitation to Pea Island NWR during 1993 was 1,757,103, slightly down from 1992. The Host/Hostess program continued to provide visitor information and operate the Coastal Wildlife Refuge Society's sales unit at the Visitor Contact Station from April-October.

Volunteers (mainly Michael Kuhns, the summer intern) and the fire crew provided manpower for a re-vamping of the sign program, minor trail maintenance, general clean-up in visitor areas, and routine maintenance of the structures associated with public use.

As in the past, public demand for beach access has increased and the amount of undeveloped beach frontage property locally available has decreased. Towns and villages in the area are supported almost entirely by the tourist industry, yet the burden to supply services for these visitors is thrust toward the federal government. The NPS expands its services as the budget allows. The Pea Island Master Plan established a maximum number of parking spaces on the refuge. At Pea Island, public use efforts continue to be governed by the limits set up in the Master Plan, thus providing some relief from the constant demand for more and more access. Refuge efforts continue to aim toward a high quality visit, as opposed to more visits.

2. Outdoor Classrooms - Students

The emphasis on non-staff conducted activities continued during 1993. School groups, scouts, etc. were encouraged in the independent use of the refuge for educational activities. Marsh investigation equipment (seines, mud sieves, etc.) was available for loan from the Visitor Contact Station (VCS). Table 8 in the Alligator River ANR includes off-refuge educational programs conducted associated with Pea Island, as well.

Since no registration was required for the use of outdoor class-rooms, the refuge has no record of the actual number of such uses that occurred. The N.C. Aquarium also utilized Pea Island marshes for a number of conducted salt marsh studies. On the whole, this type of use is increasing on Pea Island.

4. Interpretive Foot Trails

Construction of the 400' boardwalk at the head of the North Pond Trail was completed by mid-summer. Staff, volunteers, and visitors alike raved about the improvement. The boardwalk ended up being completed as a group effort - many thanks to everyone involved - including the green-headed "Duck" at Okee who loaned some equipment!

Approximately 146,497 visitors utilized the interpretive foot trail (self guided). Another 2,000 or so visitors participated in conducted trail walks.



A 400 ft. boardwalk creates an attractive new entrance to North Pond Trail. DS 3/94

6. Interpretive Exhibits/Demonstrations

The 2 interpretive kiosks and the exhibits displayed in the Visitor Contact Station continue to be popular with refuge visitors. The kiosks provide basic visitor information 24 hours a day, 7 days a week. The VCS (at the headquarters building) provides a few minor exhibits, but is open only from 9-4 seasonally.

At Pea Island, there continues to be a need to provide a place for visitor contact and limited interpretive exhibits. The Alligator River Public Use Review conducted during 1992 addressed this need and resulted in an amendment to the Pea Island Public Use Management Plan. Construction of a small VCS at the trailhead for North Pond Trail has been added to the master projects list. The Coastal Wildlife Refuge Society has undertaken the construction of a VCS as their highest priority project for 1994. Stay tuned for results next year!

During 1993, 80,607 visits and 38,576 visits were spent at the kiosk and VCS, respectively.

Table 6
PEA ISLAND INTERPRETATIVE/EDUCATIONAL PROGRAMS (On-Refuge)

Program Type	#Programs	Total #Participants
Public Summer Bird Walks	39	883
Public Children's Wildlife Discovery	22	550
Public Fall Bird Walks	10	240
Special Bird Walks	30	427
Special Marsh Programs	19	572
Other	5	182

Note: Off-refuge programs included in Table 10 of AR ANR.

7. Other Interpretive Programs

All regularly scheduled (summer and fall) interpretive programs during 1993 were conducted at Pea Island by refuge volunteers.

Four bird walks and two Children's Wildlife Discovery Programs were scheduled each week during June, July, and August. Bird walks were scheduled on Saturday mornings during the fall. Participation in these regularly scheduled public programs is shown in Table 5.

9. Fishing

Pedestrian surf fishing continued to be the major form of consumptive, wildlife-oriented recreation on Pea Island during 1993. Bluefish, spot, pompano, croakers, and trout were the major fish caught. A total of 273,958 visits were spent fishing.



North Pond is open to fishing and crabbing from 9-12 on the second Saturday in June for the Annual Fishing/Crabbing Rodeo. It's a popular event! BWS 6/93

11. Wildlife Observation

Pea Island continues to be a "birders paradise". Though numbers of some species, waterfowl in particular, have declined in recent years, the rich diversity continues to draw crowds of bird watchers year-round.

Due to the location of the road (NC Highway 12) through Pea Island, it is difficult for a traveler to pass without observing wildlife. On most days of the year, the quality of observation is quite high. During fall and winter, greater snow geese frequently feed on the road shoulders.

During spring and summer, cattle egrets replace snow geese as the most easily observed wildlife. Various species of raptors utilize the dunes, power line poles, and sign posts for resting and hunting. An estimated 1,317,820 visitors spent time in association with vehicular wildlife observation during 1993.

The number of birders requesting special permission to bird in the closed areas of the refuge remained low during 1993, as was expected. During 1990, South Pond was drawn down for management purposes, creating excellent wading and shorebird habitat. Several rare species, including curlew sandpipers, white-winged terns, and others attracted "life listers" from all over the country. Since then, things have continued to be calm.....

Refuge trails and other access points are located to make wildlife observation (on foot) easy and enjoyable. In choosing the North Pond area for a focal point for public use and closing the areas around the other 2 impoundments, the needs of the public were seriously and diligently considered. There are many refuge visitors who realize and support this policy. Refuge visitors spent approximately 286,272 visits participating in wildlife/wildlands observation (on foot) on Pea Island during 1993.

12. Other Wildlife Oriented Recreation

In the past, a few well placed photo-blinds have provided limited numbers of refuge visitors with a unique opportunity to photography wildlife. Several years ago, Hurricane Gloria destroyed the few blinds available at Pea Island. Since then, several special requests have been sent to RO for funding, when opportunities were offered. It is hoped that, eventually, photo/observation blinds may be constructed.

It is still our contention that the best photographs at Pea Island have resulted from being in the right place at the right time -- with a camera in hand. During 1993, approximately 5,483 visits were spent with wildlife/ wildlands photography.

15. Off-Road Vehicling

The use of ORV's on Pea Island is restricted to NC Highway 12. Illegal ORV traffic continues to plague the refuge; however, probably due to rapid erosion of the beach and repeated ocean overwash of NC 12 on Pea Island, 1993 has been a year for fewer ORV violations. As long as there is a physical way for vehicles to reach the beach, there will always be some problems with ORV traffic there.

As public use of Outer Banks beaches continues to increase dramatically, the importance of the few remaining tracts of natural, relatively undisturbed beach habitat is becoming increasingly apparent for gulls, terns, shorebirds, and allied bird species. It appears from weekly surveys conducted at Pea Island and along other beaches in Dare county, including Cape Hatteras National Seashore, that increasing human activity on beaches is adversely affecting bird use of this important habitat. The birds are simply avoiding areas of heavy to moderate human use and are concentrating on beaches where public access is limited and the numbers of swimmers, sunbathers, surfers, and fishermen are low. Refuge beach areas that show any evidence of nesting activity are closed to public entry.

16. Other Non-Wildlife Oriented Recreation

Because Pea Island is associated with the "beach scene", non-wildlife related recreational activities will always occur on the refuge. Swimming, surfing, and sunbathing are major summer activities. Approximately 369,260 visits were spent in non-wildlife oriented recreation during 1993.

17. Law Enforcement

Due to a MOU with Cape Hatteras National Seashore, the NPS has the primary responsibility for non-wildlife related public use on Pea Island. For this reason, a law enforcement presence is maintained regularly, though not constantly, on the refuge.

There is still an obvious need for more LE presence on the refuge. It is hoped that this need can be met during 1994. The most common problems are car clouting, illegal parking, vandalism to NPS restrooms, public nudity, littering, and dogs off a leash.

Pea Island's beach is a desolate place and has had drugs wash in from vessels whose cargo has been dumped at sea. In these cases, there are usually people on shore searching for the drugs, as well as Coast Guard and other officials.

There are minor poaching problems at Pea Island; occasionally cars will stop and shots will be fired at waterfowl from the road. Poachers sometimes slip in from Pamlico Sound to quickly shoot as many waterfowl as they can and then speed away. Some illegal hunting may take place within the refuge boundaries in the Pamlico Sound. These types of violations are difficult to detect and the violators are difficult to apprehend.

A body washed up on the Pea Island beach during April as a result of a private boat capsizing in high seas.

18. Cooperating Associations

Though the Coastal Wildlife Refuge Society is officially reported in the Alligator River ANR, a great deal of it's activity relates to Pea Island.

The sales unit at the VCS continued it's activity. During 1993, Pea Island patches and pins, duck stamp pins and key chains, insect repellent, wildlife note cards, 7 styles of T-shirts, and 23 titles of wildlife related books were on the sales list. The Society plans to build a VCS at the North Pond trail during 1994 and expand sales.

The North Pond Trail Upgrade and Renovation Project is one step closer! Phase II - the boardwalk - was completed and in service in 1993. The CWRS purchased materials at the end of 1992; refuge staff members constructed the boardwalk during early summer. Visitor response has been excellent. Since the trail is superb, even without Phase III (the T-shaped over-look), the Board voted to delay the final phase in order to complete some projects considered to be a higher priority by all. Things are looking up!

The Society purchased another 15,000 Pea Island Bird Lists and a vandal-proof donation box for the North Pond Trail. Again this year, CWRS provided a \$600.00 stipend for the summer intern at Pea Island. Michael Kuhns was hired through the Student Conservation Association and did an excellent job. This position is invaluable to both the refuge and the Society for Pea Island's summer programs.

I. EQUIPMENT AND FACILITIES

1. New Construction

Refuge staff completed a 400' boardwalk addition to North Pond Trail. The boardwalk crosses a small (but deep) open water area and turned out great! Some of the 6x6 pilings were 26' long - kind of hard to handle by hand.

2. Rehabilitation

Two 2,000 gallon underground fuel tanks were removed and replaced with self-contained above ground tanks. Eastern Fuels was awarded this contract for \$24K.

The most time consuming project completed this year was repair of South Pond levee. The March storm completely obliterated over 300' of the 110' toe width levee (20' high) along with destroying the pump house, pump, pump engine, and 20' deep bulkheading around the structure. The 8 cylinder diesel engine was found 300 yards east out in the impoundment. This project began in early June and was finished in early September. Two draglines, 3 crawlers, excavator, 2 relift pumps, 2 farm tractors, and 4 people succeeded in finishing this project in the face of adversity - a lot of equipment breakdowns and no money! The entire project was completed force account without any add-on funding. Two days after finishing, Hurricane Emily paid a visit to the refuge - the repaired levee came through in flying colors.



The breach in South Pond dike was repaired using sand blown out of the dike and deposited in a "delta" inside the impoundment. JCJ 7/93



Funds were not available to replace the pump house, engine and pump, but an aluminum flash board riser was put in to allow water input during high wind tides. JCJ 8/93

Severe storm erosion to New Field and North Pond levees was repaired - again without any add-on funding.

Aluminum stoplog water control structures were installed in all 3 impoundment units to replace old screw gate structures that had been inoperable for about 20 years. The 140' long x 48" diameter structures will greatly aid water management efforts by allowing water input from the sound without having to pump.



The rusted out flap gate at New Field impoundment was replaced with a homemade flash board riser. JCJ 6/93

3. Major Maintenance

Storm damage repair seemed to be a continual process during '93 and included repairing roofs of all 5 refuge buildings, repairing kiosks, removing storm debris, repairing interpretative signs/panels, etc., etc. Slightly over a full man year of work was devoted to this effort - this is in addition to the levee repair work detailed above.