

GREAT DISMAL SWAMP
NATIONAL WILDLIFE REFUGE
Suffolk, Virginia

ANNUAL NARRATIVE REPORT

Calendar Year 1990

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

Nansemond National Wildlife Refuge

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Lloyd A. Culp, Jr. 2/28/91 _____ _____
Refuge Manager Date Associate Manager Date

Regional Office Approval 4-9-81
Date

INTRODUCTION

The Great Dismal Swamp National Wildlife Refuge, located in southeastern Virginia and northeastern North Carolina, was established in 1974 when Union Camp Corporation donated 49,100 acres to The Nature Conservancy which then conveyed the area to the Department of the Interior. The refuge now incorporates over 106,000 acres within the cities of Suffolk and Chesapeake, Virginia, and the counties of Camden, Gates, and Pasquotank, North Carolina. Being the largest refuge that is administered within Region 5, the Great Dismal Swamp NWR includes about a third of all refuge land and half the wetlands that are incorporated into northeastern refuges.

The refuge is a forested wetland that has been greatly altered by drainage and repeated logging operations. Lake Drummond, a 3,100 acre natural lake, is located in the heart of the swamp.

The primary purposes of the refuge can be traced to two public laws. The Dismal Swamp Study Act of 1972 (Public Law 92-478) authorized a study to determine the feasibility and desirability of protecting the Great Dismal Swamp and the Dismal Swamp Canal. The resulting study basically recommended that establishment of the refuge for the primary purpose of protecting the swamp ecosystem with the development of public use opportunities as a secondary purpose. The Dismal Swamp Act of 1974 established the refuge and directed that use of the Dismal Swamp Canal would not adversely affect the refuge.

Human occupation of the Great Dismal Swamp began nearly 13,000 years ago. By 1650, few native Americans remained in the area, and European settlers showed little interest in the swamp.

In 1665, William Drummond, a governor of North Carolina, discovered the lake which now bears his name. William Byrd II led a surveying party into the swamp to draw a dividing line between Virginia and North Carolina in 1728. George Washington first visited the swamp in 1763 and organized the Dismal Swamp Land Company that was involved in draining and logging portions of the swamp. A five mile ditch on the west side of the refuge still bears his name.

Logging activities within the swamp proved to be commercially successful, with regular logging operation continuing as late as 1976. The entire swamp has been logged at least once, and many areas have been burned by periodic wildfires.

Presently, the refuge is in the early phases of implementing various habitat management techniques, primarily directed at forest and water management, in an attempt to restore and protect the natural diversity of the Great Dismal Swamp. Most of these activities are still basically experimental, for many unknown factors related to the swamp's environment and responses to various habitat management techniques still exist.

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A. HIGHLIGHTS

Forester David Brownlie reported for duty to replace Allen Carter. (Section E.1)

Ducks Unlimited approved matching funds for several water management projects within the Virginia portion of the refuge. (Section E.5)

A tremendous amount of staff time spent in supporting habitat restoration projects on other refuges and private lands in Virginia and Maryland. (Section E.8)

After a two year hiatus, prescribed burning operations were resumed. (Section F.9)

Refuge personnel participated in two inter-agency fire suppression operations. (Section F.9)

The refuge deer hunt generated the third largest harvest in the history of the hunts. (Section H.8)

Arson was suspected when the Washington Ditch kiosk was destroyed by fire. (Section H.17)

The South Ditch water control structure was constructed. (Section I.1)

Significant time was consumed in the removal of several dangerous buildings, cleaning old dump sites, and removing old underground storage tanks. (Section I.2)

Procurement of high-band radio equipment was completed. (Section I.5)

The development of a computerized georgraphic information system began as part of a general overhaul of the refuge's resource monitoring program. (Section I.6)

B. CLIMATIC CONDITIONS

Weather conditions during 1990 were generally milder and considerably drier than 1989. Total precipitation for the year was 47.05 inches, about 7% below the 30-year average and 41% less than the record-setting wet year of 1989. Only a trace of snow was recorded (February 27) compared to 25 inches (a record for southeastern Virginia) in 1989.

Rainfall was well above average through May. However, a four month period of below average rainfall began in June, with June being the driest month with an 80% rainfall deficit. October, which is normally the driest month, received 36% above average rainfall which precipitated (no pun intended) the need to cancel some deer hunt days due to poor road conditions. However, mild Indian summer days prevailed in November with below average rainfall, permitting most of October's lost hunt dates to be made up. Although December brought above normal rainfall, the surface water inflows to the swamp were still in "no-flow" condition at the close of December.

The ample rainfall during the first five months of the year enhanced waterfowl brood habitat in the swamp and resulted in a bumper crop year of blackberries and other soft mast. However, the wet conditions delayed the construction of the South Ditch water control structure by two months (past mid July). Fortunately, the relatively dry fall permitted most of the related construction work to be completed by the year's end.

Despite having to cancel a few hunt days in October, 11 deer hunts out of 13 scheduled hunts were conducted, as the dry November allowed all scheduled November dates plus two make-up dates to be held. The cooperative weather resulted in the third-largest annual deer harvest in the history of the refuge.

1990 WEATHER DATA

Month	Rainfall*	30 Year Average	%Change	Temperature Max	Extremes** Min
January	3.34	3.64	- 8 %	74	23
February	5.09	3.65	+39 %	74	16
March	4.17	3.95	+ 5 %	84	25
April	3.60	3.76	- 4.2%	92	30
May	6.54	3.98	+65 %	86	46
June	.88	4.49	-80 %	91	48
July	4.34	6.73	-36 %	94	58
August	5.30	5.92	-10 %	90	63
September	2.66	4.37	-39 %	90	40
October	4.36	3.20	+36 %	82	30
November	2.95	3.45	-14 %	76	26
December	3.82	3.28	+16.5%	71	25
Total	47.05	50.42	- 6.7%	Extremes 94	16

*Rainfall data are recorded from the official Corps of Engineers rain gauge at the Feeder Ditch Spillway.

**Unofficial temperatures are recorded at the refuge headquarters.

C. LAND ACQUISITION

1. Fee Title

The refuge encompassed 106,871 acres as of December 31, 1990. North Carolina acreage totalled 11,841 in Gates County, 9,099 in Camden County, and 3,872 acres in Pasquotank County. Of the 82,059 acres in Virginia, 46,564 are in the City of Chesapeake and 35,495 are in Suffolk.

Only one small acquisition (Tracts 20a, 20b) was completed in 1990 in the southeastern corner of the refuge in Pasquotank County. The 56.1 acres were purchased from Julien C. Headley for \$42,000.

2. Easements

A total of thirteen roads are currently used for vehicle access to the refuge or have occasionally been used in the past. In addition to these major access points, numerous other easement or fee title right-of-way corridors have been transferred to the refuge since 1974 as means of entrance or egress to individual tracts. Most are located along the western boundary and have not been used to date. Information on the control and ownership of these rights-of-way is summarized as follows:

Road Name	<u>Rights-of-Way</u>		<u>Degree of Refuge Control</u>		
	Width	Ownership	Fee Title	Easement	Permission
Lamb		USFWS	X		
North		Kirk			X
Jericho Lane	100 ft.	USFWS	X		
Badger	16 ft.	Brothers		X	
	60 ft.	Badger		X	
Washington	50 ft.	Gambardella		X	
		Baines		X	
		Brinkley		X	
Railroad		USFWS	X		
Corapeake		Hunt			X
Cross	46 ft.	Daniels		X	
Weyerhaeuser		USFWS	X		
Insurance (strip)	100 ft.	Headley		X	
Bull Boulevard	100 ft.	Rhodes		X	
		Williams		X	
		White		X	
Edge	40 ft.	Edge		X	
Portsmouth	100 ft.	USFWS	X		

3. Other

Refuge Manager Culp spent considerable time in January researching deeds in an effort to resolve a boundary dispute along the refuge's western boundary. This problem was discovered in 1989 following a survey and posting of that portion of the boundary during that year. Mrs. Mary Gambardella of Norfolk possesses a deed which claims 42 acres of refuge land which abuts the southern edge of Washington Ditch. Her deed acknowledges that the Camp Company (later known as Union Camp Corporation, the donor of the land

during the refuge's establishment in 1974) claimed the 42 acres, but refuge records do not indicate that the old Camp deeds or maps acknowledge the Gambardella claim. Mrs. Gambardella's family has owned the land since the early 1920's, and transactions on the parcel were traced back to 1875 in an effort to determine where the dispute originated. Unfortunately, no "smoking gun" was found. Since the Suffolk Courthouse and its records were destroyed by fire during the Civil War, the land's history cannot be traced earlier than 1875. This information was forwarded to the Regional Solicitor through the Realty Division for their review and advice.

The Solicitors Office (Attorney Mark Barash) determined that a thorough legal review of the Suffolk records would have to be completed in an effort to explore all possible administrative solutions to this dispute. However, competing priorities in the Solicitors office delayed their prompt attention to this matter, so the legal review had not been conducted by the year's end. Mrs. Gambardella continued to be patient with this process, and the refuge management maintained an amiable relationship with her. In the meantime, the refuge boundary signs have been removed from the disputed boundary in order to avoid law enforcement complications during the hunting season.

A request to continue cultivation of a narrow strip of refuge land along Jericho Lane was denied early in the year. These farming activities were an encroachment which was detected during the same boundary survey/posting project in 1989 during which the Gambardella dispute was discovered, and they would not have enhanced wildlife management efforts in any way.

D. PLANNING

1. Master Plan

Sporadic progress continued on the refuge's master plan, an effort that began in 1981. The Regional Office successfully converted the Draft Environmental Impact Statement on the master plan to the current version of the word processing software and incorporated the refuge staff's comments into a draft of the Final Environmental Impact Statement (FEIS). However, competing regional and national priorities at the end of the year was inhibiting progress on the final editing of the FEIS. A hard copy draft and computer disks were sent to the refuge manager for review and editing, and significant time had been consumed with that effort by year's end. Unfortunately, this final review was a slower process than anticipated, as the hard copy draft had numerous discrepancies from the draft on the computer disks. Also, the word processing conversion apparently was not perfect, as attempts to edit the disks often resulted in the text jumbling to different page formats. Thus, this final review had not been completed as the year ended.

2. Management Plans

Regional Public Use Specialist Tom Comish visited the refuge during January 30 - February 1 to assist with public use management planning. Mr. Comish completed a draft plan which was later reviewed and edited by the refuge staff. The completed plan was still being reviewed at the regional office as the year ended.

Considerable staff time was consumed in the preparation of the Marsh and Water Management Plan, as extreme care was taken to design a consistent plan to restore the swamp's complex hydrology. The plan was later approved by the regional office.

5. Research and Investigations

Great Dismal Swamp NR 90 - "The Ecology of Swainson's, Prothonotary, and Other Warblers in the Great Dismal Swamp National Wildlife Refuge" (51580-4)

Brooke Meanly, a retired Fish and Wildlife Service biologist, and his wife, Anna, banded 28 neo-tropical migrants during their third and final year of mist-netting efforts. All their mist-netting/banding activity was accomplished in May. The Meanleys decided that 1990 would be their last year of banding in the swamp due to his age (75), distance (200 miles), and costs of making the annual trip.

Species and numbers banded during the three year period included prothonotary warbler (40), hooded warbler (22), white-eyed vireo (19), Louisiana waterthrush (13), ovenbird (15), Arcadian

flycatcher (13), great crested flycatcher (6), Swainson's warbler (5), red-eyed vireo (5), black and white warbler (3), worm-eating warbler (2), blue-gray gnatcatcher (2), common yellowthroat (2), yellow-breasted chat (1), and indigo bunting (1).

Most of the birds banded occurred in the shrub strata, but some slightly higher ranging species were occasionally captured as they pursued insects close to the ground. Perhaps, the most unusual bird of the above list was the yellow-breasted chat, a bird of shrubby open country and not of swamp woodland. Brooke reported that of all his many visits to the swamp over the years, it was his first observation of a chat in a mature swamp forest. A short paper on Meanley's activities for the three years may be published in the Virginia Ornithological Society's "The Raven".

Great Dismal Swamp NR 90 - "Population Density, Home Range Size, and Habitat Preference of Swainson's Warbler (Limnothlypis swainsonii)" (51580-3)

This study was in its second year of a long term (1989-1994) project on the Swainson's Warbler. Dr. Gary Graves, Curator of Birds at the National Museum of Natural History, Smithsonian Institute in Washington, D.C., has been conducting this research.

Dr. Graves worked on the refuge from May 22 - June 2, 1990, censusing warblers along ten miles of refuge roads --- concentrating on Jericho Lane, Jericho Ditch, Williamson Ditch, Lynn Ditch and Corapeake Ditch Roads. Approximately 40 males were located; 16 males were banded with metal leg bands and color marked with plastic bands. Habitat measurements were performed on territories of banded birds. Five birds were collected for biochemical studies.

Dr. Graves has expressed interest in a habitat manipulation experiment to increase the diversity of breeding birds in a closed-canopy red maple forest. A draft proposal on the experiment is expected to be submitted in 1991.

Great Dismal Swamp NR 90 - "Songbird Use in the Great Dismal Swamp Refuge" (51580-2)

This study, conducted by Don Schwab and Tom Gwynn, was to determine songbird use of the refuge with special emphasis on the habitats of the Swainson's warbler and the effects of habitat management practices on species use. No report on 1990 activities was received.

6. Other

For several years, this station's staff has developed and implemented an "in house" version of an annual work plan based on funding and other Service directives. In 1990, the Region

implemented specific requirements for these plans, so significant time was consumed in revising this station's plan accordingly. As the year ended, the new versions of the annual work plan had been developed, and the time recording program that was developed by the Regional Office had been installed and implemented on the computer.

E. ADMINISTRATION

1. Personnel



Front Row: (Left to right) Keel, White, Kaehny, Brownlie, Winningham
Back Row: Culp, Cherry, Leary, Marlin, Rybolt (DIS-90-1, LAC, 12/90)
STAFF

Lloyd A. Culp, Jr.	Refuge Manager, GS-12	EOD 4/10/88	P
Martin C. Kaehny	Assist. Manager, GS-11	EOD 3/01/85	P
Ralph M. Keel	Biologist, GS-11	EOD 5/27/86	P
Teresa M. Cherry	ORP*, GS-9	EOD 3/12/89	P
David J. Brownlie	Forester/FMO*, GS-11	EOD 7/29/90	P
Sally D. Leary	Office Assistant, GS-6	EOD 1/13/80	P
Helen K. Marlin	Clerk-typist, GS-3	EOD 12/6/87	P
Bailey White	Equipment Operator, WG-10	EOD 3/15/78	P
Dane Winningham	Maintenance Worker, WG-8	EOD 7/24/83	P
Allen R. Carter (1)	RFMC, GS-12	EOD 12/3/89	P
Howard T. Rybolt (2)	Appraiser, GS-12	EOD 12/31/78	P
Reginald L. Brown	Student Trainee, GS-4	EOD 6/06/88	P
Rick Pearce**	Tractor Operator, WG-6	EOD 3/11/90	T
Bryan Poovey**	Tractor Operator, WG-6	EOD 3/11/90	T
Mark Douglas**	Tractor Operator, WG-6	EOD 3/11/90	T
Kenneth Powell**	Tractor Operator, WG-6	EOD 5/1/90	T
Kim Jackson (3)	Biological Aid, GS-3	EOD 6/25/90	T

*ORP - Outdoor Recreation Planner

*FMO - Fire Management Officer

** Fire Crew

(1) - Regional Fire Management Coordinator, stationed at Great Dismal Swamp NWR

(2) - Realty Appraiser, stationed at Great Dismal Swamp NWR

(3) - Career Awareness Student

The year began with recruiting underway for a forester/fire management officer, GS-11, to replace Allen Carter, who became the regional fire management coordinator in December, 1989. Unfortunately, no qualified candidates applied during the first advertisement, which closed in February, despite the fact that the position was advertised government-wide. The position was re-advertised in March with two grade levels, GS-9/11, and dozens of contacts were made with other land management agencies and through fire management contacts in an effort to attract qualified candidates.

The second advertisement produced good results, and interviews were conducted with several well-qualified individuals. An attempt to select the only qualified female candidate on the certificate, in support of the EEO emphasis, failed after she accepted an appointment to a forester/FMO's position in Georgia. Therefore, another well-qualified individual, Mr. David Brownlie, was ultimately selected for the position, and he entered on duty on July 29. Mr. Brownlie was stationed at the Hiawatha National Forest in Michigan at the time he was selected to serve at the Great Dismal Swamp NWR.

Considerable time was expended in recruiting for the four seasonal tractor operators (WG-6) who serve as the station's fire crew. Numerous distributions of the recruiting announcements throughout the local commuting area produced 15 applicants, with eight of those individuals accepting the opportunity to be interviewed and take the physical qualifications test. Of those individuals, five applicants passed the physical qualifications test, and three of those individuals were selected and entered on duty in March. Additional recruiting began, and a qualified individual was finally selected in May.

The recruiting process for the seasonal fire crew was a major administrative burden. Seasonal positions, for obvious reasons, could not attract and hold trained, experienced personnel. This constant turn-over meant that the refuge staff was constantly recruiting and training new personnel for the fire crew, and the crew's experience in actual fire-fighting seldom exceeded one fire season. Therefore, plans were underway as the year ended to convert three of the four seasonal positions to permanent full-time positions (forestry technician, two tractor operators), with actual recruiting anticipated in early 1991. This change should reduce the turn-over in the fire management positions and enable the refuge to field a trained, experienced, and safer fire crew.

Student Trainee Reginald Brown served his third season at the refuge during June - August. He anticipated graduating from Grambling State University, Louisiana, in May 1991 and returning to full-time duty at this station as a manager trainee.

Ms. Kim Jackson served an eight-week tour, which began on June 25,

as a biological aid. Ms. Jackson was recruited through the Career Awareness Program as part of the Region's efforts to recruit minorities.

The refuge continued to share with Realty half of an FTE and salary costs for the station's clerk-typist position in return for administrative support for Realty's appraiser who is stationed at the Great Dismal Swamp NWR. This unusual situation has been workable, although some administrative glitches related to time-keeping and budget planning have developed occasionally as a direct result of this split arrangement. Refuge management has proposed ~~that~~ the full FTE for this position be allocated to the station in order to eliminate these problems.

Year	STAFFING PATTERN			Total FTE's
	Permanent Full Time	Permanent Part Time	Temporary	
1990	9	0	4	11.2
1989	9	0	5	11.8
1988	9	0	5	11.8
1987	10	0	2	11.3
1986	10	0	2	11.3

4. Volunteer Program

Volunteers continued to show their support for the refuge during 1990 by donating their time and talents assisting with a variety of projects. Volunteer hours increased significantly from last year with 731 hours donated in 1990 compared to 629 hours donated in 1989. In addition to increased hours, the number of volunteers also increased as seven individuals joined the volunteer program during 1990 bringing the number of active volunteers to 22 individuals.

Volunteer assistance was received in a variety of areas throughout the year and included the following: conducting wildlife and vegetation surveys, rehabilitating and relocating wood duck and bluebird nest boxes, performing trail maintenance, picking up litter, landscaping, posting signs, assisting with vehicle maintenance, hand-clearing experimental habitat management plots, producing audio tapes of refuge brochures for handicapped visitors, and assisting with the annual deer hunt.

Two volunteer orientation and training sessions were presented during the year and, as a result, seven individuals joined the volunteer team. Most of these individuals learned of the program by word of mouth from refuge staff and volunteers.

In August, ten Boy Scouts from Troop 191 and five adults donated 96 hours (included in the above total hours) in a one-day "Take Pride in Great Dismal Swamp Refuge" cleanup project. The group

mowed and weeded the Washington Ditch parking lot, picked up litter around the parking lot and along the boardwalk trail, and cleared overgrown brush from the trail. Most of the scouts fulfilled badge requirements with this project and, although they commented that it was hard work, indicated they were anxious to return for future projects. The group was well organized and anxious to work, as demonstrated by the amount of work that was accomplished.



Boy Scouts from Troop 191 took pride in their refuge by helping clean up Washington Ditch. (DIS-90-2,TC,8/91)

Several volunteers assisted with preparing for and conducting the deer hunt by painting hunter check in/check out stations, making signs for the hunt, collating hunt information packets, stuffing envelopes, and staffing the deer check station. Biologist Keel conducted a training session for staff and volunteers on check station procedures in October. Volunteers who staffed the check station were responsible for weighing the deer, pulling the jaw bone for aging, and completing the necessary paperwork.

The refuge received several requests throughout the year from Boy Scouts wanting to conduct Eagle Scout projects. Eagle Scout Candidate David Keel from Tidewater Council Troop 496 completed his Eagle project on February 24. The project was initiated in November 1989 and involved rehabilitating and relocating 50 wood duck boxes and constructing and installing 25 sheet metal predator guards. Eight scouts and seven adults contributed 128 hours (included in the above total) in 1990 while completing the project. A total of 179 hours were contributed in 1989 and 1990 to this project.

A refuge staff and volunteer picnic was held on September 30. Thirty volunteers, staff and family members attended the picnic.

and recognition ceremony. Volunteers were recognized for their assistance throughout the year and each received a "Certificate of Volunteer Appreciation" and a volunteer cap. The picnic provided an excellent opportunity for refuge staff and volunteers to meet each other and for the staff to show their appreciation for all of the volunteers' efforts throughout the year .

Volunteer assistance enabled a variety of projects to be completed throughout the year that may not have been otherwise. Their assistance has also enabled the staff to devote their time to other priority programs. Although a large amount of staff time is required to administer the volunteer program, this program continued to provide a much needed source of support to the refuge.



Volunteers Ken Stephens and Steve Dressler hoped that dumping would cease to be a problems at Jericho Lane. (DIS-90-3,TC,3/90)

5. Funding

FUNDING LEVELS (BY SUBACTIVITY)

FY	1260(1)	1520(2)	1510(3) 1240 9100	8610(4)	TOTAL
1990	443,239		182,992	1,443	627,674
1989	350,553		98,000	2,627	465,180
1988	350,575		60,095		410,670
1987	369,343		30,000		399,343
1986	333,752	28,000	27,638		389,390

- (1) Refuge Operations
- (2) Youth Conservation Corps
- (3) Fire Management
- (4) Quarters Operations

Budget management was a rather challenging chore in FY 1990. As in past years, the FY 1990 funds advices were not distributed until over four months of the fiscal year elapsed. Administrative changes in the Denver Finance Center stalled the production of useful monthly budget reconciliation printouts during the early part of the year. Numerous revisions in the station's funds targets, especially during the final quarter, made updating the station's accounting records seem like an almost endless chore. This station also tracked much of the Region's fire management budget in supporting regional fire management coordination.

Budget planning and tracking continued to be processed on computerized files and applications that were developed by the Region on RBASE. These systems generally worked well, although each one had at least a few glitches which had to be overcome. Perhaps, the most disturbing problem was the apparent failure for several Individual Project Worksheet updates, which had been submitted throughout the year, to be entered on the Region's master files. However, the Region's efforts to automate these data bases were commendable, and continued progress and "tuning" is to be expected.

The specific basic projects which were funded within the aforementioned funds targets included:

<u>PROJECT</u>	<u>AMOUNT</u>
Vehicle Maintenance	10,000
Road Maintenance	15,000
Heavy Equipment Maintenance	15,000
Radio Repair	4,000
Water Control Structure Construction	50,000
Cross Flow Culvert Installation	10,000
Cedar Regeneration	1,500
Cedar Habitat Management	2,500
Cedar Planting	800
Lap Top Computer	3,000
Brochure Reproduction	3,200
Computer Hardware Replacement/Upgrade	10,000
Underground Storage Tank Removal	30,975
Radio Procurement	62,000
Regional Fire Cache	3,000
NUS Supplies	500
Aerial Fire Detection	1,000
Fire Equipment Maintenance	10,000
Travel, Regional Fire Mgt. Coord.	<u>8,000</u>
Total	240,475

In January, five proposed water management projects were submitted to the Region's North American Waterfowl Management Plan coordinator, Ray Whittemore, to be considered for cost sharing through Ducks Unlimited's Matching Aid to Restore States Habitat (MARSH) program. This effort prompted Mr. Ralph Bitely, who coordinates the MARSH program in Virginia, to visit the refuge in October to learn more about the proposed projects. This meeting led to Ducks Unlimited approving matching funds for the two projects which were located within the Virginia portion of the refuge, with the matching funds becoming available in early 1992. Mr. Bitely was also optimistic about the chances of obtaining MARSH funds for the remaining projects within North Carolina.

6. Safety

The major objective of the refuge safety programs has been to provide a safe and healthy work environment, minimize unsafe acts and correct hazards that could lead to personal injury or property damage, and to make safety an integral part of each employee's daily activities. The safety ethic was promoted through regularly scheduled safety meetings, training, or inspections, and the dissemination of safety related correspondence to all employees. The staff was encouraged to discuss safety related issues during the weekly staff meetings.

On March 26, the refuge staff conducted the annual hazard hunt

whereby teams were given specific tasks and areas to check for safety deficiencies. The team reports were collated, hazards prioritized, and most items were corrected by years end.

The following safety issues and tasks were addressed during the year:

- A discussion on flammable liquids and combustible materials was the topic of the February 5 safety meeting.

- The refuge staff was tested for Lyme disease on March 5 and 9.

- The March 19 safety meeting concerned a discussion of the Regional Lyme Disease Medical Surveillance Program with the refuge staff.

- The April 25 safety meeting involved assigning and subsequent inspection of refuge vehicles for safety items including flashlight, flares, spare tire, and jack. This inspection was followed by a demonstration of the correct procedure for changing a tire.

- On May 7, refuge employees viewed the four module video tape program on Fork Lift Safety and completed the workbook per Regional Office instructions.

- On May 21, a safety meeting addressing the use of safety belts in vehicles was held per Regional instructions.

- On July 6, an eight hour defensive driving course was hosted by Great Dismal Swamp NWR with 15 employees from Back Bay and Great Dismal Swamp completing the course.

- A safety meeting concerning the hazards of working in a hot humid environment was held on July 16. Employees were briefed on the signs, symptoms, and first aid procedures for heat cramps, heat exhaustion and heat stroke.

- On August 16, eight employees were certified in cardiopulmonary resuscitation and first aid.

- On October 5, search and rescue procedures were reviewed as part of the preparation for the refuge hunts.

The staff suffered one lost time accident on April 12 during the clean-up of the old Perry cabin site on Lake Drummond. Tractor Operator Mark Douglas slipped into a piling hole and injured his knee while wading in hip deep water . As a precaution, Mr. Douglas was transported to Obici Hospital for x-rays, but, fortunately, he sustained only a sprained knee. Mr. Douglas lost one day's work to recover from this accident.

Two other reportable accidents occurred during the year to refuge

personnel. On June 27, Tractor Operator Ken Powell was clearing roads of downed trees and limbs when a branch on a large limb snapped back and hit him in the nose. No lost time or medical treatment was required. The second incident occurred on August 14 when Mr. Powell was cutting lumber and a piece of sawdust was blown into his left eye, despite wearing safety glasses.

Refuge visitors were involved in two incidents during the year. A juvenile totally wrecked his Chevrolet Blazer in October when he tried to flee from the Suffolk Police at the Washington Ditch Road. The youth and about a dozen other teenagers were having a beer party at the Washington Ditch entrance when refuge officers and the local police were notified about the illicit Friday night party. On November 6, a refuge hunter fell out of his tree stand and broke his leg. Refuge and emergency medical technicians had to carry the hunter approximately one quarter mile through the swamp to the awaiting ambulance.

7. Technical Assistance

Biologist Ralph Keel attended the signing ceremony for the waterfowl/wetlands management plan at the Quantico Marine Corps Base on January 30. Ralph contributed considerable time in 1989 in developing this plan in coordination with base personnel. Regional Director Ronald Lambertson and Brigadier General Gail Reals signed the plan during the ceremony, and base officials indicated that they anticipated obtaining \$50,000 to implement specific projects that were covered in the plan.

Biologist Keel met with David Lekson and Laura Manuele (Corps of Engineers) on September 13 to check a possible wetlands fill violation that was located near the refuge's southeastern boundary. The site was discovered by refuge personnel during an aerial fire detection flight in July. Apparently, a borrow pit had been dug to develop a spoil bank road during logging operations in the area. The Corps personnel planned to continue their investigation of the site, and Biologist Keel took oblique aerial photos of the area during another flight in September.

8. Other

Refuge Manager Culp met with Associate Manager McAndrews in January to evaluate the compatibility of various activities on the refuge. This meeting was part of a nation-wide review which was prompted by a General Accounting Office audit which was critical of the level of possible incompatible and/or harmful uses of refuges.

Manager Culp chaired the project leaders meeting committee in 1990, an effort which required a tremendous amount of time. Despite the headaches that are inherent to this task, the committee was satisfied that a successful meeting was planned and carried out, as the manager evaluations of the meeting were overwhelmingly

positive.

The Environmental Protection Agency finally listed the old Suffolk landfill on Hosier Road as a priority site. This uncontrolled landfill was closed in 1985 and is suspected of contaminating one of the refuge's western inflows. The City of Suffolk was in the process of developing remedial action plans as the year ended.

The old landfill, as well as several other issues, seemed to strike a civic environmental nerve in the Suffolk area during 1990. The Hosier Road landfill contamination, concerns about expanding the regional landfill that is located near the refuge's northern boundary, the development of coal-storage and co-generation plants in the Suffolk area lead to the founding of the Suffolk Environmental Coalition. Manager Culp attended one of their meetings and maintained contact with several of their members in order to stay current with the local environmental concerns.

The Southeastern Public Service Authority (SPSA) began considering the development of a landfill on a 3,000 acre site near the refuge's eastern boundary in Chesapeake. The area was once part of the Great Dismal Swamp, but it was cleared for agriculture within the past 10-15 years. The SPSA was attracted to the site because they had a willing seller for a large contiguous tract of land. Also, they believed that little, if any, jurisdictional wetlands existed within the tract, especially after the Corps of Engineers (in a ruling issued late in 1990) exempted most "prior converted" wetlands (wetlands drained and developed prior to 1985) from wetlands protection. The refuge management and the Service's Fish and Wildlife Enhancement personnel expressed concerns to SPSA about the possible disruption of the swamp's hydrology by the landfill. Also, the area was known to support significant waterfowl use during the fall, winter, and spring.

Refuge Manager Culp was interviewed at length by Lisa Vandergriff of the Environmental Protection Agency's Oak Ridge Laboratory on June 21. The EPA was interested in local public reaction to various environmental issues and was soliciting advice on how to better communicate the federal government's role in these issues.

Considerable staff time was consumed in supporting various projects at Back Bay, Eastern Shore of Virginia, and Blackwater NWR's as well as off-refuge wetlands restoration in northern Virginia. Equipment Operator Bailey White spent most of his time at Back Bay NWR during May-September in order to assist with their impoundment rehabilitation project, and his prolonged absence was a significant disruption to most field activities underway at this station. Maintenance Worker Winningham and Tractor Operators Pearce, Poovey, and Powell spent varying amounts of time working on wetlands restoration efforts during May 28-June 8 under the direction of Mason Neck Refuge Manager Fred Milton. Several pieces of heavy equipment were transported to Eastern Shore of Virginia NWR for use

in the Region's heavy equipment training. To sum it up, the coordination that was involved in transporting personnel and heavy equipment to these other projects added to an already hectic pace at the Great Dismal Swamp.

Refuge Manager Culp was detailed to the Regional Office during April 2-5 to fill in for the Refuges-South associate managers.

Messrs. Tom McAndrews, Tom Comish, and Tom Jasikoff conducted a refuge inspection during May 7-10. A good, positive learning experience was had by all.

The refuge staff regretfully learned that Mr. Kent Livezey left his post with the Virginia Chapter of The Nature Conservancy in June. The Nature Conservancy has maintained oversight authority over specific refuge activities through deed reservations, and Mr. Livezey had been the refuge's primary contact with the organization during 1989-90. He had been supportive of the refuge resource management programs and facilitated good communication between the refuge staff and The Nature Conservancy.

Refuge Manager Culp continued to maintain contacts with the Congressional representatives. Refuge updates on the salient issues were provided to staff assistants including Ms. Ann Loomis (Senator John Warner, Virginia), Mr. Floyd Lupton (Congressman Walter Jones, North Carolina), and directly to Congressman Norman Sisisky (Virginia).

F. HABITAT MANAGEMENT

1. General

The refuge is a forested wetlands that has been greatly altered by drainage and repeated logging operations. Lake Drummond, a 3,100 acre natural lake, is located in the heart of the swamp.

The basic purpose of the refuge is to restore the natural biological diversity of the Great Dismal Swamp to the extent possible. This restoration will be a long-term process of habitat restoration. Major components of the program are experimental, for the restoration of 100,000+ acres of forested wetlands is not a common practice.

Within the refuge, five major forest types and three non-forest types of plant communities comprise the swamp vegetation. The forest types include pine, Atlantic white-cedar, maple-blackgum, tupelo-bald cypress, and sweetgum-oak-poplar. The non-forest types include a remnant marsh, a sphagnum bog, and evergreen shrub community.

Red maple is the most abundant and widely distributed plant community and is increasing in area. Tupelo-bald cypress, formerly a predominant forest type in the swamp, today accounts for only 12% of the total cover.

Another important forest type is Atlantic white-cedar, covering approximately 8% of the refuge. Stands of cedar are disappearing along the coastal plain and also in the refuge. Changes in forest types in the swamp are due to extensive draining, past forest cutting, and the effects of fire (or lack of fire). Forest management activities are focusing on the maintenance of existing forest communities, especially Atlantic white-cedar, tupelo-bald cypress, and sweetgum-oak-poplar.

The Nature Conservancy (TNC) retained general oversight authority through deed reservations over the approximately 49,000 acres of the refuge that were donated through TNC from Union Camp Corporation in 1973. Thus, refuge management has attempted to maintain continuous contact with representatives from the Virginia Chapter of TNC in order to carefully communicate and interpret the refuge's experimental habitat restoration program. This communication has generally involved personal contacts as well as submitting copies of habitat management plans to TNC for their review. During 1989-90, Mr. Kent Livezey represented TNC's interest in the refuge, and he was supportive of the refuge's management programs. Mr. Livezey perceived his role to be more advisory in nature rather than one of "over-seer", as he respected the fact that refuge management had to make the decisions on overall resource management programs in order to achieve any tangible progress. Unfortunately, Mr. Livezey departed TNC in

June, 1990, and his replacement had not been established as the year ended.

In 1990, efforts were initiated to develop computerized geographic information systems on the refuge in order to bring state-of-the-art technologies to the overall resource management operations. This development had become an absolute necessity for maintaining a state-of-the-art, credible resource management program, since the analysis and interpretation of the volumes of ecological data that currently exists was already a slow and inefficient process. The sound management and review of the current and future data will be critical to the development and fine-tuning of refuge resource management activities as well as assessing the impacts on the refuge of off-refuge land and water uses.

2. Wetlands

The refuge has been divided into seven water management units (WMU). The watersheds to the west of the refuge have provided most of the surface water inflow via Cypress and Pocosin Swamps in Virginia and Taylor Swamp in North Carolina. Other minor inflows are found in Moss Swamp in Virginia and Hall Pocosin and Folly Swamp (via Folly Ditch and Acorn Hill Millpond) in North Carolina.

Water flowed from the Great Dismal Swamp through Shingle Creek to the northwest and the Pasquotank River to the southeast. The 150 miles of ditches, which were created during the construction of timber access roads over the past two centuries, served as man-made outflows which ultimately drained, directly or indirectly, into the Dismal Swamp Canal which forms the refuge's eastern boundary.

Over 115 water control structures and culverts as well as 12 bridges are located throughout the refuge. As of 1990, thirteen of these structures were functional, and another five were near functional, needing only minor repairs. The functional structures were checked and adjusted periodically throughout the year, especially during periods of high water levels, and water level data were recorded from 28 staff gauges that were located near the structures and other strategic points within the refuge.

In 1990, refuge personnel participated in several wetlands restoration projects at locations other than the Great Dismal Swamp. In June, they assisted on a private lands restoration near Culpepper, Virginia. Also, Equipment Operator Bailey White spent most of his time during April-September working on the dike construction project at Back Bay NWR.

A wet 1989 provided plenty of water to flood much of the refuge as the year began, and these conditions were generally maintained through mid-June after above average rainfall was recorded in May. More specific observations are summarized as follows:

Water Management Unit 1

This 3,500 acre unit is divided into 10 subunits, and five of the refuge's thirteen functional water control structures are located within this area. Through 1990, the Washington/Lynn Ditch diversion structure, which was constructed in 1984, has not been utilized due to concerns about contaminants that were suspected to be flowing into this area from an old Suffolk landfill near Pocosin Swamp. However, Contaminant Specialist David Stillwell, of the White Marsh Fish and Wildlife Enhancement office, reported in October that his initial review of the contaminants testing that ~~had~~ been conducted in recent years revealed nothing that should prevent the diversion of water from Washington Ditch to Lynn. Thus, the first significant diversions from Washington Ditch may be implemented in 1991.

Favorable waterfowl brood conditions were maintained through mid-June, and wood duck broods were observed in WMU 1A, 1B, and 1D. Fledged woodies were seen in WMU 1H in early fall, but no broods were detected.

Water Management Unit 2

A water control structure was installed on the east end of South Ditch, providing the first water management capabilities in this area. This project dominated habitat management operations for the year (details are described in Section I.1).

The Railroad/West Ditch experimental burn site, established in 1986, was examined on September 20 by Forester Brownlie and Biologist Keel. The two tenth-acre circular survey plots were inundated about 5 1/2 months compared to 10 months in 1989. The "pile and burned" plot was still dominated by Bidens spp. that had increased in coverage by 19%. Cattail was present on all the .1 square meter quadrats within the plot, but its coverage had decreased by about 6%. However, cattail was still the co-dominant species. Cyperus spp., bladderwort, and false-loosestrife had disappeared from the plots, while smartweed (Polygonum spp.) was noted for the first time.

The broadcast burn plot was also dominated by Bidens spp. with an increase of 28% in coverage. Warty panicum (Panicum verrucosum) was again co-dominant, but its coverage was about 50% less than that of the previous year. Other species noted for the first time outside the quadrats were goldenrod (Solidago spp.), woolgrass, and sweetgum seedlings. Depth to water table in September was almost 2.5 feet. The area was flooded to a depth of 11 to 25 inches at the peak staff gauge reading of 5.94 in February. Water levels slowly receded afterwards, but good brood conditions prevailed until late May. Wintering wood ducks, black ducks, and mallards used the area. Both mallards and wood duck broods used the flooded woodland fringe along West Ditch. The beaver dam in West Ditch at the southeast

corner of the Railroad/West Ditch experimental burn site was a major factor in water being held on the site until late May.

Water Management Unit 3

The remnant marsh experimental site in WMU 3A just north of Cross Canal was inundated only until late May. A staff gauge was placed in the southeast corner of the area on June 6 in order to enhance the refuge data base on surface flooding.

The remnant marsh vegetation plots were examined on September 24. ~~Maidencane~~ remained the dominant species (28.9%) in the cleared site but was down about 45% from last year in percent area coverage. The co-dominant species was the Virginia chain fern at 10.5% area coverage. Beggars tick dropped out as a co-dominant to only 4% coverage, a decrease of about 10%.

The water table in the plot was 4.3 feet below the surface after almost four months of below normal rainfall. Red maple had decreased in the shrub layer to 4%, but sweetgum, blackgum, and blackberry were recorded for the first time. Total percent cover in the shrub layer was only 8%. The cleared area was prescribed burned on December 18 to set back the encroaching maple and sweetgum and remove the dead grass layer.

The untreated area plot with the red maple overstory was still dominated by fern (13%) in the understory layer. Lizard-tail and poison ivy were present at only the trace level. The water table was 5.1 feet below the surface.

Maximum water levels were achieved behind WCS 48 (Corapeake Ditch), Western Boundary fixed-level weir, WCS 41 (Persimmon Ditch), and WCS 18 (Forest Line). The leak in the gate seat of WCS 44 (South Martha Washington) was not repaired, as planned, during the low water period due to the South Ditch construction project and fire fighting details.



Red maple dominated this portion of untreated remnant marsh in September Forester Brownlie recorded data during surveys. (DIS-90-4, RMK, 9/90)



This portion of the marsh had been cleared by a dozer in 1986. (DIS-90-5, RMK, 9/90)



The cleared portion of the marsh was burned in December to retard new red maple encroachment. (DIS-90-6, RMK, 12/90)



The maple saplings were definitely scorched, but how many were killed? (DIS-90-7, DJB, 12/90)

Water Management Unit 4

All the inflows in the North Carolina portion of the refuge flow into this WMU, with Taylor Swamp via Cross Canal being the major source of surface water. Inflow from Taylor Swamp was running 3.5 feet higher on January 10 than in January 1989 due to above average rainfall throughout 1989.

Inflow remained adequate to maintain good waterfowl brood conditions until about mid-June. By the last week of June, Taylor Swamp inflow was a mere trickle.

In April, a connecting band joining a flashboard riser on one of the two culverts (WCS 53) at the head of County Line Ditch broke loose, causing the flashboard riser to indeed rise and lose its water control capability. Fortunately, above normal rainfall in May helped to maintain adequate waterfowl brood conditions, especially in the fringe marsh area.

With the beginning of a four month drought in June, water levels behind the Pasquotank Dike, which is located outside the refuge's southeastern boundary and owned by Pasquotank County, dropped three feet in about a 30 day period due to the rusted-out WCS in the dike. Although the dike is located off the refuge, it has played an important role in retaining water within the southeastern part of the refuge.

The five tenth-acre circular vegetation plots within the Highway 158 treatment site were examined on September 25. The fringe marsh plot was inundated until mid-June, but, by September 25, the water table was 1.4 feet below the surface. The plot supported a dense stand of panic grass (97% cover) with some nutgrass (Cyperus spp.) and woolgrass observed outside the plot. This plot was flooded for about 10 months last year and produced no vegetation.

The "clear and leave" treatment plot was again dominated by panic grass (55%), its coverage decreased by 17%. Greenbriar, blackberry, red maple seedlings, American holly, and fern were present but, all together, comprised only 15% coverage. Woolgrass was also present but was not detected in the quadrats. The water table was 1.7 feet below the surface.

The "clear and pile" plot was also dominated by panic grass (60%), but its coverage decreased by 22%. Switch cane was co-dominant (34%) with a 16% increase. Red maple seedlings accounted for less than 1% coverage. The water table was 2.5 feet below the surface.

The "burned woods" plot was dominated by panic grass (61%), showing only about a 3% increase. Virginia chain fern doubled its coverage but still accounted for only 6%. Woolgrass (4%) decreased by 6%. Switchcane accounted for only 2% coverage, while willow (Salix

spp.) was noted for the first time at less than one percent. The water table was 2.1 feet below the surface.

The forested control plot (red maple) was dominated by switchcane (9%) in the understory, revealing an 8% decrease. Greenbriar, an unknown moss, and red maple seedlings were also present but accounted for less than 4% coverage. The water table was 4.1 feet below the surface.

Water Management Unit 5

Peak water levels behind WCS 24 (Portsmouth Ditch/Rosemary Ditch) and WCS 36 (Northeast Ditch) were reached in February. Water levels behind WCS 24 provided adequate waterfowl brood conditions on at least a portion of Juniper and Portsmouth Ditches.

WCS 36 kept the swale area in the eastern portion of WMU 5C inundated until late May, but no waterfowl use was observed.

Water Management Unit 6

Beavers continued to provide the only water control on this unit with one culvert plug, three dams, and another dam under construction (East Ditch) noted in December.

The bog burn site was inundated for at least ten months and was used as a roosting site for over 200 wood ducks in September. The vegetation plot in the burn site was flooded with 6.5 inches of water when examined on September 18. Total percent vegetative cover (28.9%) declined almost 15%. Woolgrass was the dominant cover species (14.3%) showing about a 33% decline in area coverage. Cattail was co-dominant at 10.5% showing about a 19% reduction. Willow, the only other species present in the quadrats, showed a 57 percent reduction in coverage. Phragmites was noted scattered around outside the plots for the past two years.

Lake Drummond

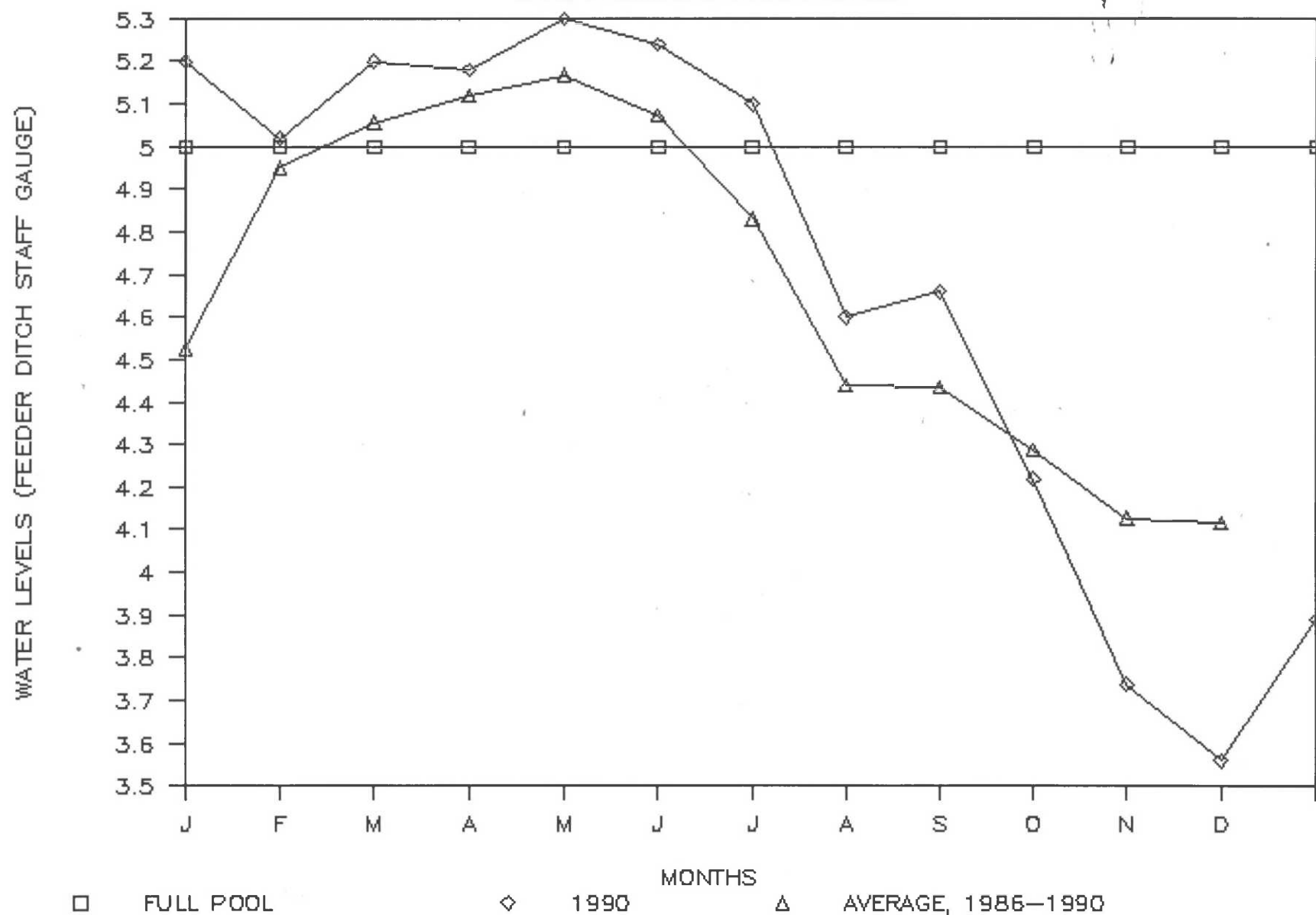
The Corps of Engineers continued to control the lake level by a spillway on the Feeder Ditch about a mile east of the lake. The lake has provided water to the Dismal Swamp Canal since the canal's construction in the early 1800's. Through an informal arrangement between the Service and the Corps, no water is released at the Feeder Ditch spillway when the lake level drops to the 3.6 mark on the spillway gauge.

The lake level remained at or above the 5.10 mark through June, but four consecutive months of below average rainfall beginning in June caused the level to steadily drop to the low mark of 3.56 in November. With the cessation of the release of water from Lake Drummond, the Dismal Swamp Canal was closed to through boat traffic on November 13 and was still closed at the end of December. The

relatively high water levels during the growing season exposed little or no lake bottom for moist soil plant production.

GREAT DISMAL SWAMP NWR

LAKE DRUMMOND WATER LEVELS



3. Forests

Three basic objectives have been established for the refuge's forest management program. One is to provide habitat for certain wildlife species. Examples include the maintenance of gallberry pocosins for black bear feeding and denning; managing mast producing stands of oak and blackgum for wood ducks, turkey, bear, and deer; and creating early successional habitat for small mammals such as the Dismal Swamp southeastern shrew.

A second objective is to provide a more balanced distribution of habitat types and age classes on the theory that greater habitat diversity will result in a greater diversity of wildlife species. Presently, over 60% of the refuge habitat is the red maple-gum type, and less than 5% of the habitat is in the regeneration or old growth age classes.

The third objective of the forest management program is to maintain or restore specific ecosystem characteristics of the Dismal Swamp. Atlantic white cedar, for example, is rapidly declining throughout its range along the Atlantic coast. The Dismal Swamp contains some of the largest remaining stands of cedar. Management tools such as timber cutting, prescribed burning, and/or planting can help regenerate this forest type. Bald cypress is another species formerly abundant in the swamp but now declining. Management could encourage restoration of this species.

Regional Fire Management Coordinator Allen Carter and Biologist Ralph Keel accompanied Fred White, Research Forester with the North Carolina Forest Service on March 2 on a tour of the refuge. The tour objective was to locate potential sites for experimental Atlantic white cedar regeneration in both the Virginia and North Carolina portions of the refuge. Sites along Jericho Ditch and Corapeake Ditch were found. Twelve plots were located and marked during July along the east side of Jericho Ditch, extending north from the fire tower, and baseline data collection started. The twelve plots were divided into three replications of four different treatments each. One of the four plots in each replication was intended as an untreated control plot. The other three plots in each replication were intended to receive timber stand improvement (TSI) treatments as follows:

Remove (cut) understory and midstory vegetation;

Remove (cut) understory and midstory, and apply Garlon 3A (herbicide) to cut stumps;

Remove (cut) understory, midstory, and overstory hardwoods, and apply Garlon 3A (herbicide) to cut stumps.

The hot weather and large volume of vegetation needing removal slowed production (averaged 12 person-days/plot) during August, requiring a scaling back of the study design. Work continued through August and into September on two of the original three replications and was completed on September 11. The third replication remained ready for treatment at any time funding and labor supply allows completion.

Biologist Keel and Forester Brownlie began marking the perimeter of another 5-acre experimental Atlantic white cedar regeneration area near the intersection of Corapeake and Forestline roads during early August. This experimental observation area will compare the effectiveness of different deer browse repellents on planted Atlantic white cedar seedlings.



"But Ralph, I am holding up the density board! Just following the yellow tape." (DIS-90-8, RMK, 10/90)

Quotes from several prospective contractors for machine clearing this site prior to planting were solicited, but all ranged from 2-4 times historical rates for this type of work. Consequently, on September 18, Biologist Keel and Forester Brownlie met on-site with Charlie Smallwood of the North Carolina Forest Service. A purchase order was subsequently issued late in September to the NCFS for this work based on the \$180/acre price quoted by Mr. Smallwood. Biologist Keel, volunteer Sam Fishel, and Forester Brownlie established and measured four plots in the treatment area on September 13 to establish pre-treatment vegetative conditions on the site. Equipment breakdowns delayed the NCFS several weeks and may require yet another change of plans for this site, as 4,000 Dismal Swamp cedar seedlings at a nearby NCFS tree nursery were originally destined for planting at this site in spring, 1991.

A study involving Atlantic white cedar regeneration and deer browse control that had been scheduled for 1990 was postponed due to a lower yield of cedar seedlings from cones that had been collected from the refuge in 1989. This study was to involve clearing up to 15 acres of red maple dominated forest, planting white cedar seedlings, and controlling deer browse using debris fences. Completing the study is still possible as soon as sufficient cedar seedlings to plant a large enough area become available.

A tentative list of future experimental plots and additional replications of previous trials giving promising preliminary results on a larger scale was compiled by Biologist Keel and Forester Brownlie with advice from Regional Fire Management Coordinator Allen Carter. That list is summarized as follows:

<u>Area</u>	<u>Management Objective/Treatment</u>
East Ditch/Jericho Lane	Bald Cypress Natural Regeneration (East Ditch Replication)
Weyerhaeuser Ditch or Northeast Ditch	Kill overstory hardwoods in place and then under-plant bald cypress.
Jericho Ditch	Atlantic white-cedar regeneration: remove (cut) understory, mid- story and overstory but do not apply herbicide to cut stumps.
Corapeake	Atlantic white-cedar regeneration: replicate Camp and Lynn Ditch trials, but attempt to incorporate a commercial timber sale into the site preparation sequence.

On August 15, Forester Brownlie inspected Atlantic white-cedars along Corapeake and Forestline roads for cone production at the request of the NCFS Tree Improvement Specialist K.O. Sumerville.

Then, on November 15-16, Forester Brownlie and volunteer Mike Lane assisted Mr. Sumerville with actual cone collection from three trees selected along Corapeake Ditch. Two additional trees along Forestline remained to be selected and cones collected at year-end to fill out the Great Dismal Swamp contribution to Mr. Sumerville's provenance study. Since Mr. Sumerville found sufficient Atlantic white-cedar provenance sites on deep organic soils within the North Carolina coastal plain, a second five-tree provenance site in the Camp Ditch area in the Virginia portion of the refuge was dropped from the study. Seed from collected cones will be sown in nursery beds at a NCFS nursery, and any surplus seedlings will be made available for planting back on the refuge.

Monitoring vegetation within previously treated experimental plots also continued during 1990. Enough sites have been treated with mechanical or prescribed fire on the refuge that this post-treatment monitoring makes up a considerable workload. During August and September, Biologist Keel and Forester Brownlie collaborated on a scheduling and priority setting exercise for this aspect of monitoring.

Initially, highest priority was given to sites under consideration for follow-up prescribed burning during 1990 and 1991. The majority of those sites are currently managed for non-forested (marsh) habitat rather than forested habitat. However, during September, Biologist Keel, volunteer Sam Fishel, and Forester Brownlie conducted stocking surveys at the one-acre East Ditch bald cypress natural regeneration plot established in 1986. Total stocking with well established bald cypress seedlings was excellent (4,614 seedlings/acre averaging 1.5-2.5 feet tall), but seedlings were not uniformly distributed across the site (4 of 14 or 26 % of the 0.5 square meter quadrats had seedlings present). The seedlings were produced from the 20-25 residual mature cypress left during the original mechanical clearing during 1986, averaging just 18.6 square feet in basal area across the site. Monitoring of this site will continue and additional replications of this treatment on slightly larger areas are planned for future years.

6. Other Habitats

Refuge roads and road shoulders encompass approximately 1,500 acres in various successional stages. A variety of plants including blackberry, devil's walking stick, partridge pea, jewel weed, setaria, pokeberry, switchcane, various forbs and grasses, and various tree saplings provide shelter, food and travel corridors for black bear, bobcat, various small mammals, reptiles, amphibians, and numerous avian species.

Under the current mowing scheme, roads are marked in quarter mile increments. Mowing is on a three year rotation, so each year every third quarter mile is mowed. The rotation is short enough to prevent woody vegetation from overtaking the road shoulders and

maximizes the production of black berries, a preferred black bear food.

9. Fire

Wet spring weather precluded prescribed burning and any need for wildfire suppression early in the season. However, a hot summer followed by a warm dry fall increased wildfire dangers steadily through November. Water tables remained well below the 2 foot maximum depth to water table needed for safe prescribed burning on

Management Officer Brownlie to complete prescribed burning plans for the Remnant Marsh, Railroad & West Ditch, and the Fringe Marsh areas (all marsh restoration or maintenance burns). A test version of the computer program RxWINDOW aided burn plan preparation and showed promise despite some minor "bugs" which program developers in Missoula, Montana, have already begun correcting in an updated version. However, those same low water tables required repeated postponement of those burns despite many otherwise good "burning days" during October or November. Fire line construction conditions were ideal during this same time, and dozer lines were constructed around the Remnant Marsh and Railroad & West Ditch burn units by late November. Earlier completion of line construction was desired but was delayed by equipment and labor commitments required to finish the South Ditch water control structure project and the November Bass Tract Fire.

Although dry and warm, no wildfires were experienced on the refuge until November 20. On the 20th, Assistant Manager Kaehny, Biologist Keel, Maintenance Worker Winningham, Equipment Operator White, and Fire Management Officer Brownlie took initial attack action on a 4-5 acre grass fire on the refuge boundary between the headquarters and maintenance compounds. The fire burned 4-5 acres including both private and refuge lands in and adjacent to the refuge "boneyard" on the former Bass property. A local resident called the City of Suffolk Fire Department which responded with three engine units which, in turn, requested assistance from the Virginia Department of Forestry. The VDF immediately dispatched a tractor plow unit. The fire was quickly controlled with this sizeable and prompt inter-agency response.

The initial investigation on this fire suggested that the fire began in one or more piles of lumber on refuge property and then spread to the surrounding grasses after burning undetected for several hours. However, refuge personnel were not burning anything in that area, and subsequent wind direction reports from the National Weather Service did not support the path taken by the fire if it had started on the refuge. Thus, the fire could have started on private property, by arson or a nearby electric fence, and spread to the refuge.

Potential prescribed burn sites were the top priority for

vegetation monitoring efforts on the refuge during 1990. During initial monitoring visits to potential burn sites, fuel loading and water table observations were noted so burn planning could begin. One or more additional visits were made to each site through October and November to monitor curing of fine fuels, fuel moistures, and water table conditions. Woody fuel inventory procedures were incorporated into a standard vegetative sampling procedure to facilitate simultaneous data collection. Regular woody fuel inventory should help "customize" standard fuel models to local conditions over time. Initial monitoring-observation visits were made to prospective burn sites as follows:

9/18/90	North Ditch Bog
9/20/90	Railroad & West Ditch Marsh
9/24/90	Remnant Marsh
9/25/90	Fringe Marsh
11/90	Sycamore/Myrtle/Corapeake Pocosin block

Rainfall and consequently water tables increased throughout the refuge during late November and early December, effectively ending the threat of further wildfire and improving the prospects for completing one or more prescribed burns. On December 7, the morning weather forecast was within the approved prescription for the Remnant Marsh burn. However, the actual wind speeds were not high enough to offset the actual relative humidity measured at the site, so the burn was once again postponed.

Remnant Marsh-Prescribed Burn

Weather and Fire Behavior: Finally, at 11:30 am on a blustery December 18, the Remnant Marsh burn was ignited. On burn day, actual midflame wind speeds averaged 5-6 mph from the south-southwest, the relative humidity was steady at 60%, and ambient temperature was 75 degrees Fahrenheit. Fine fuel moistures averaged 11-14%, and 10-hour time lag fuels averaged 19%. The fire carried well through the tall dense grasses averaging 5-10 chains per hour with 4-8 foot flame lengths, reaching maximums of 30-40 chains per hour and 25 foot flame lengths in the fire interior for a brief period when two flame fronts converged.

Control, Smoke Management, and Mop-Up: The burn presented few immediate control problems, although some minor spotting occurred across the north line at three locations requiring use of the tractor plow. All spotting was less than 1/2 chain outside the line, and flame lengths at these spot fires were just 0.5-1.0 feet, spreading at approximately 5 chains per hour. Peat ignited at numerous locations within the burn, generally beneath root wads left during the original site preparation operation. This residual peat burning required overtime on burn day and two additional days of mop up with pumps and hoses by refuge staff to secure the fire perimeter. The interior of the unit was allowed to continue to burn with daily monitoring through year's end to increase the kill

of woody encroachment and reduce surface elevations in accordance with the original burn objectives. Because the burn site was located miles from any smoke sensitive areas, the residual peat burning did not cause any smoke management problems even during several damp, drizzly days when smoke dispersal conditions were poor.

Results and Recommendations: Peat burned to depths of 2-12 inches on less than 10% of the unit. Several patches within 1 1/2 chains of each flank did not burn (5-10% of the unit), while the majority of fine fuels were consumed throughout the interior of the burn unit. The fire may have moved too quickly across the unit or fine fuel moistures near the ground were too high to completely consume densely packed fine fuels within three inches of the ground surface. Also, this initial burn may have only killed 35-60% of the woody saplings instead of the desired 75% or more. Overall, this burn was deemed a success. Recommendations for future burns at the site are to delay burning until water tables are within 0.5 feet of the ground surface and to wait until sap flow has begun in deciduous trees in the spring.



On "B-Day for Remnant Marsh", Assistant Manager Kaehny prepared for the test burn late in the morning. (DIS-90-9,RMK,12/90)



Messrs. Kaehny and Keel anchored the initial back fire at 11:35am.
(DIS-90-10,DB,12/90)



The back fire produced 3-6 foot flame lengths by the time Biologist Keel completed the ignition. (DIS-90-11,DJB,12/90)



With the ignition of the backfire complete and the northwest corner of the site burning, Biologist Keel began stringing fire along the west flank. (DIS-90-12,DJB,12/90)



The head fire was finally ignited along the southern edge of the site, producing 10-15 foot flame lengths. (DIS-90-13,RMK,12/90)



The excitement was over less than two hours later, with only the "glamorous" duties of monitoring and mop-up remaining. (DIS-90-14,DJB,12/90)

Regional Fire Management Coordinator Allen Carter and refuge Fire Management Officer Brownlie traveled to Portsmouth, Virginia, on August 2 to meet with Virginia Division of Forestry fire staff and representatives from several eastern Virginia national wildlife refuges. The need for and wording of a standardized cooperative fire agreement, based on a "model" agreement with the U.S. Forest Service, between the Virginia refuges and Virginia Division of Forestry was discussed. This station has been working with the state forestry division under the terms of a cooperative fire suppression agreement that was developed several years ago and based on a model provided by the Regional Office.

Regional Fire Management Coordinator Allen Carter conducted S-130 Firefighter and S-190 Introduction to Fire Behavior courses for the refuge's seasonal fire crew from May 1-4.

On August 11, Biologist Keel and Tractor Operators Bryan Poovey and Rick Pearce joined Paul Taylor (Back Bay NWR) and Bob Carpenter (Eastern Shore NWR) and Blue Ridge Parkway employees (National Park Service) to form an interagency fire crew. This crew was sent first to fire line assignments in Utah, then on to the 13,393 acre A-Rock complex in Yosemite National Park, California, before returning home on August 24. On October 6, Fire Management Officer Brownlie and Tractor Operators Mark Douglas and Ken Powell were dispatched to the Shorts Fire on the Okefenokee NWR in Georgia to join Service employees from three different regions and eleven different refuges in forming the Florida Interagency Crew #20. The

crew saw night duty including line holding and patrol and burning-out before badly needed heavy rainfall set in, allowing the entire crew to be released early. All personnel returned from this second off-refuge mobilization on October 11.

On the refuge, the fire crew's highest priority was to maintain constant readiness for wildfire suppression. However, they also assisted in a variety of projects including mowing refuge roads, building and grounds maintenance, boardwalk trail construction, and vehicle maintenance. They made major contributions to the South Ditch water control structure project and installation of the Jericho Ditch Atlantic white-cedar experimental plots.

Manager Culp participated in a new course on Fire Management for Line Officers in Boise, Idaho, during November 26-30 at Walt Okamoto's (Boise Interagency Fire Center) request. Manager Culp was one of several refuge and regional staff asked to help critique this first presentation of the course.

Fire Management Officer Brownlie completed the FY 90-93 fire budget exercise during late August. This exercise provided a timely opportunity for the primary refuge staff to establish schedules and priorities for refuge fire suppression equipment and staffing needs which were then translated into an amendment to the Refuge Fire Management Plan.

Regional Fire Management Coordinator Allen Carter and Biologist Keel attended a terra-torch demonstration at Mackay Island NWR on June 27. They were instructed in fuel mixing, operating, and overall safety procedures. The terra torch showed real promise for prescribed fire and back-firing operations in the Great Dismal Swamp.

In December, Forester Brownlie and Regional Fire Management Coordinator Carter participated in aerial ignition training at Blackwater NWR. Trainees gained actual experience with the use of the Premo Mark III ("ping pong ball) ignition unit. This type of ignition was used successfully at this station in 1988 during the suppression of an early spring wild fire.



The Premo Mark III was mounted on a Bell 206 helicopter. (DIS-90-15,DJB,12/90)



FMO Brownlie lifted off to "drop fire" for his final exam. (DIS-90-16,RMK,12/90)

11. Water Rights

As in past years, water management in the Dismal Swamp Canal was a source of considerable debate in the local area. The refuge's establishing legislation directed that the canal's water management could not adversely affect the refuge. This mandate has meant that the refuge management has closely monitored canal operations and maintained a conservative philosophy towards canal water management strategies since the mid-1970's, often to the chagrin of local interests, for the canal is the primary source of drainage for the swamp. A number of business interests in Elizabeth City, North Carolina, have developed a reliance on recreational boat traffic (ie. yachts travelling along the Atlantic Intracoastal Waterway) for a significant part of their income, so these interests have obviously desired to maintain a canal full of water. The City of Chesapeake, Virginia, has looked at the canal as a potential source of water to support a population of 150,000+ (and growing), so they have actually considered withdrawing water from the canal. Thus, the Corps of Engineers, which is the agency that actually operates the canal, and the refuge have been caught in the middle of these competing interests since the refuge's establishment.

In 1988, a cooperative agreement was developed among the Corps, City of Chesapeake, and the Service to permit the city to withdraw water from the downstream side of the Deep Creek spillways, which are located on the northern terminus of the canal. The city wanted canal water for storage utilizing a relatively new technique, a process which involves pumping and storing the water into an

underground aquifer. This water would then be retrieved during drought. This agreement, for the moment, postponed the city's desire to withdraw water directly from the canal. The available water would be sufficient to test their aquifer storage system (located near the refuge's northern boundary), and the water that would be withdrawn from the downstream side of the spillways should truly be excess water as long as the Corps did not alter their spillway management.

In 1990, the city tested their storage area using water from existing sources (Northwest River). Water was pumped into the aquifer, retrieved, and tested for contamination. The trial pumping was a resounding success, and the city appropriated money to design the facilities that would be needed to pump water from the Deep Creek spillways.

The Elizabeth City interests were relatively quiet much of the year, as the canal retained sufficient water throughout the peak yacht "migrations" that occur during the spring and fall. However, the canal closed in November due to low water levels, and interest in searching for a way to avoid these closures suddenly renewed.

The refuge's direct influence on the canal operations issue is derived from an informal agreement with the Corps to cease releasing water from Lake Drummond, which is located within the center of the refuge, into the canal when lake levels fall to a specific level. The lake collects much of the water from the Great Dismal Swamp, and the lake serves as the canal's primary source of water. When the Corps eliminates the release of water from the lake, the canal must be closed, since sufficient water levels cannot be maintained in the canal without Lake Drummond water.

For years, a number of Elizabeth City constituents have called for a comprehensive hydrology study, to be coordinated by the U.S. Geological Survey, of the Great Dismal Swamp area in order to establish a water budget for the swamp and the canal. Obviously, they hope that a more liberal water management strategy could be derived from the study. Refuge management has supported this idea, for basic hydrology information is needed for sound resource management planning on and off the refuge. However, interest and support for this idea has tended to die quickly whenever the canal re-opens after a drought. Therefore, refuge management will be forced to take a more active role in maintaining consistent support by the North Carolina and Virginia interests if this study is to ever become a reality.

In other developments related to canal operations, the Corps of Engineers continued to press the States of Virginia and North Carolina to share in the \$1,000,000 annual operating costs of the Dismal Swamp Canal. A convoluted accounting process resulted in the Corps requesting that each state provide \$100,000 annually for canal operations reasoning that the states receive 20% of the

benefits generated by the canal while the federal government (ie. the refuge) receives 80%. Nevertheless, no matter how it was figured, both states declined to participate due to recent budget woes. The State of Virginia even asked the City of Chesapeake to donate \$50,000 to this effort, but ten seconds of debate by the city council resulted in a unanimous vote to decline the offer.

12. Wilderness and Special Areas

The refuge has been recognized as a prominent state and national resource. As a National Natural Landmark, periodic status reports on the condition of the area are submitted to the National Park Service. The North Carolina portion of the refuge has been designated as a Natural Heritage Area by the state's Natural Heritage Program. This voluntary program does not prohibit active habitat management or future development of educational and interpretive facilities. The specific features which drew this state designation include:

- One of the largest remaining stands of Atlantic white-cedar (7,000 acres) in public ownership.
- The northern-most pocosin community type under public protection.
- A 60 acre remnant marsh that is apparently the only open marsh in the swamp.
- Several rare plant species including the log fern (Dryopteris celsa), the silky camellia (Stewartia malacodendron), and the dwarf trillium (Trillium pusillum virginianum).

G. WILDLIFE

1. Wildlife Diversity

To the casual visitor, the refuge may be just a hot, humid, monotonous tangle of trees, dense underbrush and vines that is infested with snakes and biting insects. However, the presence of five forest cover types as well as marsh, bog, pocosin, and a 3100 acre shallow blackwater lake provides a variety of habitats. Unfortunately, some types occupy a disproportionate share of swamp. For example, the maple-gum type covers approximately 60% of the refuge, while mesic hardwoods and some other community types each comprise less than 1% of the cover. The interspersing of types is less than ideal for wildlife diversity. Maple-gum and Atlantic white cedar are dispersed throughout the refuge, but mesic hardwoods and loblolly pine are limited mainly to the elevated mineral soils along the western and northern perimeters. Nevertheless, found collectively within this swamp ecosystem are at least 43 tree species, 26 shrubs, 21 vines, 17 ferns, 60 herbaceous plants, and over nine species of grasses, sedges and rushes which support the wildlife diversity that is listed as follows:

Mammals	- 42 species
Birds	- 209 species (92 nesting species)
Reptiles and amphibians	- 62 species
Fish	- 27 species
Invertebrates	- unknown

2. Endangered and Threatened Species

The first sighting of bald eagles occurred on January 5 when two adult eagles were perched along the northwestern section of Lake Drummond. The pair was again observed on January 24. No nesting activity was noted. Although individuals have been observed intermittently for years, this pair of adult eagles was the first to be seen since the refuge's establishment in 1974.

Two juvenile bald eagles were observed at Lake Drummond on January 14 by Volunteer Sam Fishel. Eagle sightings ceased until October 24 when Biologist Keel reported an adult bald eagle near the junction of the Elizabeth River and Deep Creek, northeast of the refuge. On November 26 and 27 respectively, an adult and an immature bald eagle were observed perched along the western shoreline of Lake Drummond.

The Dismal Swamp southeastern shrew (Sorex longirostris fisheri)

was designated as "threatened" in 1986. Completion of the recovery plan for this species was postponed pending the results from additional range surveys that are to be conducted by the Virginia Natural Heritage Program. The surveys were initiated during the fall of 1990 and will continue through spring, 1991.

A recovery plan for Eastern big-eared bat (Plecotus rafinesquii macrotis), prepared by the Virginia Department of Game and Inland Fisheries (VDGIF) was received and reviewed in October. Two of Virginia's four confirmed observations of this species were recorded in the refuge vicinity. The Commonwealth of Virginia designated the bat as "endangered" effective on July 1, 1987. Two sub-species of the bat have been recognized, P. r. macrotis and P. r. rafinesquii (Handley, 1959). According to the state's recovery plan, the Fish and Wildlife Service listed Rafinesque's big-eared bat, Plecotus rafinesquii, as a Category 2 species on January 6, 1989 (Federal Register Notice of Review, Vol. 54, No. 4). This designation meant that the Service has information indicating a proposal to list as endangered or threatened is possibly appropriate, but conclusive data to support listing are not currently available.

3. Waterfowl

Although 22 species of waterfowl have been recorded for the refuge, only nine species were observed in 1990. The wood duck, as usual, was by far the most common, being found year-round in the swamp. No Canada geese were observed for the second consecutive year. Canada geese have used Lake Drummond primarily for roosting and sanctuary, and their sporadic visits could be easily overlooked on the 3,100 acre lake.

January was the peak use month for the lake with tundra swans (662), mallards (150), ring-necked ducks (62), and hooded mergansers (50) being observed. By February, wood ducks accounted for over 90% of waterfowl observations. Most of the use was in the fringe marsh (WMU 4A) along Highway 158, the Railroad/West Ditch management plot, and the flooded woodlands along the ditches.

On February 20, a lone muscovy duck, observed in East Ditch north of the railroad tracks, was removed to eliminate a potential disease source. This observation was the first reported sighting of a muscovy in the refuge.

The first waterfowl brood (wood duck) was observed on April 4, the earliest recorded to date. Brood observations peaked in May, and no new Class I brood observations were recorded after May 31. Total waterfowl production was estimated at 518 birds based on incidental brood sightings, number of ducklings in Class II or III broods, and nest box checks. Wood ducks accounted for slightly over 90% (468) of the production with mallards (38) and black ducks (12) comprising the remainder.

The wood duck nest boxes produced an estimated 92 birds to flight stage. Box utilization by wood ducks was 46%, an increase of about 10% over last year. Elevating 25 boxes by at least 1.5 feet to inhibit flooding and relocating another 25 boxes to better habitat were the major factors in increased production.

By September, the "bog burn" site within WMU 6 (northern refuge) was the only flooded area within the refuge. This area is a shrub swamp with several beaver dams scattered throughout. A total of 202 wood ducks were counted during a roost survey at the site on September 25.

In November, wood duck numbers increased noticeably, and the arrival of ring-necked ducks, pintails, mallards, and hooded mergansers was noted. However, waterfowl use was relatively low through December.

4. Marsh and Water Birds

Only ten species of birds in this category have been recorded on the refuge, and only two, the great blue heron and green-backed heron, were seen regularly. The great blue heron was by far the most commonly observed of the group and was seen throughout the year. Dropping water levels during the summer months created attractive feeding conditions in the ditches for these long-legged waders. As many as 27 great blue herons were observed along a four mile segment of Lynn Ditch on more than one occasion during the late summer and early fall when water levels were at their lowest point. The great blue heron rookery in WMU 6 was active with about 20 nests counted during a March aerial survey. Most nests were located in pine trees.

Green-backed herons were frequently seen in the spring and summer, as they commonly nested in the over-hanging vegetation along the ditches. The American bittern was noted on only two occasions.

5. Shorebirds, Gulls, Terns and Allied Species

Although four gull and two tern species have been known to periodically inhabit the refuge (Lake Drummond), only two gull species were observed on the lake in 1990. These species, the ring-billed and the laughing gull, used the lake primarily as a roosting site and were more frequently seen feeding in the adjacent agricultural fields during the spring and fall.

The refuge has not been known for its woodcock habitat, but they have nested on the refuge. On January 30, woodcock were "peenting" in the Five-points area within the northwestern portion of the refuge. Woodcock were also occasionally flushed from the edges of the refuge roads that had been mown.

6. Raptors

The red-shouldered hawk was the most frequently observed of the eight hawk species that are listed for the refuge. During the spring bird count on May 6, local Audubon members counted 9 red-shouldered, 2 red-tailed, and one broad-winged hawk along the 27 mile route.

Two osprey were also reported during the May 6 count. A lone osprey was observed on September 13 by Biologist Keel, the first reported sighting for this time of the year.

Either a sharp-shinned or Cooper's hawk was observed on November 19 and 20. Confirmation as to the exact species could not be made, as only a fleeting glimpse was made. However, both species have been reported for the refuge area.

The barred, great horned, and screech owls have been known to nest in the swamp. The barred owl has been the species most commonly heard though less frequently seen. The barred owl was the only species recorded on the spring bird count.

7. Other Migratory Birds

On May 6, the fourteenth annual Dismal Swamp Spring Bird Count was conducted by Audubon volunteers. The 18 observers counted 105 species, 25 more than 1989, over the 27 mile route. The common grackle was again the most frequently recorded bird followed, in order, by the prothonotary warbler, red-eyed vireo, common yellow throat, ovenbird, great crested flycatcher, northern parula, white-eyed vireo, tufted titmouse, and Arcadian flycatcher. Species of interest included the least flycatcher, Connecticut warbler, and Lincoln sparrow.

Dove call-count surveys were conducted along twenty mile routes in North Carolina on May 31 and Virginia on June 8. An average of 1.52 doves/stop was recorded for both combined routes, a 49% increase over 1989 and the highest average for 1978-1990. The number of pileated woodpeckers (33) sighted or heard during the dove survey was also considerably higher than for any year.

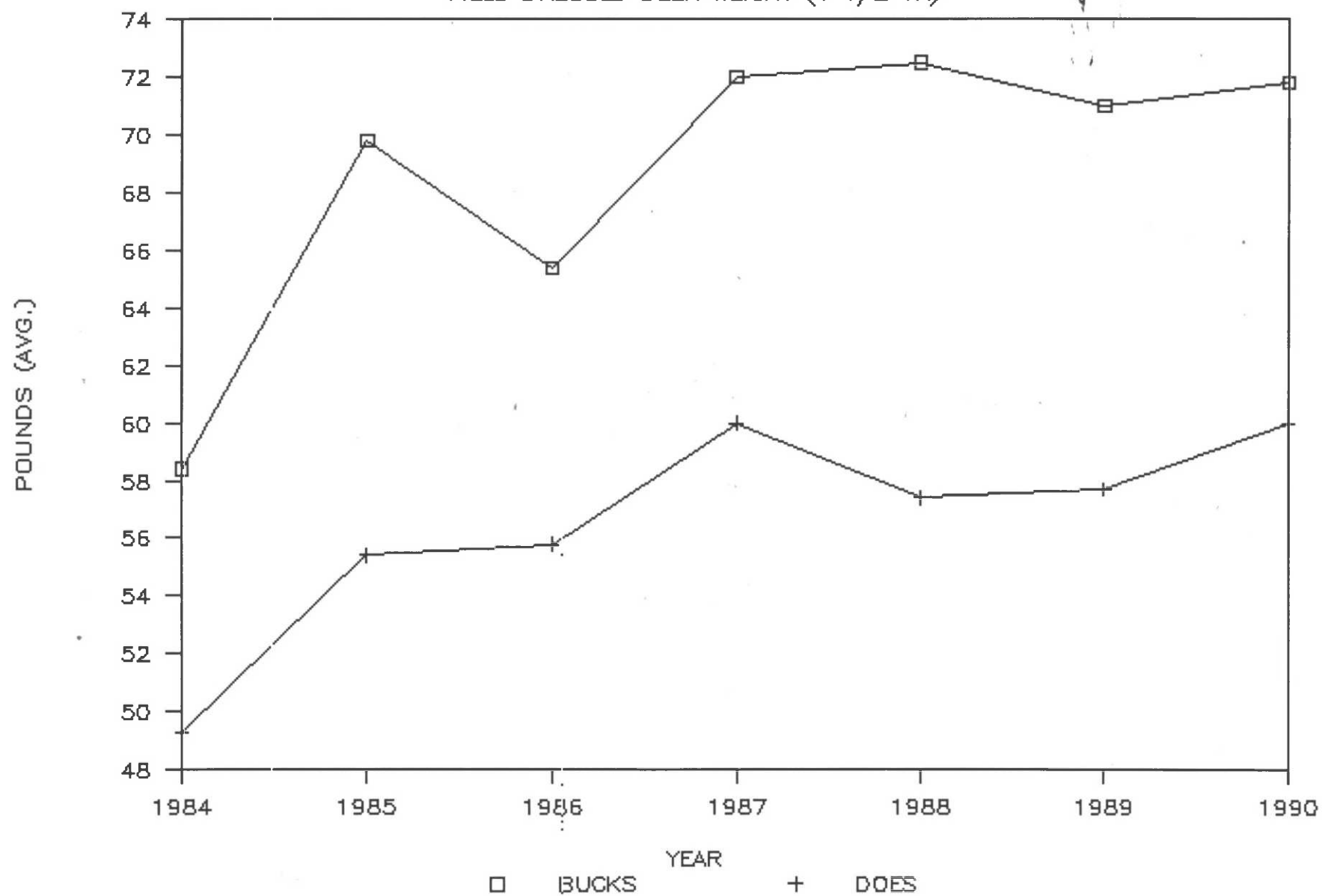
A 25-mile North American Breeding Bird survey route, initiated by Brooke Meanley in the swamp over ten years ago, was conducted on June 4. The most frequently recorded species, as usual, was the prothonotary warbler. Other common species included the common grackle, common yellowthroat, and eastern wood peewee.

8. Game Mammals

Bear sightings were reported every month of the year except February, November and December. Sightings picked up in May (6) and peaked in June (10) when signs of their activity (tracks, scats,

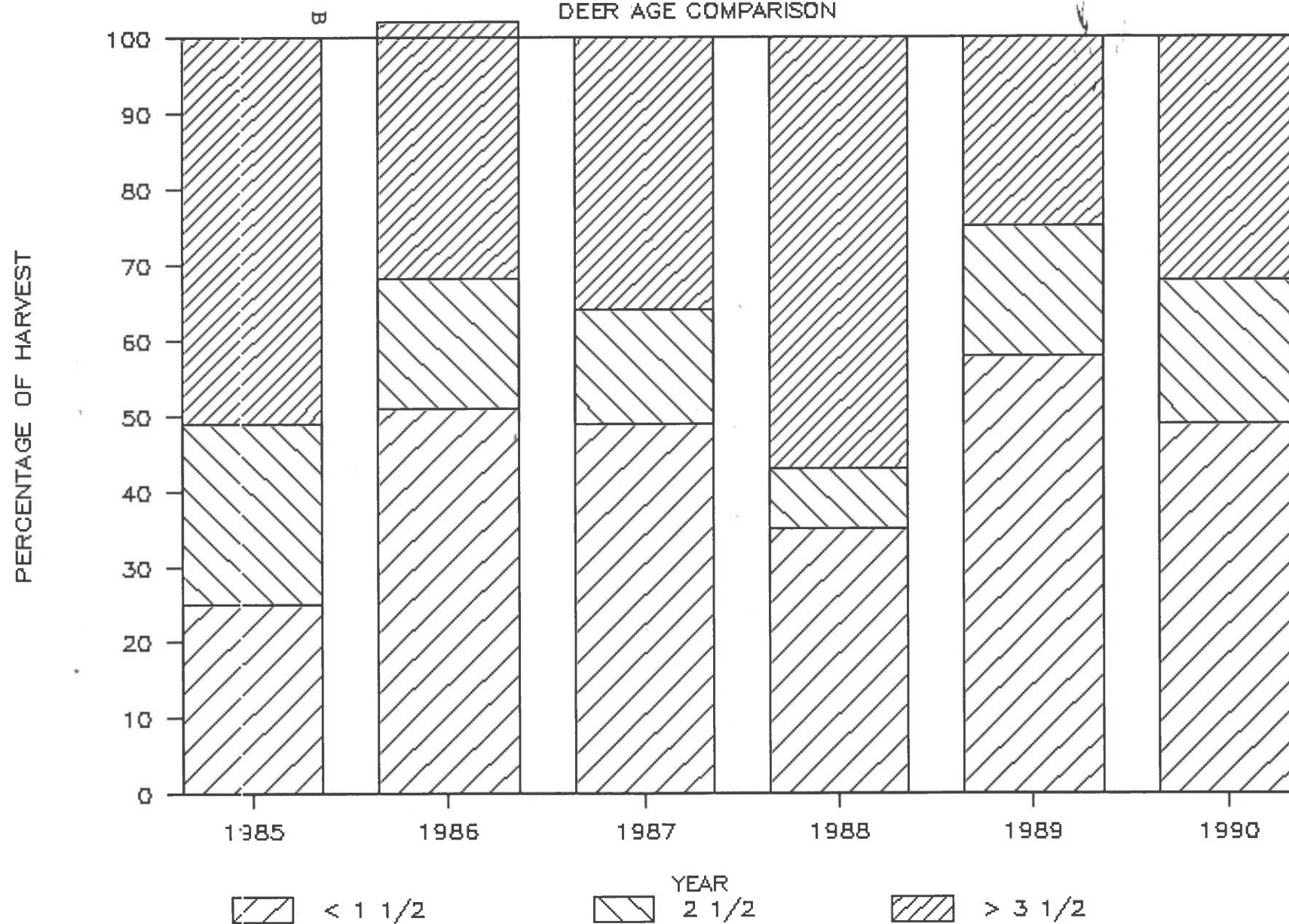
GREAT DISMAL SWAMP NWR

FIELD DRESSED DEER WEIGHT (1 1/2 YR)



GREAT DISMAL SWAMP NWR

DEER AGE COMPARISON



marked trees, compressed blackberry brambles) were noticeably more abundant. A bumper crop of blackberries attracted bears to the refuge road sides during late June. The first and only sightings of bear cubs (2) for the year occurred in July. Bear sign remained abundant through September with observations that included chewed up wood duck nest boxes/poles and bent rebar vegetation plot markers. In October, several deer hunters reported seeing bears. No sightings were reported the last two months of this year.

The results of off-refuge bear hunting in Suffolk and Chesapeake (November 26-January 5) had not been received by year's end, but state biologist Don Schwab reported he knew of two legal kills and four illegal bear kills in the Suffolk-Chesapeake area.

White-tailed deer continued to be the most abundant big game animal and the only species hunted on the refuge. Hunters harvested 233 deer (48% does) during eleven hunt days and 2,299 hunter visits from October 12 through November 9. The 1990 deer harvest was the third largest in the history of the refuge deer hunting program. The increased harvest and higher percentage of does killed can be attributed to more favorable weather and the availability of DMAP (Deer Management Assistance Program) tags provided by the state. A total of 157 tags were issued, and 46 (29%) were used to tag deer by the last hunt day. Sixty-five per cent of the DMAP kill were does (30) with the remainder consisting of button bucks (16). Deer taken under DMAP tags accounted for approximately 20% of the total kill. Six hunters took more than one deer on DMAP tags, with one hunter (Ken Runyon) killing four antlerless deer on DMAP tags. These six hunters accounted for about 35% of the DMAP kill.

Complete age, sex, and weight data were obtained on 88% of the reported kill. The biggest deer was a 150-pound, field dressed, 8-point buck taken by Ronnie Sheets from Wilkesboro, North Carolina. No sign of hemorrhagic disease such as sloughing hoofs and abrasions on carpal (knee) joints or sternum were noticed on deer brought through the refuge check station.

10. Other Resident Wildlife

Six new beaver dams were discovered during the year, bringing the beaver dam network to a total of 17 dams and 3 culvert plugs. None of the dams were removed, but their habit of burrowing and digging out dens under refuge roads created some problems when the rear tire of a refuge farm tractor fell through the roof of a beaver den under Short Ditch Road this year. These aggravations were offset somewhat by the potential benefits that are provided by beavers. In some areas, such as WMU 6, beaver dams have provided the only water retention capabilities, enhancing waterfowl habitat and restoring more natural hydrologic conditions to these areas.

No formal otter surveys were conducted, but notes of otter observations and signs were recorded. Otter signs were commonly

seen along the ditch banks, but reported sightings were down from last year. The first sighting was reported on January 14 by volunteer Sam Fishel when he saw two otters along the north shore of Lake Drummond. No further observations were reported until July when Tractor Operator Brian Poovey observed a family group of four otters in Williamson Ditch.

Refuge personnel and researchers observed eight bobcats during the year, compared to none in 1989. The first sightings (2) were made by Dr. Gary Graves in May, followed by another sighting in June on Lynn Ditch. In September, five sightings on Railroad and West Ditch Roads were reported. One of these sightings was of an adult and two kittens.

No roadside counts for rabbits were conducted, but rabbits that were observed during the two mourning dove call-count surveys were recorded. This survey, which is conducted in late May - early June, resulted in only three rabbits observed along the forty miles of road, while no rabbits were observed in 1989. No attempt was made to distinguish between the eastern cottontail and marsh rabbit.

The eastern wild turkey, a native resident of the swamp, was observed by several hunters during the October deer season. The first and only observation of a wild turkey by a refuge employee occurred on May 9.

Other observations that were recorded during the year included two road-kill grey foxes that were found west of the refuge. These foxes were the first road-kills to be observed in several years. Canine distemper may have taken its toll on raccoons as evidenced by one sick raccoon that was observed on Washington Ditch Road. A couple of other raccoon carcasses that were found on refuge roads were too decomposed for laboratory analysis.

H. PUBLIC USE

1. General

Most refuge public use activities recorded increases in 1990. Approximately 23,100 individuals visited the refuge as compared to 19,100 visitors in 1989. The growth in visitation occurred in spite of limited access and public use facilities and was spurred by the refuge's location within the fastest growing area, in terms of population, in Virginia.

Manager Culp met with Laura Walters, legislative liaison with the City of Suffolk, on August 2 to discuss short and long range plans for public use programs on the refuge. The City launched an initiative in 1990 to advertise Suffolk as one of more desirable places to live in the Hampton Roads area, and they considered the refuge to be an important asset to that effort. Their desire for improvements in refuge public use facilities was evident.

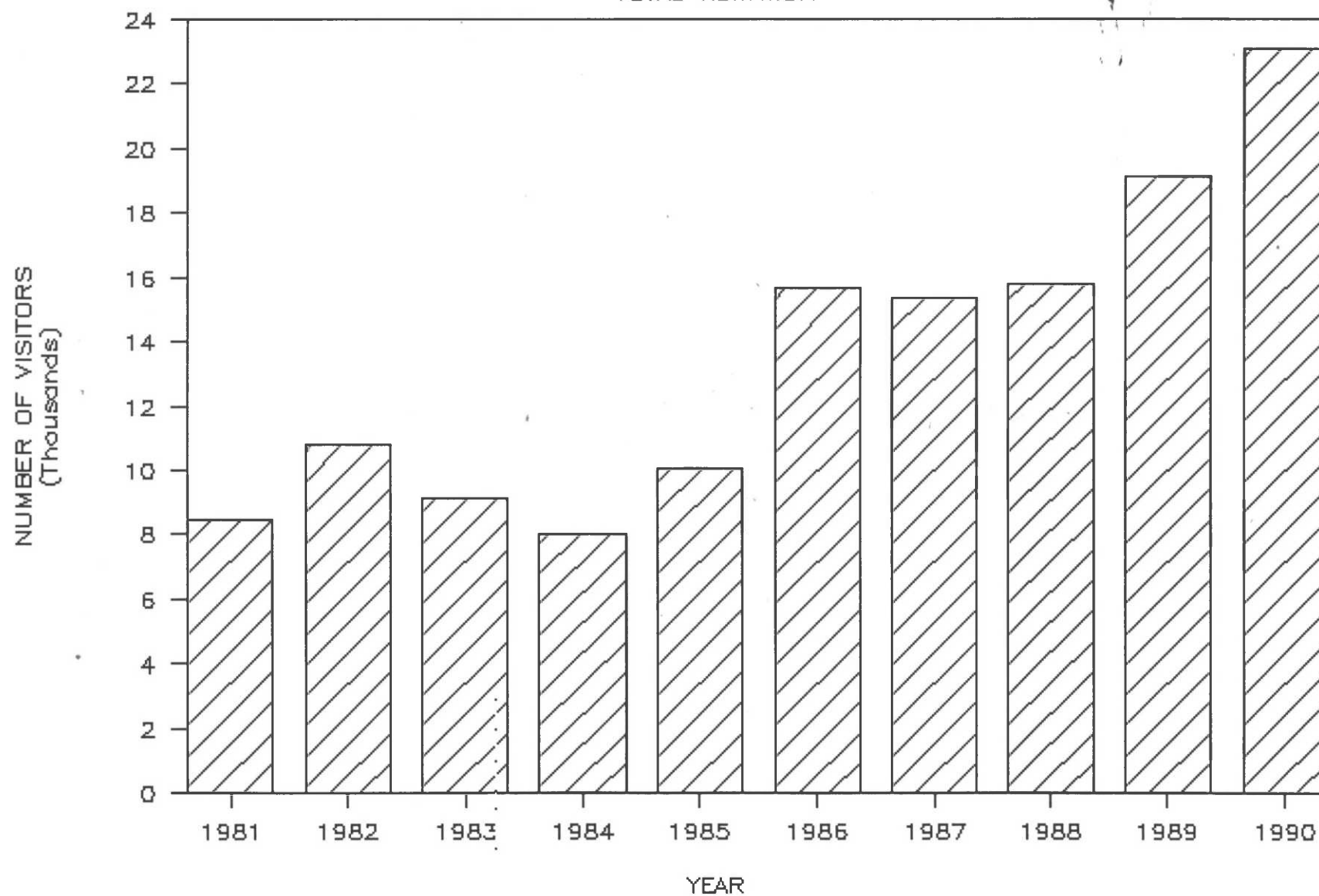
The refuge was the topic of several magazine articles and books throughout the year. Writers contacted the refuge to request slides and information on the area to include in their articles. The refuge was also highlighted on a program entitled "Virginia Outdoors". Mr. John Hodges and his filming crew with public television channel WVPT from Harrisonburg, Virginia visited the refuge on June 20 to film portions of the refuge for this program. The series of half hour programs highlighted areas in Virginia which are available for a variety of public use activities. This particular segment focused on the refuge's handicap accessible boardwalk trail and discussed the history and purpose of the refuge.

Refuge staff and volunteers were interviewed several times throughout the year by reporters from the Suffolk News Herald. These articles featured a variety of subjects which included: refuge clean-up efforts, the volunteer program, Earth Day, the delivery of refuge revenue sharing checks, outdoor classroom activities, refuge deer hunt activities, the destruction of the Washington Ditch Kiosk, and several other special interest articles. A total of eighteen articles on refuge activities appeared in local newspapers.

The refuge issued three news releases covering the results of the 1989 hunts, changes in hunt administrative procedures, and notifying the public that portions of the refuge would be closed during the hunting season.

GREAT DISMAL SWAMP NWR

TOTAL VISITATION



NUMBER OF PUBLIC USE VISITS BY YEAR
1986 - 1990

TABLE 2

<u>Activity</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>
Conducted Tours	2,000	500	400	0	40
Environmental Education (Students)	1,000	40	100	396	525
Environmental Education (Teachers)	140	60	0	70	45
Other Refuge Programs	120	70	200	118	811
Hunting (Deer)	3,800	4,100	1,800	1,651	2,642
Fishing	600	900	900	895	1,020
Foot Access	3,900	4,400	6,000	9,700	9,518
**Vehicle Access	2,300	1,700	1,300	2,170	2,827
Photography	1,500	1,600	2,500	2,400	2,383
Boating	<u>300</u>	<u>2,000</u>	<u>2,600</u>	<u>1,700</u>	<u>3,289</u>
Total Visits	15,660	15,370	15,800	19,100	23,100

**Includes access for hunting, as well as access for all other special use permits.

2. Outdoor Classrooms - Students

A variety of educational groups ranging from elementary grades to college visited the refuge during 1990. A total of 18 groups comprised of 570 students, teachers, and parents visited the refuge to participate in environmental education activities. All of these groups received an orientation to the refuge before venturing out on the trails. Several groups also took the opportunity to view wildlife films in the office's conference room. However, only small groups of thirty individuals or less could be accommodated in the conference room. The larger groups were provided orientations at the Washington Ditch parking lot. Most groups were

interested in hiking the 3/4 mile long boardwalk located at Washington Ditch and seeing Lake Drummond. Twelve special use permits were issued to educational groups to allow vehicle access to Lake Drummond.

3. Outdoor Classrooms - Teachers

No formal teacher workshops or training sessions were offered by the refuge in 1990. However, a meeting was held with 20 instructors enrolled in a summer college course on environmental education offered by Paul D. Camp Community College. The course, led by Dr. Gerald Levy (Old Dominion University, Norfolk, Virginia) encouraged the instructors to explore local areas that are available for environmental education field trips. The group was given an orientation to the refuge, and opportunities for outdoor classroom activities were also discussed.

Longer-term environmental education contacts were established with the Colonial Coast Girl Scout Council in order to plan for educational workshops in future years. Efforts were initiated in 1990 to conduct workshops which focus on the earth, to instill an appreciation for nature in the scouts, and encourage them to do their part to protect the environment.

4. Interpretive Foot Trails

Efforts to enhance the Washington Ditch entrance as the refuge's primary public access point continued in 1990. The installation of railing and handicapped access ramps/pull-offs was completed on the 3/4 mile boardwalk trail. Vehicle access was deferred to Railroad Ditch whenever possible in order to maintain the four mile Washington Ditch Road to Lake Drummond as a safe route for hikers and bikers.

In 1989, Mr. Bill Ashley, a member of the Nansemond Suffolk Izaak Walton League, met with Manager Culp to discuss the possibility of the League financially assisting the refuge in developing the boardwalk trail into a self-guided interpretive trail. Mr. Ashley's inspiration for this project developed upon his visiting the boardwalk trail during the installation of the wheel-chair platforms, as he felt that the platforms would be ideal locations for interpretive signs. By the year's end, the League had developed a fund of \$2,500 from local and state-wide donations for the purpose of installing the new signs, and contacts had been established with Wilderness Graphics of Tallahassee, Florida, to begin design of the interpretive signs.

This project was dealt a depressing blow on December 22 when an arsonist burned down the Washington Ditch kiosk. Work on sign designing was deferred for a couple of weeks to allow time for the investigation of the incident and an assessment of the corrective measures needed to help prevent future incidents of this type. As

the year ended, the arsonist had not been apprehended, but preliminary plans had been developed to re-design the Washington Ditch trail access and security to make the area less appealing to the weekend beer parties and other unauthorized activities. Fortunately, the Izaak Walton League's interest in supporting refuge efforts to improve the Washington Ditch access were not deterred. In fact, their donation to the project doubled within a few weeks after the arson incident. More details on the Washington Ditch arson are provided in the Law Enforcement section of this report.



The installation of the hand rails on the Washington Ditch boardwalk was completed to improve handicapped accessibility. (DIS-90-17, MK, 6/90)

6. Interpretive Exhibits/Demonstrations

All efforts on interpretive exhibits were focused on the development of interpretive signs for Washington Ditch (see Section H.4). Wilderness Graphics was contacted in order to develop preliminary plans for the signs which will be procured and installed in 1991.

7. Other Interpretive Programs

Refuge staff presented a variety of on-site and off-site programs throughout the year to 811 individuals who were members of Girl/Boy Scout troops, local YMCA's, Ruritan clubs, Sierra club, and garden clubs.

Biologist Keel attended the meeting of the Virginia Chapter of the Wildlife Society on February 16 and provided a short program on the

activities occurring on Virginia refuges.

Assistant Refuge Manager Kaehny presented three one-half hour programs to 90 students at Carver Intermediate School, Chesapeake, Virginia, during their career day festivities on April 26. A slide program about career opportunities and duties of a refuge manager was presented.

A group of 20 individuals participating in a program offered by the Virginia Marine Science Museum received a refuge orientation and viewed a film on wetlands before continuing their tour of the refuge. The group was issued a special use permit which authorized vehicle access to Lake Drummond. The group's visit concentrated on wetlands and the need to protect these areas.

On August 5, a tour was provided to 40 individuals attending the 41st American Institute of Biological Sciences meetings in Richmond, Virginia. These visitors were primarily professors and college students from various colleges and universities around the country. Outdoor Recreation Planner Cherry provided an orientation and accompanied Dr. Levy, Old Dominion University, on the remainder of the tour. Dr. Levy had been originally contacted about the tour, and he coordinated the arrangements with the refuge staff.

Refuge Manager Culp provided an interpretive program to approximately 70 delegates at the state convention of the Izaak Walton League in Natural Bridge, Virginia, on October 20. The League had approved donating money to assist with the development and installation of interpretive signs at Washington Ditch.

Outdoor Recreation Planner Cherry attended a dinner on August 9 that was sponsored by the Norfolk Convention and Visitors Bureau. The dinner and meeting attracted a number of different agencies that provide tours for large organized groups, primarily high school and college groups, and provided an excellent opportunity to discuss environmental education opportunities available at the refuge.

8. Hunting

The annual 13-day deer hunt, the only hunting allowed on the refuge, was scheduled for Thursdays, Fridays and Saturdays during October 11 - November 10. In 1990, the 2,299 hunter visits generated 18,587 activity hours, as the hunters bagged 233 deer, the third largest harvest since hunting was established on the refuge in 1979.

DEER HUNT DATA 1982-1990

Year	Hunt Days	Permits Issued	Hunter Visits	Activity Hours	Reported Deer Kill	Hunter Success
1982	6	605	659	6,479	114	17
1983	6	375	743	6,981	105	14
1984	7	593	1,247	10,738	188	15
1985	9	2,284	2,216	21,052	211	9.5*
1986	11	2,659	3,825	28,285	281	7.3
1987(1)	12	2,750	4,124	37,215	324	7.9
1988(2)	7	3,212	1,807	16,222	123	6.8
1989	7	2,153	2,084	14,483	115	5.5
1990	11	1,205	2,642	19,674	233	8.8

(1) Includes 2 days, archery only

(2) Includes 3 days, archery only

*Beginning in 1985, hunters were not required to check deer at the refuge check station, so all deer were not check by refuge personnel.

The increased deer harvest was a direct result of the relatively dry weather that was experienced during the 1990 hunts. Pervasive wet weather during the 1988 and 1989 hunts forced the cancellation of several hunt dates during those years, as heavy rainfall turned the old timber access roads throughout the refuge into slippery quagmires. In 1990, four hunt dates were "rained out" and two hunt dates were opened late after light rains created the necessity to check refuge roads before permitting hunter access. However, the remainder of the scheduled dates plus two planned "make up" dates resulted in 11 out of 13 planned hunt dates to be conducted.

The Region directed that a \$10 non-refundable permit fee be charged for the 1990 hunts in order to defray some of the hunt expenses. This fee was probably the primary reason that 1,205 permits were issued for the 1990 hunts as compared to 2,176 permits for the 1989 hunts. This result was not necessarily bad, as the number of "no show" permittees probably decreased substantially. Also, the staff time involved in permit issuance was reduced.

Several news releases were issued beginning in June to announce the refuge's 1990 deer hunt dates, the requirement of the \$10 non-refundable permit fee, and the October 1 deadline for permit applications. The headquarters telephone answering machine provided permit application information at night and on weekends. These announcements resulted in a steady but manageable flow of permit applications that were processed during July-September. A hunter roster was maintained on a DBASE computer file, and the computer provided updated alphabetized hunter lists and printed labels for all hunt permits.

Four separate entrances were provided for hunters to gain access onto the refuge. Each entrance was assigned a specific hunter capacity in an effort to maintain safe hunter densities within each refuge area. The four access entrances were Portsmouth Ditch Road (125 hunters), Jericho Lane (250 hunters), Corapeake Ditch Road (Virginia - 125 hunters and North Carolina - 150 hunters) and Railroad Ditch Road (100 hunters) for a maximum of 750 hunters permitted on the refuge each day.

Hunter check in/check out stations were located at all hunter entrances, and pertinent hunter information was displayed at each station. The hunters also had to sign in/out on the registers at these stations in order that the refuge staff could assure that all had safely returned from the swamp. Hunters also recorded some basic deer harvest data on the register, a critical feature since they are not required to check their deer through the refuge's check station.

The hunt entrances were effectively "self service" except in the early mornings and late afternoon. Refuge personnel opened each entrance about one hour before sunrise and checked registers in the late afternoon to assure all hunters were out by closing time. The self-service feature permitted other refuge activities to be carried out during the remainder of the day.

Several local radio stations were contacted to assist the refuge in relaying critical hunt information, particularly when cancellations were necessary. As in previous years, the decision to cancel a hunt day was based on the current weather and road conditions and the National weather Service's 36-hour weather forecast. The decision to cancel a hunt day was generally made by noon on the day before the affected hunt. By making the decision as early as possible, the staff was able to contact the radio stations to have the cancellation notice aired on the radio, to post the necessary signs, and to make the required changes on the office's answering machine.

Two scouting days were originally scheduled, but one day was cancelled when wet weather created poor road conditions. During the one day of scouting on October 6, 343 visits were recorded which accounted for 1,087 activity hours. Only individuals with valid permits were allowed vehicle access for scouting and were required to carry a compass. Hunters also had to sign themselves in and out just as they do on hunt days. The refuge gates were open from 8:00am to 3:00pm on the scouting day.

One unfortunate accident occurred when a hunter fell from his tree stand and broke his leg. Refuge personnel and EMT's had to carry the hunter about 1/4 mile through the swamp to get him to the awaiting ambulance. However, for the second year in a row, no search operations were needed for lost hunters.

The 1990 hunting season was a resounding success with a good deer harvest and only one significant accident/incident. The hunt was still a drain on staff time, but other critical work was accomplished during the hunt season. Changes which were made in previous years seemed to help the refuge conduct a relatively uneventful hunt. These changes include requiring all hunters to possess a compass when scouting and hunting on the refuge, cancelling hunts if the weather forecast predicted a 60% chance (or greater) of rain on the hunt day, and only permitting access through the specified entrances.

9. Fishing

Lake Drummond, located in the center of the refuge, continued to be open to fishing year round from sunrise to sunset. Boaters and fishermen gained access via the Feeder Ditch which connects the Dismal Swamp Canal to Lake Drummond.

For many years, the Corps of Engineers has maintained and operated a small tram to portage small boats around their spillway which is located on the east side of the lake. In 1990, the Corps ceased to provide this service, citing the tram's deteriorated condition. Despite this minor setback, the Corps recorded 830 fishing visits throughout the year with the most use occurring during the spring and summer months.

Refuge fishing access permits continued to be issued for vehicle access to Lake Drummond via Railroad Ditch Road during April 1-June 15. This access was tightly controlled, for the small parking area at the lake's western bank accommodates only about a dozen vehicles. Also, access was curtailed during rainy weather when roads were in dangerous condition.

The number of fishing permits issued this year remained relatively the same as 1989 with 107 permits issued in 1990 and 105 in 1989. Wet road conditions prevailed throughout the season, reducing the number of days that Railroad Ditch Road was opened for fishing access. When the roads were opened to vehicle access, 107 visitors took advantage of the good conditions and accounted for 850 activity hours.

11. Wildlife Observation

Washington Ditch and Jericho Lane continued to attract most wildlife observation. The boardwalk trail and the shortest route to Lake Drummond attracted most visitors to Washington Ditch, while the spring bird migrations caused traffic to increase at Jericho Lane during April and May. Both entrances provided good seasonal bird-watching opportunities.

12. Other Wildlife Oriented Recreation

Hiking, biking, photography, and boating continued to be popular refuge activities. Most visitors gained access through the Washington Ditch and Jericho Lane entrances, but a few visitors used the numerous other secondary entrances to utilize other portions of the 150 miles of roads that are open to hiking and biking. All boating activities were confined to Lake Drummond. Total visitation for all refuge activities increased slightly in 1990 with 15,190 visits recorded in 1990 compared to 13,800 in 1989. Boating visits were recorded by the Corps of Engineers at the Feeder Ditch spillway and accounted for 3,289 visits. Visitation for hiking, biking and photography were estimated based on data from a traffic counter located at the Washington Ditch entrance. Estimates are based on calculating that the other entrances receive about 25% of the use that is recorded at Washington Ditch.

14. Picnicking

Picnicking occurred on the refuge, although no picnic facilities are provided. The majority of outdoor classroom groups picnicked sometime during their visit in the parking lots or at Lake Drummond. The demand for this activity was low and will continue to be permitted as long as littering does not become a problem.

16. Other Non-Wildlife Oriented Recreation

Dog retrieval, firewood cutting, and horseback riding were the only other non-wildlife oriented recreational activities occurring on the refuge. Special use permits were issued to hunt clubs and individuals in order to authorize vehicle access for retrieving hunting dogs which wander onto the refuge during the white-tailed deer hunting season. In 1990, a \$25.00 non-refundable permit fee was charged to help defray some of the expenses of administering this program. The fee helped reduce the demand for this activity, as only nine permits were issued in 1990 compared to 27 issued in 1989. The permits covered both the Virginia and North Carolina hunting seasons and were issued for the period of October 1, 1990-January 1, 1991. All permittees were required to phone the refuge prior to each visit to receive permission for vehicle access, to obtain information on the road conditions, and to obtain the current gate combination. Access was granted from 8:00 am to sunset only and was suspended during wet road conditions. Although some staff time was consumed in administering this program, allowing owners to retrieve the dogs helps keep the problem of free roaming dogs on the refuge to a minimum.

Firewood cutting was allowed again in 1990, but poor road conditions kept the use to a minimum. The number of permits increased somewhat over last year with 83 permits issued in 1990 compared to 71 permits in 1989. However, a considerable decrease

in visits for this purpose occurred when compared to 1989 as only 16 visits were recorded in 1990 and 256 visits in 1989. The permit allowed individuals to cut firewood at specified locations and any tree except oak, Atlantic white-cedar, pine, and cypress to be removed within 50 feet of the center of the road. While firewood cutting has been recorded as a non-wildlife oriented activity, this program continued to complement the overall road maintenance efforts by removing the tree canopy which shades the roads. The resulting drier roads were easier to maintain and generally provided better access into the refuge.

Horseback riding was permitted in certain areas of the refuge and was generally used by refuge neighbors who train and race their horses. This use was reduced significantly in 1990 because of poor road conditions and resulting safety hazard. The public use management plan which was completed in 1990 called for phasing out this activity.

17. Law Enforcement

A staff of four refuge officers was maintained throughout 1990, with all the officers being senior management personnel. Most enforcement activities were accomplished concurrently with other field duties, as other pressing tasks did not allow much time for routine patrols. Virginia and North Carolina wildlife officers conducted some patrols in the refuge vicinity, resulting in a few apprehensions on the refuge. Stronger ties with the Suffolk police department were established in order to solicit their support in patrolling the more active public use areas. However, grapevine reports and physical evidence indicated that vandalism, trespass, and possibly poaching were occurring without apprehensions.

Refuge officers only had to make one court appearance, when Assistant Manager Kaehny attended a session in Norfolk on February 5. The defendant did not appear, but the mid-February report from the Central Violations Bureau indicated that he finally forfeited collateral on February 6.

Assistant Manager Kaehny was detailed to Mason Neck NWR during October 14-15 to assist with managing the protests that were occurring during their archery deer hunts. Both Assistant Manager Kaehny and Biologist Keel were detailed again to Mason Neck during December 2-3 to assist with the opening of the gun deer hunt.

Various problems persisted at the Washington Ditch entrance to the refuge. Throughout the year, vandalism and littering continued at the area's boardwalk and pier on the lake. On May 5, the Suffolk police discovered two stolen vehicles that had been torched in the parking lot. The ultimate indignity occurred on the night of December 22 when someone set fire to the kiosk, totally destroying the facility.

In an effort to counter these problems, several weekend and night patrols were conducted, and information that might lead to apprehensions was solicited from neighbors and visitors. The Suffolk police cooperated by increasing routine patrols at Washington Ditch and Jericho Lane. Unfortunately, no apprehensions resulted from the patrols. However, a break occurred on October 5 when one of the refuge's neighbors contacted Manager Culp at 10PM to report that traffic was entering the Washington Ditch road. Manager Culp, Assistant Manager Kaehny, and two Suffolk patrol units converged on the area within a half hour, resulting in the apprehension of about a dozen juveniles who were having a beer bust in the parking lot. One youth was arrested when he attempted to flee the police units and wrecked his brand new Chevrolet Blazer. Fortunately, no one was hurt, but the Blazer was totalled. All the youngsters were charged by the Suffolk police under local ordinances against trespass, and the juvenile who fled in the Blazer was charged with reckless driving. Ultimately, a lenient court dropped all the charges except the reckless driving.

For two months following the October beer party, vandalism and littering dropped dramatically. The peace came to an abrupt end with the torching of the Washington Ditch kiosk. The local authorities were extremely helpful with the investigation, and a reward was offered, sponsored by the Suffolk Crime Line and the local chapter of the Izaak Walton League, for information leading to the apprehension of the arsonist. Unfortunately, no leads developed by the year's end.

North Carolina officers arrested an individual on the refuge on November 12 after he was detected with a firearm along the refuge's southeastern boundary. The young man attempted to flee from the officers on an ATV, but he was caught about four miles within the refuge on the County Line Road. The defendant was ultimately convicted only on a concealed weapons charge. The young fellow's family apparently had sufficient political connections at the state level to inflict political heat on the state officers involved with the case, as the defendant alleged that he was "set up" and harassed. Federal charges on refuge trespass and firearms possession were still pending on this case as the year ended.

This section will be concluded on a tragic note. During the refuge's deer hunts in 1989, a Mr. John Esser of Virginia Beach was reported missing after he told friends he was going hunting at the refuge. Mr. Esser was checked in and out of the refuge on October 12, and neighbors saw him on October 13. However, refuge records indicated that he was never again checked into the refuge after his one day's hunt on October 12, and no evidence was discovered that he was ever on the refuge again. In April 1990, Mr. Esser's remains were discovered a short distance outside the refuge's southeastern boundary in Pasquotank County, North Carolina --- the victim of a violent homicide.



The Washington Ditch kiosk was thoroughly cleaned and spruced up in August by Boy Scouts. (DIS-90-18,TC,8/90)



By the end of December, the kiosk was reduced to a charred mess. (DIS-90-19,TC,12/90)

I. EQUIPMENT AND FACILITIES

1. New Construction

In December of 1989, the water system in the new headquarters (completed in 1988) building tested positive for coliform contamination. Additional samples were submitted for bacteriological analysis in January after purging the system with bleach, but the results were the same. The Regional Engineering Division was advised of the problems in order to solicit their advice and determine if the problem may be covered under the building's warranty. However, their best immediate response was to continue monitoring the water quality, cease drinking the water, and try to determine the exact cause of the contamination. As the year progressed, the coliform contamination was no longer detected, indicating that the heavy rainfall in 1989 may have caused the contamination when surface water seeped into the well.

The staff suffered through the winter of 1989-90 without the headquarters main heating/cooling system, as a December 1989 ice storm created numerous problems with the system. The problems were not easily corrected due to the haphazard manner in which the system's original contractor had wired the various timers and thermostats that control the units. During their final warranty inspection on March 15, Regional engineers advised hiring a reputable local heating/cooling system contractor to install and re-wire new thermostats would probably be the least expensive option. Thus, Nansemond Heating and Cooling accomplished the repairs for approximately \$1,000, and the system has worked perfectly since June.

The major construction project for the refuge in 1990 was the force account construction of the South Ditch water control structure (N4) at the intersection of Riddick and South ditches. The structure consisted of two aluminum (14 gauge) culverts (5'x30'); each with a double barrelled flash board riser (8 gauge), 6' high by 10'3" wide; and made from ALCLAD aluminum alloy. The risers included in a 2' full circular anchor base with an anti-seep strip extending into the anchor base. The risers were connected to the culverts with corrugated, positive-lock connecting bands, and a 96"x108" diaphragm (12 gauge) was installed on each culvert/riser. The two culverts/risers were fabricated by U.S. Aluminum and Steel Highway Products Corporation for \$15,072.

Actual field work on this project began on July 17 and was essentially completed on November 30. Difficult access to the remote site along nine miles of dirt and peat roads (via Railroad, West, and South Ditch Roads) meant that refuge personnel were constantly repairing roads for the dump trucks that were delivering fill and other materials to the site. Despite the constant road maintenance, trucks were constantly getting stuck even on perfectly

dry roads, as the peat road beds would virtually cave in from the weight of the trucks. Thus, a large amount of additional road fill was required to repair the roads in addition to the 500 cubic yards needed for the water control structure. Ultimately, the combination of road maintenance and water control structure construction required over 230 staff days.

To start the project, 3000 cubic yards of road material were purchased to rehabilitate three miles of South Ditch road. This preliminary road work was required to gain access to the water control structure site for the delivery of clay fill, equipment, and supplies needed for the construction project. Despite limiting the size and maximum load capacity of the trucks, the 6.2 miles of what were considered good refuge roads (Railroad and West) were torn up during each day's delivery. This development made it necessary to procure additional road materials to repair the Railroad/West Ditch access roads.

Actual work on the water control structure began on September 26 with the delivery of equipment and the clearing of a site to stock pile the 500 cubic yards of clay fill. Burris Construction Company was to deliver the clay fill at a cost of \$4,000 (\$8.00/yard), and two trucks began hauling fill on October 1. However, after only one trip to the site, the contractor determined that they could not deliver the material due to the poor road conditions.

Burris Construction Company then hired a sub-contractor who delivered 110 cubic yards (11 loads), and this contractor also quit. A deal was finally negotiated with Burris Construction to deliver the rest of the clay fill to the intersection of West and South Ditches, with the refuge hauling the clay fill the remaining three miles to the site.

In October, refuge personnel hauled clay fill, cleared the water control structure site, installed the coffer dams and diversion ditch, set the structure, and began backfilling. In November, the remaining steps in the construction were completed as listed below:

- completed the delivery and installation of the 500 cubic yards of clay fill

- poured approximately 11,000 pounds of sack concrete (175 bags) into each riser anchor base
- built 40' bulkhead retaining walls at each end of the structure to prevent washing and erosion of the fill
- anchored the risers and culverts by driving six 20' steel pipes (three along each side of the structure) and securing the risers/culverts with 100 feet of 1/2" steel cable
- secured the retaining walls with 200' of cable
- installed a clay core perpendicular to the ditch and culverts into the surrounding peat soils to inhibit erosion around the structure.

On November 30, the coffer dams were removed and the diversion

ditch was filled to complete this project.

Equipment Operator Bailey White was detailed, along with this station's excavator, to Back Bay NWR during most of April-September to assist with their dike construction project. His prolonged absence generated renewed appreciation for his services at the Great Dismal Swamp, for it seemed that all field operations suffered without Bailey's keen attention to details and acceptance of nothing less than perfection.

DIRECT PROJECT COSTS
SOUTH DITCH WATER CONTROL STRUCTURE

Aluminum Culverts and Risers	\$15,072
Sack Concrete (349 bags)	937
Turn Buckles (8)	175
Cable Clamps (36)	45
Cable, 1/2" (300')	On hand
Lumber, 2"x8"x12' (60)	On hand
Bolts, Galvanized 1/2"x8" (80)	On hand
Lag Bolts, 3/8"x5" (40)	On hand
Packer and Mud Pump Rental	300
Clay fill (500 cubic yards)	4000
South Ditch Road Material (3000 cubic yards)	24,600
Railroad & West Ditch Road Material (3,630 cu yds.)	21,995

Total Direct Costs: \$67,124



This scene was all too common in July and August, as trucks that were delivery materials to the South Ditch construction site would get stuck on perfectly dry roads. (DIS-90-20,MK,7/90)



Delays in getting equipment and materials to the site prevented actual work on the South Ditch structure from beginning until the fall. (DIS-90-21,MK,9/90)



The structure's clay foundation was installed in October. (DIS-90-22,MK,10/90)



The first large culvert and flash board riser assembly was carefully positioned... (DIS-90-23,MK,10/90)



... for installation. (DIS-90-24,MK,10/90)



The risers were anchored to steel posts which had been driven deep into the ground. (DIS-90-25,MK,11/90)



The first back-filling began in November. (DIS-90-26,MK,11/90)



The front bulkhead was installed,... (DIS-90-27,MK,11/90)



...followed by the rear bulkhead. (DIS-90-28,MK,11/90)

2. Rehabilitation

During the first four months of the year the refuge staff made a concerted effort to clean up a number of old structures and dump sites that have graced the refuge for years. The last of the old hunt cabins (Badger) that was located along the shores of Lake Drummond was demolished in a blaze of glory on January 5.

The refuge staff spent two weeks beginning January 18 in removing two buildings, debris from two old house sites and a trash dump from the Gornto tract located along U.S. Highway 17 on the eastern boundary of the refuge. This site had become an ugly eye-sore along U.S. 17, and the dilapidated building sites were attracting vandalism and other suspected nefarious deeds. The close proximity to the highway and overhead power lines prohibited the use of fire to accomplish this project. Thus, the excavator with clam shell bucket was used to demolish the buildings and load the debris on refuge trucks. Some of the non combustible material was hauled to the regional landfill, involving a 70 mile round trip. Permission was obtained from a neighbor in North Carolina to pile and burn the combustible material on his land, requiring a 30 mile round trip.



The remains of old buildings on the Gornto tract were removed in January. (DIS-90-29,MK,1/90)

The refuge crew and equipment were then dispatched to an unauthorized dump along Jericho Lane. Over 100 tons of garbage and debris was removed from the site and transported to the landfill. The excavator and dump truck carried the bulk of the trash away, and volunteers completed the final touches on cleaning up the site.

Some time was consumed in cleaning up the old Perry Cabin site that is located at the point where Washington Ditch drains into Lake Drummond. That building was demolished in December, 1989, and some old pilings and metal roofing remained to be removed from site.

A contract was awarded to LRS Environmental Services, Inc., of Hampton, New Hampshire, to remove six underground fuel storage tanks for the Gornto Tract along U.S. 17. The small tract, which was added to the refuge in 1988, had underground fuel oil tanks as well as several gasoline tanks that supported a convenience store gas station. Little information was available about the tanks, as these tanks had been out of operation for at least a decade.

The tank removal began in June. The first two tanks that were excavated were 550 gallon tanks with one being completely full of liquid. The last two were 5000 gallon tanks, and the residual fuel removed from all the tanks totalled 10,000 gallons. The cost of the project totalled \$27,600.

Soil and water samples from the site were submitted for analysis by high resolution gas chromatography for total petroleum hydrocarbons and ranged from a low of 70 ppm (mg/kg) to 2000 ppm (mg/kg). The contaminated sites were delineated by fencing and the contaminated soils were stock piled and covered with polyurethane. Upon reviewing these analyses, the State Water Control Board requested additional site assessments to better evaluate the level of site contamination. As the year ended, plans were being developed to complete these assessments.

The installation of railing and wheel-chair platforms, a project which began in 1989, was completed in August. The project was accomplished in accordance with the Section 504 Handicapped Accessibility Report which was completed in 1987.

The South Ditch water control structure construction project created constant dump truck and heavy equipment traffic on Railroad and West Ditch Roads. This traffic tore up refuge roads that had been considered to be some of the better roads within the 150 mile system. Constant road repairs were needed in order maintain access to the water control structure site. A total of 3,000 cubic yards of Type II sub-base sandy clay fill was procured to rehabilitate the South Ditch Road, enough material to establish a six inch base along the three miles of South Ditch Road. However, much of this original road material had to be used to repair Railroad and West Ditch Roads after the constant bombardment of dump trucks, and additional road fill materials were procured to complete and maintain repairs on Railroad, West, as well as South Ditch Roads. The trucks literally pulverized the roads despite that fact that truck loads were limited in an effort to reduce this impact. A dust layer of a half-foot in depth developed, so that even light rainfall created a slippery surface that was slick as ice. Heavier rains created a quagmire in which the trucks would get stuck, and

dump truck deliveries would be delayed 3-4 days in order that the roads could dry. During delivery operations, two tractors were kept in constant operation to fill deep holes in the roads when the trucks broke through the road base and pull trucks out when they were stuck.

Frequent rains in August prevented all delivery of material to South ditch for 22 days. As a result, the contractor was permitted to stock pile approximately 1000 cubic yards of material on the Bass Tract located near the refuge shop for later delivery by refuge personnel. Back Bay NWR's Mack dump truck with its oversized tires was frequently used to transport material to the construction site when conditions were too wet and muddy for the contractor's trucks, which were not well equipped for the refuge roads.

By the end of November, delivery of the water control structure materials had been completed, and about 2,000 cubic yards of road fill had been spread on West Ditch Road. However, December rains put an end to further road repairs until the drier conditions develop in 1991.

The wooden steps on the Jericho fire tower were replaced with aluminum steps which had been constructed from military surplus materials. Since the new refuge radio system will include a relay transmitter to be located in the tower, safe access into the tower became more critical. As the year ended, most of the step and deck replacement had been completed.



Acrophobics needed not apply for the task of replacing the steps and decks on the Jericho fire tower. (DIS-90-30,DW,12/90)

From March 12-20 Equipment Operator White was detailed to Blackwater NWR to demolish and remove an old building with the excavator.

3. Major Maintenance

Maintaining the refuge's 150 miles of roads has always been a major effort. Considerable work was required throughout the year in clearing the roads of downed trees, limbs, branches and debris that result when storms or high winds pass through the area. Some of the major 1990 tasks have been summarized below:

Boom axing road shoulder and ditch banks	51 miles
Mowing roads and road shoulders	78 miles
Disking	8 miles
Grading	40 miles
Spot filling and graveling	10 miles

Repairing vandalism damage was a nagging problem throughout the year. In January, two handicapped parking signs and posts at the Washington Ditch parking lot and a handicapped sign at the Jericho Lane parking lot were replaced after they had been stolen. An ill-advised camp fire on the Lake Drummond pier required repairs to the main joist and 96 square feet of decking. Additional steel posts were installed at the Weyerhaeuser gate to inhibit trespass by ATV's. In July and September, the Washington Ditch boardwalk railing was repaired after someone tried to knock off several sections of railing. The obviously worst act of vandalism occurred on December 22 when someone burned down the Washington Ditch kiosk and damaged much of the boardwalk railing on the front portion of the trail. The only immediate repairs that were accomplished after that incident included the cleanup of any hazardous materials (nails, splinter boards, charred wood) in order to permit re-opening the trail.



An early spring tornado may have touched down near Cross Canal, knocking over numerous trees. (DIS-90-31,MK,5/90)

4. Equipment Utilization and Replacement

A fleet of eleven vehicles, four large trucks, and seven pieces of farming and heavy equipment with 17 specialized attachments were maintained. The maintenance and repair of this equipment required considerable staff time to ensure all vehicles and equipment were maintained in good safe working order. Vehicles were serviced semi-annually including changing all fluids and filters, greasing, and ensuring all safety components were operable. The larger trucks, farming and heavy equipment were serviced annually including changing all fluids, filters, steam cleaning, dropping belly pans to remove combustible debris, sanding and painting rusted areas, and performing other time-specific maintenance as detailed in the manuals. Depending on running time and working conditions, equipment was sometimes serviced more frequently.

In addition to the daily, annual and semi-annual preventative maintenance programs, the following repairs and improvements were accomplished on refuge vehicles and equipment in 1990:

Insley excavator - installed two hydraulic hoses and fittings to accommodate the 3/4 yard clam shell bucket; sand blasted and painted boom and under carriage; repaired hydraulic pump and replaced coupling and hoses

Caterpillar D-6 - replaced batteries

Ford 8700 Tractor	- replaced leaking hydraulic seals and couplings; tractor seat, front and side panels, throttle control, valve cable, exhaust pipe and muffler; two coupling kits
Ford 6600 Tractor	- replaced muffler and exhaust pipe; repaired flat tire
John Deere 4240 Tractor	- (Back Bay's) - replaced hydraulic hoses and fittings; repaired muffler and exhaust pipe; changed oil and filters
Boom ax	- repaired motor; replaced boom, sleeve brake assembly and installed new blades
Hardee mower	- repaired broken weld on mower deck
John Deere 1408 Mower	- replaced motor drive shaft and seal, universal, and yoke assembly
Back Bay's Front-end loader	- replaced battery cable, greased
Portable bridge	- re-welded arm which enables D-6 dozer to hook to bridge for placement in ditches
Sand blaster	- replaced bushings
Ford tractor grading blade	- replaced hydraulic cylinder
1979 IHC Truck	- Installed headlight
1979 Autocar & lowboy trailer	- replaced battery to pony motor; installed 40' of two ply rubber conveyor belt runners on lowboy weight bearing fenders to protect metal and reduce slippage when loading equipment; replaced four tires, strobe light and installed air conditioning unit
1983 Ford LT 9000 Tiltbed	- installed air conditioning unit
1981 GMC dump truck	- repaired broken running and tail lights; broken spring

Back Bay's 1979 Mack dump Truck	- repaired brakes, replaced four batteries, clutch repairs and oil leak in front wheel hub, replaced rear running lights, mud flaps, tail gate pins, replaced bushings, spring pins and oil seals, clutch adjustment. A broken oil line resulted in the engine freezing up in November.
1989 Dodge Crewcab	- undercoated
1989 Dodge 4x2 pickup	- built rack for portable fuel tank to prevent sliding and damaging truck bed
1985 Chevrolet Blazer	- replaced rear window, rear pinion seal, front drive shaft, and installed a transmission cooler unit
1985 Jeep Cherokee	- replaced solenoids and repaired winch
1983 Chevrolet	- replaced left front lower, pivot and spindle
1981 Chevrolet 4x2 pickup	- replaced four tires, resurfaced front disc brake rotary

On April 12, Equipment Operator White transported a motor grader for Back Bay NWR from the St. Julian Creek military surplus depot in Portsmouth, Virginia.

In May, Equipment Operator White transported the Case 850 dozer, Ford 8700 farm tractor, and disk to Eastern Shore of Virginia NWR for their use during their heavy equipment training sessions. On June 8, Eastern Shore of Virginia NWR returned the 8700 farm tractor and borrowed the refuge's 1981 GMC dump truck and requested the use of the Case 850 for their building demolition project. The Case was loaned to them June 17. On July 23, Eastern Shore of Virginia NWR personnel returned the refuge's disk that had been on loan to them since May. On August 30, Tractor Operators Poovey and Powell traveled to Eastern Shore of Virginia to return the AMC dump truck on loan to them since June 8.

During the five month period from July through November, this station borrowed a number of pieces of equipment from Back Bay NWR for use during the South Ditch water control structure construction and road rehabilitation projects including their AC front end loader, JD 4042 farm tractor, box scraper, and 1979 Mack Dump Truck.



The boom and under-carriage of the excavator was sand-blasted and painted to prepare it for the salty elements at Back Bay NWR. (DIS-90-32,MK,3/90)



The excavator looked almost new after a fresh coat of paint. (DIS-90-33,MK,3/90)

5. Communications Systems

Considerable time was spent in the procurement of high-band radio equipment to replace the existing low band radio system. This move was prompted by recommendations from radio technicians from the Boise Interagency Fire Center (BIFC) who inspected the existing system in 1989. The BIFC technicians felt that a high-band system with repeaters would provide better coverage for portables, eliminate most of the existing interference from far-away transmissions, and better utilize the latest radio technology. They provided a report with general recommendations on the specific equipment that would be needed to make this transition.

Obtaining the BIFC equipment specifications was the first big step in a long, arduous process of obtaining bids and selecting vendors for the equipment. With all the military installations in the refuge vicinity, some radio vendors apparently felt that the refuge's radio project was rather "small potatoes" and were less than enthusiastic about reviewing the proposed specifications for bidding. Also, assuring that the vendors were properly interpreting the specifications was difficult, as radio technicians spoke a language heretofore unknown to this station's refuge manager. Varying responses were finally obtained from General Electric, Motorola, Midland, and King. Based on their responses and bids, the base station/repeater was ordered from General Electric, and the mobile radios were ordered from Motorola.

Concurrent with the radio procurement process, efforts were initiated to obtain approvals for the two VHF and two UHF frequencies that will be needed for the new system. This process added new perceptions about bureaucracy. The paper work to obtain the frequencies was submitted in May, 1990, and all the frequencies had not been assigned as the year ended. Apparently, the normal process has taken 4-6 months. However, the radio authorization responsibilities were transferred from Washington, D.C., to Denver in 1990. During this process, this station's radio authorization requests were lost and had to be re-submitted in November. Therefore, actual installation of the equipment will have to be postponed until the frequencies are ultimately assigned sometime in 1991.

6. Computer Systems

Progress was made towards bringing geographic information systems (GIS) technology to the refuge resource monitoring program. Early in the year, Manager Culp contacted Dr. Robert Giles at Virginia Tech to request their assistance in developing a GIS program for the refuge. Dr. Giles has been recognized as an authority in GIS technology and has been involved in reviewing refuge resource management programs in the past. He was extremely enthusiastic about joining forces with the refuge to develop an overall resource

monitoring program and offered his unqualified support.

Dr. Giles met with the refuge staff on August 13 to discuss resource management needs and discuss possible strategies to follow in developing the most pertinent monitoring programs, with the staff stressing the absolute need of "user friendly" programs. He immediately began assimilating some basic refuge information for digitizing and programming into computer files. During the process of gathering some of this basic data, Forester Brownlie discovered that the U.S. Geological Survey is in the process of digitizing the quadrangle maps which cover the refuge. Dr. Giles also informed us that he had tentatively lined up a doctoral candidate, Ms. Carmel Kelly of the University of California-Berkley, to work on the project. She was scheduled to arrive at Virginia Tech in late 1990.

In order to become better acquainted with the world of GIS, Manager Culp attended the first annual GIS conference in Fort Collins, Colorado, during June 4-7. The conference was a meaningful effort to consolidate information about some of the leading GIS accomplishments of the Service, and it proved to be a very productive and informative meeting.

In preparation for developing geographic information system (GIS) capabilities for the refuge, a Gateway 2000 80386 desk top computer with math co-processor was purchased to replace the old Digital Rainbow 100 computer. An excess AT&T plotter from the Regional Office was obtained to accompany for plotting the GIS records. As the year ended, the basic GIS and data management software including PC-ARCINFO, Lotus, and DBASE had been ordered.

The refuge staff continued to use various RBASE applications that were developed by the Region for tracking budgets and budget planning. Lotus files on water levels/rainfall, deer harvest, and public use were maintained. Hunter rosters and permits were recorded on DBASE. Word processing and electronic mail utilizations were routine and a part of daily life in the refuge office.

For administrative tasks, two Epson LT-286e lap top computers were delivered in November and had already proven to be extremely useful by the end of the year. With more and more administrative task being accomplished on computers, the refuge staff needed the additional equipment to avoid the "traffic jams" that were beginning to develop at the one desk top computer.

J. OTHER PROGRAMS

1. Cooperative Programs

In 1988, the Service signed a cooperative agreement, pursuant to the Sikes Act, with the Department of Defense to provide technical assistance regarding the management of wildlife resources on the Naval Security Group Activity, Northwest (NSGANW) installation which is located a few miles east of the refuge. Regional Fire Management Coordinator Carter reviewed and commented on the installation's prescribed burning plan in December 1989 when they listed the refuge as a cooperator and emergency contact in case a prescribed burn got out of control. NSGANW Natural Resource Specialist Robin Heubel contacted the refuge staff in January to announce the initiation of prescribed burning and request that refuge fire suppression resource be on stand-by. Fortunately, their burning proceeded well, and refuge resources were not needed.

As in past years, Biologist Keel coordinated state woodcock and mourning dove surveys in April and May.

Gypsy moth traps were set at various locations on the refuge in cooperation with the U.S. Forest Service. Southeastern Virginia has been infested with gypsy moths for years, but forest tent caterpillars have inflicted more tree defoliation than anything else within the refuge. Of the eight traps that were set, six traps caught nine gypsy moths. This level of moth activity was similar to the previous year's, and no eradication procedures were recommended.

3. Items of Interest

Biologist Keel completed the Crew Boss (S-230) training that was administered by the U.S. Forest Service in Charlottesville, Virginia, during March 19-22.

Refuge Manager Culp and Assistant Manager Kaehny attended an eight hour Fred Pryor Seminar on "Managing Multiple Priorities" on March 22 in Virginia Beach.

Manager Culp, Assistant Manager Kaehny, Biologist Keel, and Regional Fire Management Coordinator Carter attended the 40 hours of law enforcement refresher training at Eastern Shore of Virginia NWR in April.

Biologist Keel attended the Northeast Wildlife Conference at Nashua, New Hampshire, on April 7-9.

Outdoor Recreation Planner Cherry attended the Basic Refuge Academy in Blair, Nebraska during April 30 - May 18.

Tractor Operators Douglas, Pearce, Poovey, and Powell completed the S-130/190 basic fire courses and completed on-refuge heavy equipment training in early May.

Biologist Keel completed the I-220 Basic Incident Command System course, sponsored by the U.S. Forest Service, at Blacksburg, Virginia, during June 13-14.

Refuge Manager Culp attended the project leaders meeting at Eastham, Massachusetts during September 9-13.

Refuge Manager Culp and Regional Fire Management Coordinator Carter participated in the first "Fire Management for Line Officers" training that was conducted at the Boise Interagency Fire Center during November 27-29.

4. Credits

The preparation of the annual narrative report was a group effort. The specific assignments are listed below:

Helen Marlin - typing

Marty Kaehny - Sections E.6, I.1-4, editing

Dave Brownlie - Sections C.1, F.3, F.9

Ralph Keel - Sections B, D.5, F.2, F.6, G,

Teresa Cherry - Sections E.4, H.1-16, editing

Lloyd Culp - Sections A, D.1-2, D.6, E.1, E.5, E.7-8, F.1, F.11-12, H.17, I.5-6, J, K, Editing

K. FEEDBACK

This station's staff would not be unique in remembering 1990 as one of the most hectic years in recent memory. Refuge personnel surely felt that their duties and responsibilities to their field stations required full time attention. Yet, 1990 was a year in which their time was often divided among projects on private lands, other refuges, and other details. Frankly, the manager of this station was fortunate to be working with a staff that remained civil despite the pressures.

Few would question the intentions of the myriad of projects with which refuge folks were involved. A renewed environmental consciousness has developed within this nation and the world, providing opportunities for the Fish and Wildlife Service to do good things. These expanded opportunities have been practically irresistible to the personnel within the refuge division and this entire agency. Many, if not most, entered the exciting world of wildlife conservation in order to satisfy an innate need to make this world a little better place in which to live.

These new opportunities, however, have strained refuges' personnel resources. Many managers felt that these resources were inadequate even before the Service launched the new endeavors. Under these circumstances, something had to give. One option to deal with this problem would be to defer refuge priorities in favor of the regional and national priorities. Unfortunately, the implementation of this option would cost the refuge in numerous ways. For example, the refuge visitor would not understand why it required refuge personnel weeks to repair or maintain public facilities. The local refuge support group would not accept excuses for a staff's slow response to accommodate their desire to provide tangible support for critical refuge projects. The refuge hunter would not understand why a hunt is administered in a sloppy manner. Perhaps, the only excuse that would be credible to the public is that these are all instances of a "typical government operation".

In reality, most of the more critical and visible refuge projects are accomplished despite the obstacles. Refuge folks would find it difficult to overtly permit their efforts to crumble, for years of their lives have been invested in the cause of securing progress for their refuge. What is given up in the attempt to maintain this progress? Does the staff sacrifice even more personal time with their families? Were some "corners cut" in some of those everyday administrative procedures that some do not consider to be particularly important until a GAO or IG audit develops or (ahem) an "irregularity" is detected in the books? Would the staff "overlook" some standard safety procedures in their rush to accomplish the several "number one" projects for the day?

To close, these comments are intended only to provoke some thought, and maybe some assurances, that this agency's managers are being sensitive to all the issues that are involved with the expanded opportunities. All who have been involved with the exciting projects of 1990 have earned a pat on the back for their dedication and genuinely good intentions. However, managers at field, regional, and national levels should be working on the following:

1. In accomplishing routine and new projects, determine the true cost of administering an optimum operation. Do not automatically accept the premise that the refuge team can always "make do" with anything less than a basic level of support which permits the safe and efficient accomplishment of critical refuge operations.

2. Discard the old notion (if not already done so) that each and every member of the refuge's management team can do everything from cleaning bathrooms to being a political advocate. The variety can be interesting and challenging, but it often results in a "half-baked" job on several fronts. Perhaps, the time has come to reassess the staffing patterns on refuges in light of the expanded duties and directions they face.

3. Strive to secure the support and resources that this agency needs to fulfill its cause in a first class manner.

NANSEMOND NATIONAL WILDLIFE REFUGE

ANNUAL NARRATIVE REPORT
Calendar Year 1990

U.S. DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service
NATIONAL WILDLIFE REFUGE SYSTEM

A. HIGHLIGHTS

Nothing to report.

B. CLIMATIC CONDITIONS

The climate is oceanic, subject to fogs and storms, but tempered by the moderating effect the Atlantic Ocean. Temperature extremes range from eight to 95 degrees, and the average summer and winter temperatures are 80 and 50 degrees respectively. Average rainfall is 48", and there are 210 frost-free days. The last and first frost average April 1 and October 15 respectively.

C. LAND ACQUISITION

Nothing to report.

D. PLANNING

Nothing to report.

E. ADMINISTRATION

The refuge was established when the Department of Defense transferred 206 acres of land, mostly marsh, to the U.S. Fish and Wildlife Service on December 12, 1973. No additional land has been acquired for the refuge. The refuge has been administered as an unstaffed satellite refuge of the Great Dismal Swamp NWR since its establishment.

F. HABITAT MANAGEMENT

General

No active habitat management is underway at this time. However, this section will be used to describe the natural communities on the refuge.

The only open public access to the refuge is by water, but no trails or other public use facilities have been developed on the refuge. Land access is possible through the Naval Transmitter Station and has generally been restricted to government employees.

Wetlands

The Nansemond Refuge is nearly 100 percent tidal marsh. The marshes are salt to brackish of excellent quality. The refuge has over a mile of frontage and some bottom along the Nansemond River and Oyster House Creek. Adjacent property is owned by the U.S. Navy, so there are no developments encroaching upon these marshes.

The dominant vegetation is Spartina patens with Spartina alterniflora in the lower areas. There are numerous tidal guts, pans, and potholes providing excellent interspersions of types. Edge

vegetation grades from salt marsh to tidal marsh and low value trees. These spartina marsh areas have potential for prescribed burning using the creeks and their tributaries as natural fire breaks.

In 1990, Contaminants Specialist David Stilwell (Fish and Wildlife Enhancement, White Marsh) continued to work with the Navy and the Environmental Protection Agency in developing proper monitoring techniques on a former hazardous waste site that is adjacent the refuge. PCB contaminated transformer were removed from this site which drains into the refuge in the early 1980's. Mr. Stilwell reported that the Naval officials were cooperative in this joint effort to assure that no further damage occurs.

G. WILDLIFE

Endangered and/or Threatened Species

The area offers excellent potential nesting and food hunting habitat for osprey and bald eagles, and opsrey are frequently observed along the Nansemond River. Intermittent observations of bald eagles are reported.

Waterfowl

Oyster House Creek and the Nansemond River are wintering areas for black ducks and some divers. Limited census records indicate the area appears to be excellent wintering and migration habitat for Canada geese, black ducks, canvasbacks, and other waterfowl species.

Marsh and Water Birds

Common gallinule, clapper, Virginia and sora rails have been observed and/or heard in the area. Also sighted were green-backed, great blue, and black-crowned night herons and the common egret.

Other Migratory Birds

Mourning doves are abundant along the edges of the marsh and in the small upland fields.

Game Mammals

White-tailed deer, cottontail rabbits, and eastern gray squirrels use the timbered field edge.

Other Resident Wildlife

Bobwhite quail have utilized the field edge. Mammals using the refuge include mink, striped skunk, muskrat, river otter, raccoon, red fox, weasel, meadow vole, white-footed mouse, opossum, and shrews.

Muskrat sign is abundant in the marsh, and two otter dens were found during the summer of 1986. Fiddler crabs are abundant in the marsh along the edge of the tidal creeks and guts.

H. PUBLIC USE

The refuge, by land, is almost completely surrounded by a naval transmitter facility where access is restricted. Therefore, the refuge has not been opened for public use.

I. EQUIPMENT AND FACILITIES

Nothing to report.

J. OTHER ITEMS

This report was prepared and edited by Manager Culp.

K. FEEDBACK

Nothing to report.

United States Department of the Interior • Fish and Wildlife Service
Great Dismal Swamp National Wildlife Refuge
P.O. Box 349 • Suffolk, Virginia 23434
Telephone: (804) 986-3705

Deer Hunt Information - 1990

The deer hunting areas as shown on the attached map and as posted will be open to public hunting for white-tailed deer only. Hunting shall be in accordance with applicable State and Federal regulations.

You are responsible for complying with the following special conditions:

PERMITS

A Refuge permit and the appropriate State hunting license are required. The permit is not valid until it has been properly signed and the hunter possesses a **compass**. **ACCESS WILL NOT BE PERMITTED WITHOUT A VALID PERMIT**. Hunter capacity is 750 per day on a first come, first served basis.

SCOUTING

Official scouting days will be held on October 5 and 6 from 8:00 a.m. to 3:00 p.m. Only hunters with valid permits will be allowed access into the Refuge on scout days. Hunters must sign in and out on each visit.

SPECIES TO BE HUNTED

White-tailed deer

BAG LIMIT

Virginia - One deer per day (either sex)
North Carolina - Two deer per day (either sex)

SEASON

October 11,12,13; 18, 19, 20; 25, 26, 27
November 2, 3; 9,10

CANCELLATION

HUNTS MAY BE CANCELLED due to **HIGH FIRE DANGER** or when rain and other **INCLEMENT WEATHER** renders Refuge roads unsafe to travel. Decisions on the cancellation of hunts will be based on actual weather conditions and the 36-hour weather forecast from the National Weather Service. Significant precipitation on the day before a hunt or a weather forecast of a 60% chance (or greater) for precipitation on the day of the hunt will result in the cancellation of that day's hunt. If a cancellation is necessary, every effort will be made to make that decision by noon of the day before the scheduled hunt. If any hunt dates are cancelled, additional hunt dates will be scheduled on November 1 and 8 to replace the cancelled dates. No other "make up" dates will be provided. **PLEASE CALL (804) 986-3705 IF THE STATUS OF ANY SCHEDULED HUNT DATE IS QUESTIONABLE!** This hunt information line will provide the latest hunt information 24 hours a day effective October 1.

HUNTING HOURS

Hunters will be admitted into the Refuge approximately one hour before legal hunting hours. Hunters must leave the Swamp and sign out no later than one hour after legal hunting hours.

HUNTER ORANGE

All hunters are required to wear a **MINIMUM of 400 SQUARE INCHES** of solid-colored **BLAZE ORANGE** on the chest, shoulders, back, and head during the hunt. Camouflage hunter orange does not meet this requirement.

HUNTER CHECK-IN/CHECK-OUT

All hunters must sign in and sign out at one of the four Refuge entrance points. **ACCESS TO THE REFUGE HUNT AREAS WILL BE PROVIDED ONLY THROUGH THE DESIGNATED ENTRANCES AT CORAPEAKE DITCH ROAD, RAILROAD DITCH ROAD, JERICO LANE, AND PORTSMOUTH DITCH ROAD.** When an entrance reaches capacity, that area is closed to all other hunters for the day even if a hunter checks out. Failure to sign in and/or out will result in permit revocation and prosecution in Federal Court. **ONLY HUNTERS WITH VALID PERMITS WILL BE ALLOWED ACCESS INTO THE REFUGE AT THE DESIGNATED ENTRANCES FOR THE HUNT.**

WEAPONS

Shotgun 20 gauge or larger and bow and arrow in accordance with State regulations. Hunters may use and have in their possession only buckshot and/or rifled slugs. All other firearms are prohibited.

PERMIT FEES

A non-refundable fee of \$10 will be charged for each permit and the permit will be valid for all scheduled hunt dates on the Refuge. This fee will defray some of the costs associated with the administration of the hunts.

PROHIBITED

- Access to Refuge at any location other than designated entrances to hunt areas at Corapeake Ditch, Railroad Ditch, Jericho Lane, and Portsmouth Ditch Roads.
- Hunting on any area that is not designated as part of the Refuge hunt area by signs or current hunt maps.
- Rifles, pistols, dogs, fires, camping, littering, and the use of boat trailers (only car top boats will be permitted).
- Driving motorized vehicles off the roads and/or on roads closed to vehicles.
- Loaded weapons in a vehicle and/or on Refuge roads and road rights of way.
- The use of nails, wire, screws, or bolts to attach a stand to a tree or hunting from a tree into which a metal object has been driven to support a hunter. **TREE STANDS MUST BE REMOVED FROM THE REFUGE AT THE END OF EACH HUNT DAY.**
- The use of permanent markers such as paint to locate stands or trails.
- Blocking the entrance to roads that are closed to vehicles when parking. Refuge personnel need access through these points.

SAFETY

- Fire Danger - You are asked to be especially careful when smoking. This Refuge has the potential for "ground fires" which can burn three to four feet deep. If you discover a fire or notice smoke by sight or smell, please notify a Refuge official as soon as possible.
- Bridges - Bridges are designed for foot traffic across ditches. They are slippery when wet and require caution when crossing.

For further information, contact the Refuge Manager, Great Dismal Swamp National Wildlife Refuge, P.O. Box 349, Suffolk, Virginia 23434 or phone (804) 986-3705.

HAVE A SAFE AND ENJOYABLE HUNT!

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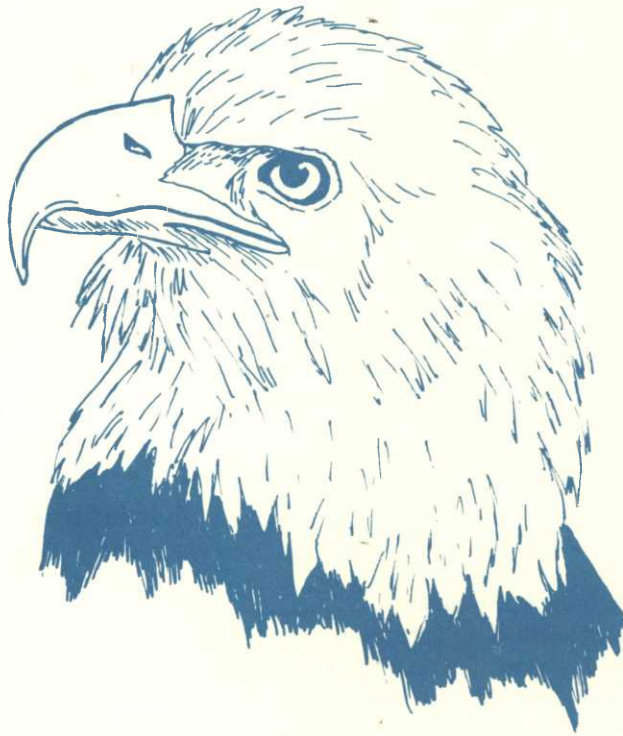
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Birds

Great Dismal Swamp
National
Wildlife
Refuge



Virginia

s S F W

— Bald Eagle	r	r	r	r
— Northern Harrier (Marsh Hawk)	r	r		
— Sharp-shinned Hawk †	o	r	c	u
— Cooper's Hawk †	o	r	o	o
— Red-shouldered Hawk †	c	c	c	c
— Broad-winged Hawk	u	o		
— Red-tailed Hawk †	c	c	c	c
— American Kestrel †	u	u	u	u
— Merlin	o	r		

GROUSE - QUAIL - PHEASANT - TURKEY

— Bobwhite †	c	c	c	c
— Turkey	r	r	r	r

RAILS - GALLINULES - COOT

— King Rail †	r	r	r	r
— Sora	r	r	r	r
— Common Gallinule	r	r	r	r
— American Coot	o	o	o	

OYSTERCATCHERS - PLOVERS - SNIPES - SANDPIPERS

— Semipalmated Plover	r	r	r	
— Killdeer	u	u	u	
— American Woodcock †	c	c	c	u
— Common Snipe	o	o	o	
— Whimbrel	r			
— Spotted Sandpiper	c	u	u	
— Solitary Sandpiper	u	r		
— Greater Yellowlegs		o	o	
— Lesser Yellowlegs		o	o	
— Least Sandpiper		o	o	
— Short-billed Dowitcher		r		
— Semipalmated Sandpiper	o	o		
— Western Sandpiper		r		
— Sanderling		o		

GULLS - TERNS - SKIMMERS - AUKS - MURRES

— Great Black-backed Gull	o	o	o	
— Herring Gull	u	u	u	u
— Ring-billed Gull	c	u	c	c
— Laughing Gull	o	o	o	o
— Royal Tern	o			
— Caspian Tern	o			

DOVES - CUCKOOS - OWLS - SWIFTS - HUMMINGBIRDS

— Rock Dove	u	u	u	u
— Mourning Dove †	c	c	c	c

s S F W

— Yellow-billed Cuckoo †	c	c	o	
— Black-billed Cuckoo	o			
— Screech Owl †	u	u	u	u
— Great Horned Owl †	u	u	u	u
— Barred Owl †	c	c	c	c
— Chuck-will's-widow †	u	u	o	
— Common Nighthawk	r	r	r	
— Whip-poor-will †	u	u	o	
— Chimney Swift	c	c	u	
— Ruby-throated Hummingbird †	c	c	u	

KINGFISHERS - WOODPECKERS -**FLYCATCHERS - LARKS - SWALLOWS**

— Belted Kingfisher †	c	c	c	c
— Common Flicker †	u	u	c	c
— Pileated Woodpecker †	c	c	c	c
— Red-headed Woodpecker †	u	u	u	o
— Red-bellied Woodpecker †	c	c	c	c
— Yellow-bellied Sapsucker	u	o	u	u
— Downy Woodpecker †	c	c	c	c
— Hairy Woodpecker †	u	u	u	u
— Downy Woodpecker †	c	c	c	c
— Eastern Kingbird †	u	u	u	
— Great Crested Flycatcher †	c	c	c	
— Acadian Flycatcher †	c	c	u	
— Eastern Phoebe †	c	c	u	r
— Eastern Wood Pewee †	c	c	u	
— Tree Swallow †	u	o	u	
— Bank Swallow	o			
— Rough-winged Swallow †	u	u	o	
— Barn Swallow †	c	c	c	
— Cliff Swallow	r	r		
— Purple Martin	u	u		

JAYS - CROWS

— Blue Jay †	c	c	c	c
— Common Crow †	c	c	c	c
— Fish Crow †	u	u	u	u

CHICKADEES - TITMICE - NUTHATCHES -**CREEPERS - WRENS**

— Black-capped Chickadee		r	r	
— Carolina Chickadee †	c	c	c	c
— Tufted Titmouse †	c	c	c	c
— Red-breasted Nuthatch †	r	u	u	
— White-breasted Nuthatch †	c	c	c	c
— Brown-headed Nuthatch †	u	u	u	u
— Brown Creeper †	r	o	o	

s S F W

— House Wren †	u	u	o	r
— Winter Wren	r	u	u	
— Carolina Wren †	c	c	c	c
— Marsh Wren	o			

MOCKINGBIRDS - THRASHERS - THRUSHES

— Mockingbird †	u	u	u	u
— Gray Catbird †	c	c	c	c
— Brown Thrasher †	u	u	u	u
— American Robin †	u	u	c	c
— Wood Thrush †	c	c	u	
— Hermit Thrush	o	u	c	
— Swainson's Thrush	o	r		
— Gray-cheeked Thrush	o	r		
— Veery	o	r		
— Eastern Bluebird †	u	u	u	o

KINGLETS - WAXWINGS - SHRIKES

— Blue-gray Gnatcatcher †	c	c	u	
— Golden-crowned Kinglet	o	u	u	
— Ruby-crowned Kinglet	o	u	u	
— Water Pipit	o	o	o	
— Cedar Waxwing	c	r	u	c
— Loggerhead Shrike	r	r	r	

STARLINGS - VIREOS - WARBLERS

— Starling	u	u	u	u
— White-eyed Vireo †	c	c	c	
— Yellow-throated Vireo †	u	u	u	
— Solitary Vireo	o	o		
— Red-eyed Vireo †	a	a	c	
— Philadelphia Vireo	o	o		
— Warbling Vireo	o	r		
— Black-and-white Warbler †	u	c	c	
— Prothonotary Warbler †	a	a	c	
— Swainson's Warbler †	u	u	u	
— Worm-eating Warbler †	u	u	u	
— Golden-winged Warbler	o			
— Blue-winged Warbler	c	u		
— Tennessee Warbler	u	u		
— Nashville Warbler	o	o		
— Northern Parula †	u	u	u	
— Yellow Warbler †	u	u	u	
— Magnolia Warbler	o	o		
— Cape May Warbler	o	o		
— Black-throated Blue Warbler	u	u		
— Yellow-rumped Warbler	c	u	c	
— Black-throated Green Warbler †	c	c	u	

The Great Dismal Swamp National Wildlife Refuge, established by Congress in 1974, currently contains more than 100,000 acres of forested wetlands. A primary concern at the refuge is to offer food, rest and protection for migratory birds. Also, a variety of educational and recreational opportunities are offered for the public, including tours, hiking, biking, canoeing, photography, hunting and fishing.

Birding is popular in the Swamp from April through June, but is best from mid-April - mid-May, the peak of the spring migration. As many as thirty-five species of warblers have been observed and provide the principal attraction.

An annotated list of accidental species which have been seen on the refuge is available from the refuge manager.



This folder lists over 200 birds that have been identified on the refuge, and is in accordance with the Sixth American Ornithologists' Union Checklist.

Most birds are migratory, therefore their seasonal occurrence is coded as follows:

Season:

s - Spring	March - May
S - Summer	June - August
F - Fall	September - November
W - Winter	December - February

† - Nesting has occurred on the refuge within the past 5 years.

* - A species which occurs and/or nests in only one or two locations in the refuge.

Relative Abundance:

a - abundant	a species which is very numerous
c - common	certain to be seen or heard in suitable habitat.
u - uncommon	present, but not certain to be seen.
o - occasional	seen only a few times during the season.
r - rare	seen at intervals of 2 to 5 years.

s S F W

LOONS - GREBES

Common Loon	o	r	o
Pied-billed Grebe	u	o	u
Horned Grebe	r	r	o

PELICANS - CORMORANTS

Double-crested Cormorant	u	u	u	u
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BITTERNS - HERONS - IBISES

American Bittern	o	o	r	r
Great Blue Heron †	c	c	u	u
Green Heron †	c	c	u	
Great Egret	o	o	o	o
Snowy Egret	o	o		
Little Blue Heron †	o	o	r	
Cattle Egret	o	o	r	
Black-crowned Night-Heron †	u	u		
Yellow-crowned Night-Heron †	o	o		
White Ibis	r	r	r	

WATERFOWL

Whistling Swan	o	u	u	
Snow Goose		o	o	
Canada Goose †	u	u	c	
Brant		r	r	
Mallard †	u	u	u	u
Black Duck †	u	u	u	u
Gadwall		o	o	
Pintail	r	o	o	
Green-winged Teal	o	o	o	
Blue-winged Teal †	r	r	r	r
American Wigeon	o	o	o	
Wood Duck †	c	c	c	c
Canvasback	r	o	o	
Redhead	o	o		
Ring-necked Duck	u	u	u	
Lesser Scaup	u	o	o	
Common Goldeneye		o	o	
Bufflehead	r	o	o	
Ruddy Duck	r	o	o	
Hooded Merganser †	u	o	o	u
Common Merganser	o	r	o	
Red-breasted Merganser	o	r	o	

VULTURES - HAWKS - EAGLES -

OSPREYS

Black Vulture †	u	u	u	u
Turkey Vulture †	c	c	c	c
Osprey	o	r		

s S F W

— Cerulean Warbler	o			
— Blackburnian Warbler	o	o		
— Yellow-throated Warbler †	u	u	u	
— Chestnut-sided Warbler	o	u		
— Bay-breasted Warbler	o	o		
— Blackpoll Warbler	u	o		
— Pine Warbler †	c	c	c	u
— Prairie Warbler †	c	c	c	o
— Palm Warbler	u	u		
— Ovenbird †	a	a	c	
— Northern Waterthrush	c	u	u	
— Louisiana Waterthrush †	c	c	c	
— Kentucky Warbler †	r	r	r	
— Common Yellowthroat †	c	c	c	u
— Yellow-breasted Chat †	u	u	u	
— Hooded Warbler †	c	c	c	
— Wilson's Warbler	r	r		
— Canada Warbler	o	o	o	
— American Redstart †	c	c	c	

MEADOWLARKS - BLACKBIRDS - ORIOLES

— Bobolink	o	r		
— Eastern Meadowlark	o	o	o	r
— Red-winged Blackbird †	u	u	c	c
— Orchard Oriole †	u	u		
— Northern Oriole	u	u	o	r
— Rusty Blackbird	o	o	o	
— Brewer's Blackbird		r	r	
— Great-tailed Grackle	o	o	o	o
— Common Grackle †	c	c	c	c
— Brown-headed Cowbird †	c	c	c	c

TANAGERS - GROSBEAKS - FINCHES

— Scarlet Tanager †	u	r	r	
— Summer Tanager †	u	u	u	
— Cardinal †	c	c	c	c
— Rose-breasted Grosbeak	u	u		
— Blue Grosbeak †	u	u	o	
— Indigo Bunting †	c	c	u	
— Evening Grosbeak	o	o	u	
— Purple Finch		o	u	
— Pine Siskin	o	u	u	
— American Goldfinch †	c	u	u	c

SPARROWS - BUNTINGS

— Rufous-sided Towhee †	c	c	c	c
— Savannah Sparrow	u	o	u	
— Dark-eyed Junco	o	c	c	

s S F W

— Tree Sparrow	r	o	o	
— Chipping Sparrow †	u	u	o	r
— Field Sparrow †	u	u	u	u
— White-crowned Sparrow	r	r	r	
— White-throated Sparrow	u	c	c	
— Fox Sparrow		u	u	
— Swamp Sparrow	u	r	o	u
— Song Sparrow †	u	u	u	u



NOTES

Date _____ Time _____

Observers _____

Weather _____

Tides _____
