MACKAY ISLAND NATIONAL WILDLIFE REFUGE

Currituck County, North Carolina
and
Virginia Beach, Virginia

ANNUAL NARRATIVE REPORT

Calendar Year 1995

(Acting) 2/27/03

Refuge Manager **Date**

3-28-03

Refuge Supervisor **Date**

4-2-03

Regional Chief, NWRS **Date**

INTRODUCTION

Mackay Island National Wildlife Refuge (NWR) was established in 1961 as a wintering area for greater snow geese and feeding habitat for other migratory birds - primarily waterfowl. It is located on the north side of Currituck Sound which has been long recognized for supporting significant migratory waterfowl populations and tremendous sport fisheries resources.

Major land acquisition totaling about 7,000 acres was completed in the early 1960's. Most recently, an expansion project (initiated in 1989) promised to add another 1,340 acres through donation and matching grants. Within this expansion project, 941 acres have been added to the refuge through a 72 acre fee title purchase and the remainder in donations from the J. P. Knapp Foundation and The Conservation Fund. This brings the refuge total to 8,024 acres. Approximately 85 percent of the refuge is situated in North Carolina with the remainder in Virginia. Virtually all acreage is under active management.

Mackay Island NWR is actually a composite area consisting of Mackay Island, parts of Knotts Island west of Highway 615, a portion of the mainland extending from Virginia Beach and extensive marshes connecting these higher grounds. The refuge is bounded on the north by Back Bay and to the east by the North Carolina Outer Banks. Connection to the mainland from Knotts Island is by Highway 615 (the Causeway) that cuts east to west through the refuge. The refuge maintains a gravel road connecting Knotts Island and Mackay Island. Elevations range from 0 to 10 feet above sea level. Table 1 shows the acreage of each habitat type/land use.

TABLE 1

HABITAT TYPE	APPROXIMATE ACRES	PERCENTAGE
Wetland-Estuarine	6,018	75
Woodland	1,524	19
Buildings, Roads, Etc.	262	3
Cropland	220	3
TOTAL	8,024	100

Historically, salinity levels in the surrounding waters of Back Bay and Currituck Sound have fluctuated between 1-10% sea strength. Most often they were below 10% and normally between 3-8%. In the early 1980's, salinity levels exceeded 10% but more recently, salinity has ranged between 1-3%. Submerged aquatic vegetation (SAV) had been abundant in these waters but this is no longer true. The declines in SAV (Miriophyllum, Potomogeton, Vallisneria, Ruppia, etc.) are not fully explained but speculative causes include high salinity, agricultural runoff, and urban effluent.

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A. HIGHLIGHTS

A permit package for the restoration of the Kitchin Impoundment was submitted and declined. Negotiations for mitigation continue. D. 4.

A total of 275 kids and parents attended the Greenwing Fishing event. H.4.

Trophy deer harvested in refuge deer hunt. H.8.

B. CLIMATIC CONDITIONS

Weather for 1995 was not highlighted by any major storms or hurricanes. The winter was relatively mild (only 36 freeze days) except for an intense period of "real" winter in late December with snow proceeded by an ice storm. Rainfall for the year was normal with 31.94 inches.

TABLE 2
MACKAY ISLAND NATIONAL WILDLIFE REFUGE
ANNUAL WEATHER REPORT - 1995

MONTH	PRECIPITATION	TEMPERATURE HIGH	TEMPERATURE LOW	FREEZE DAYS
January	1.61	69.8	22.6	8
February	4.03	62.0	15.0	9
March	2.10	75.0	28.0	2
April	2.28	83.0	33.0	0
May	2.85	91.4	44.4	0
June	3.94	99.1	58.8	0
July	2.54	103.8	71.0	0
August	1.88	*	*	0
September	1.90	86.4	56.1	0
October	4.07	83.3	43.9	0
November	2.47	75.7	30.2	4
December	2.27	69.3	25.2	13

C. LAND ACQUISITION

1. Fee Title

The east side of the refuge along NC State Highway 615 and it's extension north into Virginia continues to undergo development which impacts the refuge programs. Numerous small tracts of land still exist in private ownership between the refuge boundary and the highway. Many of these tracts which have been in agriculture are becoming sites for permanent trailers and houses, complete with families who may or may not appreciate the attributes of the refuge in their backyard. A major problem for the refuge occurs with our burning program. Each year it becomes more difficult to burn due to smoke management concerns. The Knotts Island Community is growing - resulting in increased pre-suppression efforts to protect additional lands and structures from arson. Also, with increases in people on the refuge boundary, the number of law enforcement violations increase. A significant problem currently exists with the trespass of domestic animals and illegal hunting on the east boundary line. In April, letters of inquiry were sent to selected landowners to ascertain whether there were willing sellers in this area. Since few responses were received, it may be assumed that land acquisition is not the solution to the problems described above.

D. PLANNING

4. Compliance with Environmental and Cultural Resource Mandates

In January, a permit package for the restoration of the Kitchin Impoundment was sent to the Corps of Engineers (COE, Washington NC). In April, a letter was received from North Carolina Division of Coastal Management which stated that the project was inconsistent with Coastal Area Management Act (CAMA) Regulations. No permit can be issued by the COE unless the project is found to be consistent under CAMA or a variance is obtained from the North Carolina Coastal Resources Commission. The project was deemed inconsistent with CAMA Regulations since 100 acres of emergent marsh would be converted to submerged aquatic vegetation (SAV) under this project proposal. SAV is not considered wetlands under CAMA Regulations. Apparently, the Division of Coastal Management is the sole objector to this project. Extensive consultations took place in 1994 to alleviate the concerns of National Marine Fisheries, North Carolina Marine Fisheries, North Carolina Wildlife Resources Commission, Environmental Protection Agency, North Carolina Division of Water Quality, and COE. After numerous alternatives were discussed, the refuge offered CAMA mitigation for the perceived loss of wetlands. CAMA staff visited the Refuge in June to look at an area south of Mackay Island Road which was impounded by the road prior to the establishment of the Refuge. The Refuge informally offered to restore hydrology to this area through the installation of numerous pipes under the road. After much discussion on site the CAMA staff decided they would discuss this issue more and let us know of their decision at a later date. Two months after the meeting we received a call from CAMA with the decision that this type

of mitigation would not be appropriate as mitigation. Numerous discussions occurred with CAMA concerning mitigation until December when a decision was made to seek advice from the Regional Solicitor on what our next step will be. A package of information on the Kitchin Impoundment was sent to the Regional Solicitor via the Regional Office in December.

A COE Nationwide Permit was submitted in January to allow the installation of a dry hydrant along the Marsh Causeway. The Knotts Island Volunteer Fire Department requested this use and would supply all the needed materials and personnel for installation. The COE Permit was later received and the dry hydrant project was completed in August. This dry hydrant was considered critical to fire protection for the community of Knotts Island.

In May, a moist soil management plan was developed and sent to COE and North Carolina Division of Environmental Management (DEM) under COE General Permit 297 to permit the disking of moist soil units. The COE and DEM concurred with this action and a water quality certification was received in June.

E. ADMINISTRATION

1. Personnel

1. Kenneth L. Merritt	Refuge Manager EOD 08/22/93	GS-11 PFT
2. Ben G. Nottingham	Ass't Refuge Manager Transferred 09/01/95	GS-09 PFT
3. Peggy VanZant	Office Assistant EOD 01/13/92	GS-05 PFT
4. Timothy G. Williams	Engr. Equip. Operator EOD 04/21/85	WG-08 PFT
5. Michael R. Panz	Police Officer EOD 09/28/86	GS-07 PFT
6. Robert Futrell	Maintenance Mechanic EOD 07/01/90	WG-10 PFT
7. David Wales	Forestry Technician Period of Work 1/1/95 - 03/31/95	GS-04 TFT
8. Dorothy Foskin	Forestry Technician Period of Work 1/1/95 - 03/31/95	GS-04 TFT

Staff Training:

RM Merritt attended Negotiations Training in Norfolk (1/25-26), a Regional Steamlining Committee meeting at Wheeler NWR (2/28), the 40 hour Law Enforcement refresher training at Quincy, FL (March), Project Leaders meeting in Columbia, SC (4/13) and the Project Leaders meeting in Atlanta (5/22-26).

ARM Nottingham attended S-290 and S-390 fire training courses at Bombay Hook NWR in Delaware (1/23-27), the 40 hour Law Enforcement refresher training at Quincy, FL (March), Windows Computer Training (2/2), Fire Management for Line Officers training in Atlanta, GA (4/4-7) and a Wetlands Reserve Program training session in Greenville,

NC (5/22).

RLEO Panz attended S-290 and S-390 fire training courses at Bombay Hook NWR in Delaware (2/23-27), provided training assistance during ROBS, FLETC Glynco (February), completed 40 hour Law Enforcement refresher training at Quincy, FL (February), and provided training assistance during Basic Refuge Officer Training at FLETC, Glynco, GA (8/4-7).

Office Assistant VanZant attended a memory management course in Norfolk (4/24-25).

Maintenance Mechanic Futrell traveled to Minnesota to learn first hand how to install electric deer fencing (8/14-18).

The staffing pattern for the past five years is depicted below:

TABLE 3
Number of Employees

Year	Permanent Full-Time	Permanent Part-Time	Temporary Full-Time	Total FTEs
FY 1995	5.8	0	0.50	6.50
FY 1994	6.0	0	0.50	6.50
FY 1993	6.0	0	0.85	6.85
FY 1992	6.0	0	0.85	6.85
FY 1991	4.9	0	0.50	6.50

2. Youth Programs

The refuge provided Youth Conservation Corp (YCC) opportunities for two youths from mid-June to mid-August. The program was again very successful providing YCC enrollees good conservation work experience and having the refuge receive help. Adam Ansell and J.P. Robbins performed a variety of tasks including painting, vehicle maintenance, landscaping, boundary posting and clearing, building maintenance, wood duck banding and providing office support. At various times, YCC enrollees received environmental education tasks and were exposed several times to field work consisting of surveying piping plover nesting activity and banding.

4. Volunteer Program

The volunteer program continued to support the refuge operations with a relatively high number of volunteer hours. The total number of hours donated in 1995 increased slightly from 1994's 1,950 hours to 2,315 hours, yet the number of volunteers decreased from 87 to 53 individuals.

The Currituck Chapter of Ducks Unlimited (DU) contributed 1,500 hours of volunteer time with organizing and conducting the kids fishing day. On August 12, 275 children participated in the event run by forty-two DU members.

Volunteers assisted the refuge in other facets of public use of the refuge. Larry Wales continued to add a sizeable number of slides to the refuge slide file and assist with various festival events. Several volunteers assisted refuge staff with Open Roads Day, Open House, special requests for refuge tours, and refuge slide shows.

Scouting support consisted of a major cleanup on March 11 by 30 Boy Scout, Girl Scout and Cub Scout troop members completing a major trash cleanup along the Causeway. Five large truckloads of garbage were hauled away. On April 8, the Refuge thanked the Scouts for their support with a nature hike and talk for their naturalist and forester merit badges, followed by a cookout at the Visitor Center.

On August 26, 15 volunteers were given an Appreciation Dinner at the Refuge Visitor Center to honor their accomplishments during the past several years.

5. Funding

Funding levels increased slightly over the last five years which basically further reduced our ability to operate due to rises in fixed costs such as salaries and benefits, and inflation. Again, the DU contribution was held over due to our inability to obtain the proper permits to proceed with the Kitchin Impoundment Project. An additional $2100.00 was received from the Asheville Endangered Species Office for support of piping plover census work at Currituck NWR. Operational fire funding remained sufficient to maintain the refuge burning program.

	FY-95	FY-94	FY-93	FY-92
Base Funding-1261/1262	$261,200	$270,000	$254,200	$245,900
DU Reimbursable Account (1971)		$143,300	$143,300	$143,800
				$145,800
Fire Funding (9120)	$2,000	$62,200	$182,855	$28,100
Private Lands (1120)			$9,600	
Small Maintenance Funding (1262)	$38,000		$20,000	
Endangered Species (1130)		$3,000		
Endangered Species (1113)	$2,100			

6. Safety

One lost time accident occurred in 1995. Equipment Operator Williams injured his back while installing a new Refuge entrance sign on April 11. He lost 2.5 days work due to lower back muscle strain.

Maintenance Mechanic Futrell was out three weeks in May recuperating from a hernia operation.

Safety meetings were held throughout the year. Topics included: Aids in the Workplace (March), Highway Hydroplaning (May), Tick Bites and Prevention (June), Hearing Protection and Tests (July), and CPR/Basic First-Aid (August).

8. Other Items

A revenue sharing check was distributed to Currituck County in the amount of $53,678.00. The City of Virginia Beach also received a revenue sharing check in the amount of $2,588.00. A continued decline over the last several years makes it difficult to maintain a healthy relationship with county and city officials.

"Fishing Day " sponsored by Ducks Unlimited

F. HABITAT MANAGEMENT

1. General

Habitat management at Mackay Island NWR has been accomplished by a variety of techniques including: (1) water level manipulation in four impoundments (26-550 acres in size), (2) prescribed burning, (3) forest silviculture practices (salvage cuts & reforestation), and (3) mechanical treatments such as disking and mowing to control undesirable vegetation or to promote selected vegetation in moist soils. A cooperative farming program is employed which enables the refuge to provide supplemental green browse, and to a lesser extent, cereal grains for wintering snow and Canada Geese.

2. Wetlands

West Pool

The West Pool is a 26-acre moist soil unit which has been managed for a longer period than any other impoundment on the refuge. Water levels are managed by capturing tides and augmented by pumping.

A flooded condition was maintained through January with a gradual draw down from March 15 (2.20) to June 1 (.085). Ditch top levels were maintained until July 1 when water levels were dropped further to allow disking of the eastern portion of the unit which was dominated by non-food species. Disking was completed on July 18 and the area was immediately reflooded to saturate soils. Water levels were allowed to drop to just above ditch top for the remainder of the growing season. Dabbler use was good during January, February, and March with 300-500 ducks including mallards, green-winged teal, and black ducks using the area on a daily basis. In September, vegetative transects were completed to assess vegetation response. The West Pool had a jump in good food plants from 20.3 percent last year to 37.5 percent this year. Total fair and good food plants was 56.0 percent of the area, about the same as last year. Due to the late season disking, much of the east side of the impoundment remained bare. This occurred despite the maintenance of a moist soil condition from July 18 to the end of the growing season. Bermuda grass (Cynodon dactylon), fall panicum (Panicum dichotomiflorum), and water hyssop (Bacopa sp.) were the dominant plant species this year with a high percentage of bare ground (23 percent). Alligatorweed (Alternanthera philoxeroides) dropped from 12.2 percent composition last year to 4.5 percent in 1995. The spraying of this species in 1994 appears to have been effective. From October 1 through 15, water levels were increased by pumping from Currituck Sound. Water levels increased naturally with rainfall in late October, November, and December. Waterfowl use of the impoundment began again in late October and throughout the month of November with up to 800 ducks including mallards, pintail, green-winged teal, and shovelers feeding in the western half.

Middle Pool

The Middle Pool is approximately 550 acres in size. The impoundment's current

management strategy includes managing it as a flooded forest and a partial SAV impoundment where light reaches the previously cleared areas. Trees standing in the impoundment are of non-commercial value and growth is second or third generation. The forest canopy is composed mainly of loblolly pine, sweet gum, black gum, red maple and willow.

This impoundment was held at full pool for virtually all of 1994 and 1995 which was different from the previous moist soil management in prior years. This action was done to retard the encroachment of pines and rank shrubs in open areas. The wax myrtle understory of the forested areas and a fair number of pines in the overstory started to stress after two years of continuous flooding.

The impoundment was used in January, February, and March by a daily average of 300-500 ducks. Peak duck numbers were reached in mid-January at 800 with mallards, black ducks, and wood ducks the most numerous. Waterfowl numbers for this impoundment are no doubt underestimated since a majority of the area is in flooded timber and cannot be censussed effectively. One hundred to two hundred coots also used the area on a regular basis during the first three months of the year.

Vegetation transects were completed in September. This impoundment developed a tremendous amount of niad (47.5 percent) which is classified as a very good waterfowl food. This species replaced much of the Utricularia spp. that was the dominant plant last year occurring in 43 percent of the sample plots. Coontail (Ceratophyllum demersum) and bladderwort also occurred in significant numbers in the surveys. Coontail was not observed in last year's surveys and bare ground decreased from 40 percent in 1994 to 15.7 percent this year. Moist soil species were largely absent with high water levels during the year. Nineteen percent of the transect samples revealed either no plant species or those showing no food value.

This impoundment provided excellent wood duck habitat in summer as evidenced by casual observations of 1,000 to 2,000 woodies that visited the pool in July and August. Many wood duck broods were also seen in the impoundment indicating good brood habitat. Waterfowl numbers increased significantly in the November-December period over the same time period last year. Waterfowl began using the area in significant numbers in late October with up to 500 ducks using the area. During the months of November and December, 2,000-3,000 ducks including mallards, green-winged teal, gadwall, black duck, and wood duck used the impoundment regularly. Again, survey numbers probably underestimate the waterfowl using this area since mallards, black ducks, and wood ducks used the flooded timber extensively. Coot numbers increased from 350 in late October to 1,150 in mid-December.

East Pool

Water elevations were manipulated this year to maximize a diversity of wildlife use. A normal pool level was maintained during the winter to permit migratory waterfowl feeding on SAV species. Vegetation transects were completed in September revealing a good density and distribution of SAV species with Myriophyllum and Ceratophyllum species dominant. The amount of good/fair foods increased slightly from 63 percent last

year to 72 percent this year. Bare areas and non-food vegetation decreased from 36 percent last year to 27 this year. Puddle duck use by mallards, gadwall, black duck, green-wing teal, pintail, and wigeon was well above normal in January with a peak of 4,000 early in the month. The daily average for the month was 3,500 which was also higher than normal. Duck populations quickly declined during the next two months with a daily average of 1,000 in February and 200 in March. Coot numbers were much less than normal with an average of 200-300 in January, February, and March. Water levels were gradually drawn down from early January to the end of March to insure that declining SAV was available to waterfowl. In April, water levels were increased through a combination of rainfall and pumping to enhance SAT through the growing season.

Vegetation transects were completed in September revealing a good density and distribution of SAT species with Myriophyllum sp. and Ceratophyllum sp. dominant. The amount of good/fair foods increased slightly from 63 percent last year to 72 percent this year. Bare areas decreased from 36 percent last year to 27 percent this year and non-food (bare areas and non-food plants) decreased from 37 to 28 percent. From early November to the end of December, water levels were lowered gradually to maintain the availability of SAT to waterfowl. Waterfowl numbers were well above average during the last two months of the year. Average daily waterfowl numbers in November were estimated at 3,000 with an average of 6,000 in December. Mallards, gadwall and green-winged teal were the most numerous species using the impoundment. Coots arrived in late October with a peak of 350 and continued to use the area heavily through the end of the year. November and December peak number of coots reached 1,150 and 650 respectively.

Kitchin Upland Impoundment

Constructed in 1990, this 26-acre impoundment has experienced mixed success in achieving desirable waterfowl habitat objectives. This impoundment was established on upland farmfield and originally planned to be operated as a moist soils management area. However, the impoundment has had a continuing problem of not holding water due to permeable soils and an inefficient 30 year old pump. To offset these problems, a DU MARSH project proposal was previously developed to install a new higher velocity pump and to decrease the required head pressure by installing a new delivery pipe. The pipe was installed in August but the pump and rip-rap for erosion control on the inlet channel remain to be acquired.

This year, the impoundment was managed as a moist soil unit and fallow area for the upper elevations. The impoundment floor is quite variable in elevation and cannot be effectively managed for moist soil throughout. General observations showed that the water level was kept only half full at the start of the year due to pump difficulties. Up to 350 ducks and 100 swans used the impoundment to feed on moist soil plants, grasses, and roots from January to March. Water levels were allowed to decline gradually in the spring with normal evaporation and transpiration. No vegetative transects were accomplished but the lower areas contained excellent moist soil species including; millet (Echinochloa crusgalli), fall panicum, and smartweed (Polygonum spp.). Upper elevations contained a variety of upland plants which could be classified as mostly non-food plants. By June, all water had evaporated from the impoundment and continuing

pump problems prevented the maintenance of a moist soil environment. Water could not be pumped into the unit in the fall due to a broken pump which was too costly to repair. The unit remained dry through the last three months of the year with insufficient rainfall to flood the area.

Great Marsh

The Great Marsh or Middle Marsh area is a heterogeneous 5,000 acre tract of emergent marsh that comprises most of the refuge. Water levels are largely uncontrolled in this slightly brackish water marsh. There are two fixed crest weirs that control a minimal water level in two very small ponds. A similar weir is maintained at the Woods Pond near Currituck Sound. These structures retain stable water during low-tide events and attempt to enhance SAT growth. Infrequent observations showed that these weirs are working to hold water and some SAT vegetation was present. No vegetation transects were conducted to accurately quantify the success of the weirs.

Bays and Canals

Buck Island Bay, NC, Bellows Bay, NC, Flynn's Folly, VA and Bull's Bay VA are within the refuge boundary. They have historically supported significant growths of aquatic vegetation, including Eurasian milfoil, chara, naiads, sago pondweed, and wild celery. High salinity and siltation in the 1980's severely decimated these aquatic food beds, especially those on the Virginia end of the refuge. This year's beds of milfoil and other aquatic grasses appeared to significantly increase in Bellows Bay, Flynn's Folly, Bull's Bay, and Barley's Bay.

Crawfish Impoundment

A small scale management study to evaluate the compatibility of crawfish production and habitat for wintering waterfowl was discontinued this year. After several unsuccessful years of stocking the pond and managing for crawfish and waterfowl it became apparent that the site was too small (1.3 acres). Predation by egrets and herons, raccoons, and river otter all but decimated the few crawfish that were produced this year. Early in the year, this site attracted a small number of puddle ducks (20-70) that fed on a good production of SAT that was produced in 1994. In the spring, the impoundment was allowed to gradually dry, yet the bottom was kept covered with at least 3-5 inches of water. In late May, crawfish trapping was conducted with marginal returns. In June the impoundment was allowed to dry to the drainage ditch where moist soils were maintained. During the summer-fall, fall panicum grass was produced along with some knotgrass and smartweeds. In November, the impoundment was pumped full and it was discovered that the impoundment had apparently settled or shifted to cause some seepage. Repairs were made to the dikes and the area was reflooded. Fall-early winter waterfowl use was fair with 20-40 ducks present. Waterfowl using this impoundment are subject to considerable disturbance with the headquarters road bordering the west side.

3. Forests

There are approximately 1,500 acres of forest on the refuge, of which an estimated 350

acres have commercial value. In recent years pine beetle have afflicted the area and some refuge pine forests; however, no sizeable pine beetle infestations were seen this year.

4. Croplands

The refuge farmland acreage measures 220 acres which are farmed under a cooperative farming agreement with Mr. Bonney Bright, the only farmer that operates on Knotts Island. In early April, a cooperative agreement was signed to cover the Mackay Island and Kitchin Tract areas (170 acres); this year the entire cooperative farm acreage was divided into two agreements; one annual agreement for the Knotts Island fields and a two year agreement for the Headquarters field. The Knotts Island fields were planted in a wheat-soybean rotation and the headquarters field will be planted in a corn-wheat-soybeans-wheat (green manure) rotation.

Mr. Bright provides all equipment, seed, fertilizer, pesticides, and labor to farm a total 170 acres for his use. The refuge received its' shares in winter wheat at the Headquarters farm fields and custom planting of winter wheat at Live Oak Point. Live Oak Point received heavy use by snow geese and small numbers of Canada geese in the fall-winter of the year. The refuge was successful this year in persuading Mr. Bright to plant early on Live Oak Point to feed early arriving snow geese. As often happens, 6,000-8,000 snow geese arrived in October and completely denuded the area. Subsequently, little goose use occurred until December when the wheat partially recovered. Up to 250 Atlantic Population Canada geese used the area for feeding in January, February, and December.

Mr. Bright received a mixed return on his crops across his 120 acres of cropland on the Knotts Island tracts. Winter wheat produced well on the 120 acres 40-45 bushels per acre; soybean yields were poor (10 bushels/acre) due to inconsistent rain and deer depredation. The 47-acre Kitchin Tract was planted in corn. The corn grew well early but suffered at mid-season with drought and ended up producing a meager 32 bushels/acre yield. Winter wheat was planted late in 1995 after the corn was harvested and sparse rains and cold temperatures in December resulted in little green browse until spring green-up.

In 1994, plans were made to establish an experimental plot of a minimum-input, minimum-maintenance forage crop in the fall for wintering Canada and snow geese. Several consultations with extension and agronomists were made to gather advise on the best species to plant for growing cool season forage. Several species of Ladino clover (7 pounds/acre) were selected to be mixed with annual rye (17 pounds/acre). After soil testing and fertilizing, this seed mix was planted in early October (1994) by Mr. Bright as part of his rent owed. Because we were not sure of the success prospects of this planting and fiscally limited, we opted to plant 15 acres of this clover-rye mix. Mr. Bright wet seeded (or water dispersed) the clover overtop of the drilled rye. By November, much rye had emerged but the clover grew up spotty over much of the area.

In a follow up evaluation of the area in 1995 it was found that little of the clover actually germinated and went to seed. Small patches of clover were smothered by invading weeds including mustard and Johnson grass and the project was discontinued. Canada geese and snow geese did use the area for feeding in February and the first part of March but it was

difficult to tell if they were attracted by the rye or clover.

9. Fire Management

Mackay Island NWR has an active fire management program and attempts to burn roughly 2,000 of 6,000 acres under prescription each year. The objectives of burning are to discourage woody vegetation encroachment, reduce hazard fuel levels, promote nutrient exchange, and improve conditions for snow geese feeding on marsh grasses. Burning makes the roots of giant cordgrass more available and it is not unusual to find geese on the burned areas immediately following the fire. Three prescribed burns totaling 1,575 acres were completed this year. Three arson fires were ignited this year, burning a total of 26 acres.

10.Pest Control

Pest control is applied through various facets of cooperative farming, marsh management, and trapping programs.

Because the coop farmer employs minimum-tillage and no-till practices, some pre-emergent pesticide applications are depended on each year. The refuge is continually working with this farmer to reduce the number and quantity of pesticides used through gradual implementation of various integrated pest management (IPM) practices. In 1994, nine pesticides were approved (Project Leader and Regional Office levels) but only six were used. The following pesticides were utilized to control the listed pests.

TABLE 4

Pesticide	Used To Control
Roundup	Johnsongrass, Phragmites
Weedar 64 (2,4-D)	Broadleaf weeds in wheat, corn
Duel 8E (Metochlor)	Grasses, broadleaf weeds in
Harmony Extra	Mustards in wheat

As in 1994, we were unable to interest trappers in the area due to low prices for muskrat and nutria. We did receive several inquiries about whether the refuge was willing to pay trappers for this service, the refuge declined. Trapping of these furbearers is considered a management tool to avoid high populations and subsequent damage to the marsh. If low prices for furs continues and we are unable to attract trappers it is likely that habitat damage to the marsh will occur as well as severe furbearer die-offs.

Crop management by refuge staff.

G. WILDLIFE

2. Endangered and/or Threatened Species

In recent years, Mackay Island NWR had been used by bald eagles during the late fall-winter period, however eagles were seen in warm seasons also. During the first three months of the year, 2-3 bald eagles were commonly seen at the East and Middle Pools. Aerial surveys by Dr. Mitchell Byrd on February 23-24 revealed no nesting activity on Mackay Island.

Several observations of single, immature bald eagles occurred in July and August. These observations were sporadic and it was not until November-December that mature and immature bald eagles (2-4) used the refuge on a regular basis.

A small number of peregrine falcons are typically seen during the fall migration. One to two birds were regularly seen in September hunting over the impoundments.

3. Waterfowl

Wintering waterfowl use at Mackay Island has been highly dependent on winter severity and habitat condition. Due to the lack of harsh winter weather and depleted SAT beds, waterfowl use has been well below historical use levels over the last six to ten years. November through February are typically the highest use months. Beginning in the 1993-94 wintering season (November 1993), aerial surveys were conducted bimonthly; this represented a doubling of aerial survey effort. These flights were done in conjunction with biweekly ground surveys to assess use. During the 1994-95 winter, the overall waterfowl use was up 9% from the previous year (Table 5). Increases in ducks and coots in refuge impoundments and bays correlated with fall forecasts and improvements in submergent aquatic vegetation.

TABLE 5
WINTERING WATERFOWL OCCURRENCE ON
MACKAY ISLAND NWR
1994-1995

GROUP	PERCENT	NUMBER OF USE DAYS	PERCENT DIFFERENCE FROM 1993-1994	PEAK NUMBER	PEAK PERIOD
Tundra Swans	4.1	49166	-5	1503	12/21/94
Canada Geese	1.5	17603	35	418	11/21/94
Snow Geese	49.2	594087	3	12100	2/16/95
Ducks	38.6	465337	18	5492	12/9/94
Coots	6.6	79668	18	1554	11/11/94
All Waterfowl	100	1205860	9	13214	1/13/95

A. Snow Geese

Snow goose use for 1994-95 rose slightly from last year increasing 3 percent in use days but peaking well below last year's high of 16,800. Flocks of 6,000 to 8,000 used the Great Marsh from middle January to the end of February.

B. Tundra Swan

Swan use was similar to last year though surveys showed a 5 percent decline. This decline continues a trend that has occurred the last 5 years. Reduced use of the refuge is probably related to improved habitat conditions throughout Back Bay and Currituck Sound.

C. Canada Geese

Migrant Canada geese use increased by 35 percent over last year but remained miserably low when compared to historical records. Several small flocks totaling 100-150 geese used the refuge regularly through the winter with a peak of just over 400 occurring in late November. 150-200 Canada geese regularly used Live Oak Point in mid-January. The Great Marsh south of the Causeway was also used regularly during the months of January and February.

Over the last several years, the refuge has received increased use by resident Canada geese during the nesting season. Marshes around Mackay Island and impoundment fringes are the primary nesting areas. At least 11 broods of goslings were seen during the summer in and around Mackay Island. Toward the end of July, congregations of family groups and immature geese were observed in the West Pool and along the southern shores of Mackay Island. These groups ranged from 60-75 birds.

D. Ducks and Coots

Overall duck use in 1994-95 increased 18 percent from the previous year (Table 6). Duck habitat in impoundments and bays was improved from last year with an increase in submerged aquatic vegetation and all impoundments were fully watered during the majority of the season.

The 465,337 use-day total for 1994-95 was 18 percent greater than the previous year and is right at the 10 year historical average. Still, with all time low flyway numbers in the last 10 years, accompanied by poor habitat conditions, duck use is significantly down from the long term historical average for the refuge.

TABLE 6
COMPOSITION OF DUCKS WINTERING ON MACKAY ISLAND NWR
1994-1995

SPECIES	PERCENT	NUMBER OF USE-DAYS	% DIFFERENCE FROM 1993-1994	PEAK NUMBER	PEAK PERIOD
G. W. Teal	9.8	118,416	+43	4,000	03/13/95
Gadwall	12.3	148,131	+30	2,361	12/17/94
Mallard	7.4	89,152	-18	1,466	12/09/94
Black Duck	4.0	44,791	-42	1,260	12/21/94
Wood Duck	0.4	4,486	-25	119	12/17/94
B. W. Teal	0.1	1,293	-6	33	10/20/94
Shoveler	1.2	14,806	+22	297	12/17/94
Wigeon	1.6	19,859	+31	616	01/13/95
Pintail	0.9	11,282	+36	255	01/13/95
Ruddy Duck	0.2	2,194	+284	68	12/21/94
Bufflehead	0.0	420	+48	10	11/21/94
Merganser	0.0	373	-47	19	11/21/94
Ringneck	0.5	6,032	+3,091	240	02/23/95
Canvasback	0.0	260	+1,138	40	12/21/94
Redhead	0.0	432		60	1/5/95
Scaup	0.0	390		21	12/3/94
Unknown	0.0	22	-90	2	02/16/95
All Ducks	38.6	465,337	+18	5,492	12/09/94

Dabblers heavily characterize the duck use and typically feed on SAT or seeds from moist

soil habitats. Green-wing teal, gadwall, shoveler, wigeon, and pintail showed significant increases over last year. These increases were likely related to more plentiful food in the impoundments and bays and more ducks returning from the breeding grounds.

Coot numbers also increased this year with 18 percent more than the previous year.

Diving duck use continued to be well off long term historical averages. Exceptions to this trend in 1994-95 were ringneck ducks and canvasbacks. In particular, ringneck use was extremely high based on 10-year averages and this use was concentrated in the Middle Pool where an abundance of bladderwart was present.

Wood Duck Production

Since the wood duck nesting box program began in 1970 when thirty-seven pairs of wood ducks from Patuxent Wildlife Research Center were released on the refuge, the number of nest boxes installed on the refuge has swelled to 151. Nest box use increased slightly in 1995 compared to 1994. One hundred and four of 150 functional boxes were used by wood ducks; this yielded a 68 percent use rate (60% rate in 1994). However, this use rate was appreciably lower than a 10-year average of 77% determined by former manager, Bill Hegge, during the 1980s. Successful nests per number of available boxes was 47 percent which is significantly lower than the 10-year average of 61% observed during the 1980s.

TABLE 8
Wood Duck Box Program
Nesting Year - 1995

	NUMBER	PERCENT
Total usable boxes	150	100
Total boxes checked	150	100
Estimated boxes used by wood ducks	104	68
Number of boxes with dump nests	10	6.7
Estimated boxes used by other ducks	0	0
Estimated boxes used by other wildlife	3	2
Estimated wood duck broods produced	72	48
Estimated wood ducks hatched	720	

4. Marsh and Water Birds

A variety of marsh and waterbirds (20+ species) inhabit the refuge at some part of the year. Several are year-round residents and nesters.

Sightings of little blue and green-backed herons in the Middle Marsh and Pools, and the year-round presence of several other heron and egret species led us to suspect that these species are nesting on or near the refuge. No documentation of nesting activity by wading birds was found this year on the refuge. Colonial water birds such as snowy, common, and cattle egrets, little blue and green-backed herons, and glossy ibises nest at a sizeable rookery south of Mackay Island on Monkey Island.

With the spring draw down in the East Pool, an appreciable number of wading birds utilized the shallow pools for feeding on small fish. It was not uncommon to see 30-40 common and snowy egrets congregating around one or two isolated pools in the East Pool during May. Great blue herons and glossy ibises also took advantage to feed in shallow East Pool water.

5. Shorebirds, Gulls, Terns and Allied Species

Observations of shorebirds occurred along the shorelines of bays and sounds when wind tides expose mudflats and in temporary wetlands and moist soil impoundments. In the fall, snipe and woodcock were seen in wet woods and along wetland interfaces. Common, least, sandwich, and royal terns are observed over the marshes from spring until fall. Greater black-backed, herring and ring-billed gulls are present year-round. Laughing and Bonaparte's gulls are more seasonal.

6. Raptors

Three species of owls, two hawks and ospreys are verified nesters at Mackay Island. Over 20 species of raptors use the refuge at one season or another. Bald eagles and peregrine falcons are the most noteworthy raptors. The refuge experiences a small but noticeable passage of migrant raptors such as Cooper's hawks, sharp-shinned hawks, merlins, kestrels, and red-tailed hawks in the fall. Turkey vultures are frequent fall and spring users as they roost in pine woods at several locations on the refuge.

Osprey production was assessed from May through August. Ten osprey platforms have been erected on the refuge. In 1995, only four platforms were used by osprey as nest sites. However, several osprey nests in snags were used in the Middle and East Pools. By July, an average of two young birds had successfully fledged from at least seven nest sites.

Screech owls have used wood duck nest boxes when boxes are inventoried and cleaned in mid-winter. Their use of the boxes does not seem to conflict with wood duck use since most of the owls leave before wood duck nesting peaks. In 1995, three boxes were used by screech owls.

7. Other Migratory Birds

Refuge woodlands, fields, and wetlands provide habitat for a variety of neo-tropical

migrants. Seventeen warblers make up the majority of this use. Many bobolinks used the LOP agriculture field in the spring on their return migration from South America.

8. Game Mammals

The white-tailed deer herd on the refuge and Knotts Island remained stable based on consistent observations of deer in the early evening. Refuge personnel observed 60-80 deer during pre-hunt season evenings in croplands adjacent to the office and in the farm fields by the shop on Knotts Island. Cursory examinations of deer harvested in the fall showed that most deer appeared to be in good health. However, this type of assessment is not representative of herd health. In 1993, a comprehensive serologic, parasitologic, and pathological evaluation was conducted on deer from Mackay Island and collected by biologists from the Southeastern Cooperative Wildlife Disease Unit. This examination found noteworthy signs of diseased and parasitized deer. The collective assessment (including APC results) indicated that the herd was exceeding the nutritional carrying capacity.

10. Other Resident Wildlife

Sightings of red fox increased this year and at least two litters of red fox were noticed on the refuge. No sightings of grey fox were made on the Knotts Island side of the refuge.

Bob-white quail are common at the refuge on agricultural field edges and wooded areas.

The refuge and its adjacent wetlands protect productive habitat for a diverse herpetological fauna. Impoundments on Mackay Island, other adjacent wetlands and uplands provide habitat for more than 26 documented species of amphibians and reptiles.

11. Fisheries Resources

Salinity in the adjoining Currituck Sound has varied over the last 25 years. In recent years, salinity has appeared to be fairly stable having declined from more saline conditions when saltwater was pumped into Back Bay and drought was prevalent in the late 1980s. This decline in salinity has allowed a partial recovery of SAT and some fishery resources including largemouth bass, crappie, bowfin, carp, yellow perch, channel catfish, and a variety of sunfish.

Through the spring and summer, most fishermen met with success in East Pool. Largemouth bass, bream, crappie, bowfin, and catfish were most frequently caught.

15. Animal Control

The refuge staff attempts to maintain a viable trapping program to aid in the control of muskrat and nutria populations on the refuge (Section H.10). The burrowing activities of these furbearers cause appreciable damage to the dikes and marsh roads of the refuge.

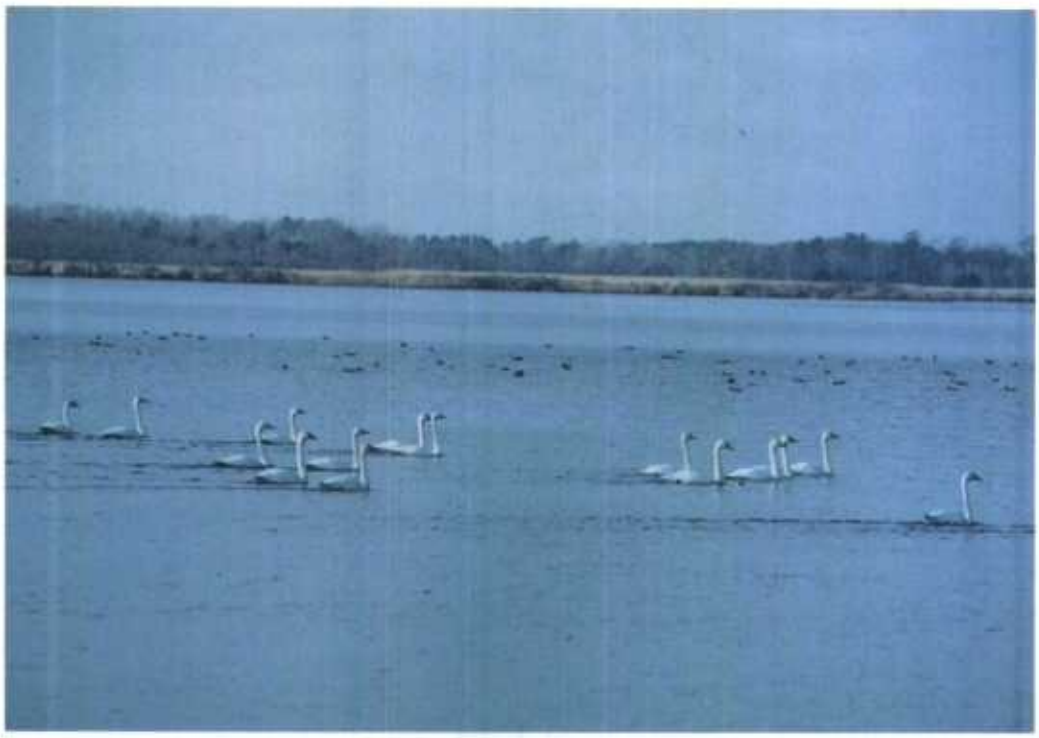
Free-roaming dogs and cats continue to be a problem at the refuge. Efforts are made to work cooperatively with Knotts Island residents to control their dogs and cats but compliance with refuge regulations is low. Public meetings were held at various sites in Currituck County to discuss the issue of roaming dogs. No decision had been made by the County by the end of the year.

16. Marking and Banding

Prebaiting for wood duck banding was started in April at the banding site on Mackay Island Road. Despite staff efforts to attempt to exceed 1994's 169 wood ducks banded, we were unable to capture any of the abundant wood ducks in 1995.

An bald eagle is keeping watch over the nest.

Snow Geese feeding in the marsh.



Tundra Swan.

Canadian Geese taking flight.

An Osprey perched on its nest.

H. PUBLIC USE

1. General

The refuge provides a variety of wildlife oriented public use and recreational opportunities. These include wildlife observation, hiking, bicycling, fishing, crabbing, boating and deer hunting. The Knotts Island Causeway and Mackay Island Road are open all year. The refuge marsh and dike/trail system are open from March 15 through October 15 each year. The dikes and marshes are closed from October 16 through March 14 to avoid conflicts with wintering waterfowl.

2. Interpretive Exhibits/Demonstrations

The refuge maintains an informational exhibit at the office. A kiosk at the entrance to Mackay Island Road displays a color map and a panel dedicated to Joseph Knapp. Regulations are posted at all public use areas.

7. Other Interpretive Programs

Refuge staff provided the following programs and tours.

January - Ken Merritt toured 90 students from Princess Anne Middle School, Ben Nottingham showed them a video and discussed career opportunities

February - Tim Williams and Volunteer Larry Wales operated an exhibit at the Virginia Beach Wildfowl Festival with Back Bay NWR staff

April - Mr. Nottingham led 20 Webelos Scouts on a nature hike for their naturalist and forestry merit badges. Peggy VanZant operated a display at the Knapp Middle School Earth Day event.

May - Mr. Nottingham spoke with 25 students from Knotts Island Elementary for International Migratory Bird Day. A tour and contest was held afterward.

July - Mr. Merritt and Mrs. VanZant operated a booth at the Knotts Island Peach Festival

August - Staff assisted the Currituck County Ducks Unlimited Chapter with the annual Greenwing fishing event. A total of 275 kids and parents attended.

October - The annual "Open Road Day" was held on the 8th in conjunction with "National Wildlife Refuge Week". The dikes were open to traffic and the staff provided educational materials and information. A total of 65 cars were counted during the day.

8. Hunting

The annual deer hunt was held in October, November and December on a non-quota system. Hunters were not required to check-in/out and could roam freely throughout the designated zones as long as they had a NC hunting license and a signed refuge brochure. Deer could be checked with any employee, at the Knotts Island Market or by phoning 1-800-I GOT ONE. The scheduled gun hunt dates were October 20/21, 27/28 and November 3/4, 10/11, 17/18, however the "furlough" caused the loss of the last two days. Bow hunting was allowed November 27--December 2. A total of 120 deer were harvested by 442 hunters in 14 days. The largest deer was taken by a hunter from Moyock, NC, weighing 210 pounds and sporting a very nice 14 point rack.

9. Fishing

A large part of our visitation comes from fishing, where more than 25,000 visits are estimated annually. Fishing is permitted on the dikes and in the marsh ponds/canals from March 15--October 15. The Knotts Island Causeway, the Great Marsh Trail and Mackay Island Road are open all year. The dikes and marsh are closed from October 16 through March 14 to minimize waterfowl disturbance.

10. Trapping

The abundance of nutria, muskrat, raccoon and damage to roads and dikes have provided the continued impetus for controlling these populations. Due to depressed fur prices, no trappers applied this year.

11. Wildlife Observation

Wildlife observation is an important recreational opportunity for refuge visitors. State Highway 615, which stretches 3.5 miles through the middle of the refuge to Knotts Island, treats winter motorists to the sight of tens of thousands of snow geese foraging in the marsh. Parking areas are provided at the entrance sign, the bridge over Coreys' Ditch and the Great Marsh Trail, but visitors may stop anywhere along the shoulder. Over 100,000 vehicles use the Causeway each year.

The Great Marsh Trail, at the east end of the Causeway, winds 1/3 mile around a horseshoe shaped pond and is open all year from sunrise to sunset. The first mile of Mackay Island Road is open all year for driving, hiking, bicycling, fishing and wildlife observation from sunrise to sunset. The Mackay Island Trail circles the East Pool for 3.8 miles. The Live Oak Point Trail follows 6.5 miles of dikes around all three impoundments, including portions of the Mackay Island Trail. The dike/trail system is open March 15--October 15, from sunrise to sunset for hiking, bicycling, fishing, crabbing and wildlife observation.

14. Picnicking

No facilities are provided expressly for picnicking, but visitors may lay a blanket down at

any of the public use areas.

17. Law Enforcement

Three employees have law enforcement authority; two collateral duty and one full-time officer. The full time officer splits his responsibility between Mackay Island and Currituck Refuges and assists other refuges, FWS Agents and state officers as requested. One collateral officer, Assistant Manager Ben Nottingham transferred in September.

Refuge officers work independently with little or no readily available back-up assistance. Currituck County Sheriff's Department has a Deputy for Knotts Island, however, he covers all of the north end of the county, and is often not close by. One Currituck Deputy covers a 25 mile long section of the Outer Banks, which includes the Currituck NWR. NC Wildlife and NC Highway Patrol Officers live on the mainland and are a minimum of one hour away. Virginia Officers have at least a 30 minute response time.

Statistics for 1995:

Incident Reports filed	175
Violation Notices issued	71
Written Warnings given	85
Verbal Warnings	277
Visitor Assists	742
Assist Other Agencies	21
Cases made by state officers	6

A breakdown of incidents by category:

Type of incident	# reported warnings	# written notices	# violation
Accident: Motor Vehicle	8		
Aircraft Incident	1		
Arson: Marsh	3		
Assist Citizen	5	1	
Assist Other Agency	21	7	
Camping	3	3	5
Controlled Substances	2	2	
Disorderly Conduct	1		
Dogs at large	2		
Fire (bonfire)	5	2	
Firearms	7		5
Fishing Violations	17	16	11

Type of incident	# reported warnings	# written notices	# violation	
Hunting Violations	5	6	1	
Larceny	1			
Littering	9	5	1	
MBTA	16	20	8	
Permit Violations	2	2		
Probation Violations	3		2	
Property Found	3			
Suspicious Activity	1			
Traffic	10		6	11
Trespass: Cattle	1			
Horse	1	1		
Other	3	5		
Vehicle	36	11	24	
Unsecured Installation	1			
Vandalism	6		1	
Wildlife Incidents	2			
***Totals	175	85	71	

***These include Currituck NWR incidents

Fishing on the Disabled Fishing Pier.

A Moyock resident gets the big kill.

I. EQUIPMENT AND FACILITIES

2. Rehabilitation

Air conditioning ductwork in the Headquarters was inspected in 1984 by Regional Office engineers. They found the system riddled with extensive rodent damage and containing unacceptable levels of mold and mildew. MMS funding was received this year and bid advertisements were sent out to prospective bidders in January. Princess Anne Plumbing of Virginia Beach began the replacement of the duct work in March. On April 21, Eric Marshall of the Regional Office Engineering Division inspected the work and payment was made. This newly installed rigid duct work should eliminate future problems. In addition, a set of thermostat controlled attic fans were installed by Princess Anne Plumbing to further energy conservation in the Office. A more intensive mouse control program was instituted by the Refuge to curtail future damage to Headquarters facilities.

The Office Assistant's office in the front of the Headquarters building was rehabilitated to improve the general appearance and the monitoring of visitors in the exhibit area. Walls were paneled, sliding glass windows were installed in the entrance hall and exhibit area, and privacy doors were installed between the entrance hall and office and exhibit area respectively.

Refuge entrance signs were purchased and installed west of the Headquarters and at the shop respectively replacing worn and non-standard signs. The old entrance sign near Coreys Ditch was also removed.

The oil furnace in the shop was replaced after a major breakdown with a smaller, more efficient unit.

3. Major Maintenance

The D-4 bulldozer received a major hydraulic pump replacement by Carter Machinery in early February. In March, the D-4 was being used to clear fence line at the Swan Island Flats when major problems with the tracks developed. The dozer was moved to Back Bay NWR to be hauled to Carter Machinery for repair. An inspection revealed that both tracts and their link assemblies were worn out and rusted. In May, the entire left-hand track assembly was replaced along with both idler yoke seals and roller pin assemblies at a cost of $6,981.00.

In May, the S-10 Blazer was found to have water in the oil system and the intake manifold gasket was replaced. Shortly thereafter, it was determined that the engine suffered rod and bearing damage and the engine was replaced with a rebuilt. The radiator was also replaced at this time.

In June, the refuge bombadier and a disk from Alligator River NWR were transported to Corolla NC to be used at the Swan Island Flats. After several delays resulting from repair work to the Alligator River disk, it was replaced by the Kewanee Disk from Mackay

Island. The bombadier subsequently began to lose power and the fuel lines were cleaned. A short time later the bombadier suffered a major breakdown when the spider assembly in the planetary drive was severely damaged after oil loss due to a broken seal. After two weeks waiting for parts, the spider assembly was replaced but further damage was discovered which included the planetary drive bearings and a rear oil seal. This required us to enlist Alligator River NWR to deliver Mattamuskeets bombadier to finish the disking and transport our bombadier out for repairs. Repairs were completed in mid-July and the disking of the Flats was completed by the end of the month.

Other maintenance included replacement of water pumps on the blue dodge and S-10 pickup, overhaul of a 4-wheeler, new plugs and wires were installed on the forklift, a new shaft and prop were installed on the Go-devil, a new muffler was installed on the JD 430 tractor/mower, and a set of freeze plugs were installed on the blue Dodge.

4. Equipment Utilization and Replacement

Refuge staff traveled to Alligator River NWR to pick up a surplus trailer obtained from Okefenokee NWR for housing Student Conservation Association Resource Assistants. Upon closer look, this trailer was found to be missing a power converter and needed a door which would cost approximately $600-800 to repair. Subsequently, Pocosin Lakes NWR lent us one of their trailers for the summer.

Two new vehicles arrived this year: an F-250 Ford 4x4 pickup purchased with fire funds to be used at Currituck NWR, and an F-150 Ford 4x4 extended cab pickup to replace the Chevrolet S-10.

J. OTHER ITEMS

1. Cooperative Programs

In February, Refuge staff met with North Carolina Division of Forestry Officials to discuss this year's burn plan and to update each other on equipment upgrades and changes.

After applying for a Nationwide COE permit in January and having it approved in March, work commenced on the cooperative effort with the Knotts Island Volunteer Fire Department to install a dry hydrant near the Great Marsh Loop Trail on July 18. The task was completed in early August. This will allow the department to draw emergency water from below the surface that is free from freezing during winter months.

3. Items of Interest

Mackay Island Complex was selected to complete a workload analysis as part of a pilot project initiated by the Washington Office.

With the donation of the Miller Tract, the refuge agreed to fence off the private cemetery

on the northwest corner of the tract. This project was completed by Refuge staff in April. The Refuge assumed no responsibility for maintenance of the fence or cemetery.

ARD Geoff Haskett and District Manager Bill Grabill visited both Mackay Island and Currituck NWR's on May 4 to orient ARD Haskett on refuge programs and issues.

4. Credits

K. Merritt	Sections C, D, F, G, I and J.
G. Andres	Sections A, B, and E.
M. Panz	Section H and F.9.
P. VanZant	Typing, Colating
S. Andres	Editing
K. Smith	

Photography Credits

CURRITUCK NATIONAL WILDLIFE REFUGE

Currituck County, North Carolina

ANNUAL NARRATIVE REPORT

Calendar Year 1995

Kendrell A Sais — 2/27/03

Refuge Manager — **Date**

Bill A Gabriel — 3-28-03

Refuge Supervisor — **Date**

Bill Oliveira — 4-2-03

Regional Chief, NWRS — **Date**

INTRODUCTION

Currituck NWR is located in northern Currituck County, North Carolina along the Outer Banks barrier island chain. The Currituck Banks are part of an extensive coastal lowland that stretches from Newfoundland southward to Florida, and westward into the Gulf of Mexico. Along the Currituck Banks, inlets have periodically formed and reformed depending on storms, amount of sedimentation, tidal heights, and degree of vegetation on the barrier beach.

Acquisition of Currituck NWR was intended to preserve and protect a part of the NC Outer Banks, one of the largest undeveloped coastal barrier ecosystems remaining on the East Coast. Service ownership ensures perpetuation of basic wetland functions, including nutrient cycling, floodplain and erosion control, and will help preserve the role of Currituck Sound estuaries as nurseries. The sound is an important black duck wintering area. Ownership of the protective buffer east of the productive marshes bordering the sound protects the marsh from direct pollution sources associated with development.

The Outer Banks remained isolated from the mainstream of activity in early America, and those few people who lived there relied heavily on activities associated with the area's natural values for their subsistence. Activity in the Currituck Sound area reached a peak in the late 1800's when commercial fishing and market hunting were at an all-time high. A number of hunting clubs were established for hunting waterfowl and drew much of their membership from affluent northern businessmen and professionals.

The navigation hazards along the Outer Banks resulted in numerous shipwrecks along the coast. Lifesaving stations were established along the beach of which several still exist. One station is located on an inholding within the Swan Island Tract (SIT) and is used as a seasonal residence by a private citizen. The Currituck Lighthouse at Corolla still functions throughout the year.

During 1975 and 1976, The Nature Conservancy (TNC) acquired several parcels of land on the Currituck Outer Banks. The two major tracts of land were being utilized by the Swan Island and Monkey Island Hunting Clubs. Funds to purchase these areas were provided by the Melon Foundation, a sponsor of the National Wetlands Project. TNC transferred approximately 500 acres of the Monkey Island Tract to the State of North Carolina for inclusion in the National Estuarine Sanctuary System as the Currituck Banks component. A narrow strip from sound to sea of about 50 acres was retained by TNC between the Sanctuary and the Monkey Island Tract.

The Migratory Bird Conservation Commission (MBCC) met to consider the Currituck Refuge on August 2, 1983. The MBCC approved the boundary of the refuge in two parcels: the Monkey Island Tract, which is 1.5 miles north of Corolla, NC, and the SIT some 3.5 miles further north. Two phases of acquisition resulted in 1,770 acres in fee title, 166 acres in conservation easement and some hunting blind rights at a cost of $3.9 million. A third tract, 54 acres of marsh and low shrub and hardwood woodland, was acquired in 1988, through a trade with Currituck County, NC, for Monkey Island and is located along the west side of Corolla village. All three tracts comprise about 1,824 acres

and have been administered by Mackay Island NWR at Knotts Island, NC, since July of 1990.

Aerial view of Monkey Island.

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A. HIGHLIGHTS

Negotiations pertaining to North Carolina Power's request for an underground distribution line right-of-way continue. D.4.

Cattle trespass continues to pose a problem. G.15.

B. CLIMATIC CONDITIONS

As an unmanned refuge, weather is not monitored on the Currituck NWR. Weather is monitored at Mackay Island. In 1995, a note of interest was the approach of Hurricane Felix on August 16. All indications during the days prior to landfall were that the Outer Banks would take a direct hit. Fortunately, the storm stalled and veered back to a northeastern track. Currituck NWR did suffer heavy erosion damage, but no breaks through to the Sound occurred.

C. LAND ACQUISITION

1. Fee Title

Currituck Refuge, which was once thought to have potential for about 15,000 acres of the North Carolina Banks is a fragment of what was envisioned in the final Environmental Impact Statement (EIS) proposing its establishment in 1980. The main reason for the scaled back version of about 1,800 acres, which now exists, is easy to comprehend with land prices skyrocketing north of Corolla NC due to development.

The reasons for establishing the refuge and the importance of this fragile coastal barrier island ecosystem are clearly defined in the original EIS. These reasons were reemphasized with the listing of the piping plover in 1986 thus protecting it under the Endangered Species Act. In fact, the Swan Island Tract and areas north of the refuge have been identified as the best piping plover nesting habitat in North Carolina.

Small tracts of land such as the Covington Tract need to be given serious consideration for acquisition before they are subdivided and developed. These smaller tracts have great value for migratory birds, endangered species, bio-diversity, water quality, dune protection, and will lessen the indirect affects of increased human activity associated with development.

D. PLANNING

4. Compliance with Environmental and Cultural Resource Mandates

In 1992, North Carolina Power initiated actions to obtain a right-of-way (ROW) for an underground distribution line across approximately 9,800 feet of Refuge Lands. The site of this ROW would be at the Swan Island Tract (SIT) which is just south of the community of Carova, North Carolina. Currently, the electrical supply for Carova comes

from an existing overhead line from the north which is under service from Virginia Power. The capacity of the existing system is not adequate to meet current demand and will not meet future demands with development proceeding at a rapid pace. Carolina Telephone has also expressed interest in the ROW to install an underground fiber optic cable but has apparently decided to let North Carolina Power take the lead.

A Section 7 Evaluation was originally completed in August of 1993 which considered the direct impacts to species covered under The Endangered Species Act (i.e., piping plover, seabeach amaranth, loggerhead sea turtles, bald eagle, and peregrine falcon). This Section 7 was later revised to include indirect impacts and contained specific mitigation measures. Numerous meetings and telephone conversations took place from February to June this year in an attempt to properly mitigate the impacts and grant a ROW to North Carolina Power. Meetings were held in February and March with officials of North Carolina Power, Currituck County, and Carolina Telephone with little progress made toward an agreement on proper mitigation. A meeting with Regional Solicitor John Harrington was held in Atlanta in April concerning the Service's position that mitigation was appropriate to alleviate indirect or secondary effects of this project on the refuge. There did not appear to be a case in the refuge system where secondary impacts were cited as the single factor in a compatibility decision. In June, North Carolina Power sent a letter to the Regional Director expressing concerns about the Service request for mitigation and the delays in getting a ROW for the power line. The Regional Director responded in a letter stating that mitigation was appropriate for this project and that environmental education and land protection measures are required. In July, a meeting was held in Manteo, North Carolina with North Carolina Power and Carolina Telephone officials to discuss the newly completed Environmental Assessment (EA). Deputy Associate Manager Cal Garnett and Realty Chief Tom Follrath attended along with Refuge Manager Ken Merritt. North Carolina Power agreed to revise the original EA to include secondary impacts and agreed in principle to provide mitigation for environmental education and a visitor contact station. The rest of the year was quiet while the EA was being revised by North Carolina Power.

E. ADMINISTRATION

1. Personnel

As an unstaffed satellite refuge, Currituck is managed by the staff at Mackay Island. Of note for 1995, a Student Conservation Association (SCA) volunteer was hired primarily to conduct surveys at Currituck NWR. In April, Jon Obrecht was selected; he began service on April 26 continuing through August 2.

5. Funding

The Mackay Island NWR fiscal budget was augmented in 1995 with an additional $2100.00 from the Asheville NC Endangered Species Office for piping plover surveys at Currituck NWR. The funds were used to hire a seasonal Student Conservation Association member.

F. HABITAT MANAGEMENT

1. General

Currituck NWR is located on the Currituck Banks stretch of North Carolina's Outer Banks barrier island. The Currituck Outer Banks are primarily maintained by a variety of coastal processes including long shore currents, tides and tidal currents, wave action, storm surges and wind action. These dynamic forces cause shorelines to undergo constant change. The adaptability of this coastal strand to constant physical change is a major part of their natural ecology. The approximate size of the habitat types on the refuge are: 13% sand and dune, 48% brush and woodlands and 39% marsh.

2. Wetlands

Two types of wetland areas are situated across the three major land tracts of the refuge; these include the brackish water marshes that border Currituck Sound and the wetland flats between the primary dunes and the ancient secondary dunes. The most extensive area of these interdunal flats occur on the SIT where the refuge operates a water control structure. This structure is situated in the middle of an old dune line where these wetlands, also known as the Flats, drain into a creek which empties into Currituck Sound. The structure is adjusted to maintain moist soil conditions by trapping rainwater through the summer to promote moist soil species.

This year, rain was scarce from July through September which completely dried out the flats. The flashboards were pulled from the water control structure early this year to dry out the flats for disking. The bombadier and disk were employed in early June, but constant breakdowns resulted in the completing of the project in mid-July. With little rainfall until mid-September, the wetland vegetation was very slow in coming back. September and October came with ample rainfall to promote Bacopa sp. and fall panicum. The fall panicum emerged in a carpet but was quickly trampled and consumed by feral horses. Rainfall was normal through the fall but was insufficient to fill the flats until mid-December. Waterfowl use was almost non-existent with the disking, poor growing conditions, and grazing pressure.

The second type of wetland on the refuge includes the Currituck marshes along the western side of the refuge. These emergent marshes are dominated by Juncus roemerianus, Typha spp., and Spartina cynosuroides. These sizeable marshes are influenced by wind tides. Management on marshes include placement of wood duck nest boxes through cooperation with the former owners, the Swan Island Gun Club, and prescribed burning on the marsh. No prescribed burns were conducted this year.

3. Forests

Forty-eight percent of the total refuge consists of maritime shrub and forest habitat. A dense shrub thicket occurs on the protected west side of the primary dune system. Dominant shrub species include American holly, yaupon holly, wax myrtle, and live oak.

Farther west from the primary dunes, a low, laterally branching maritime forest dominated by live oak and red cedar is found. West of ancient secondary dunes the forest becomes taller and exhibits a more open canopy where loblolly pine is dominant. All of these shrubs and woodland areas provide important resting and cover habitat for neo-tropical passerines and raptors.

6. Other Habitats

Approximately 243 acres of beachfront and sand dune are contained within the Swan Island and Monkey Island tracts. The refuge's fee title ownership extends along the beachfront out to the mean high water line. The intertidal zone falls within the state's ownership according to state law.

G. WILDLIFE

1. Wildlife Diversity

A rich wildlife diversity occurs across the Currituck Outer Banks due to the diversity of habitats along this area. Avian species comprise the bulk of the wildlife diversity as indicated by over 240 species having been documented at Back Bay NWR ten miles north of Currituck NWR. The Currituck Outer Banks serve as a migration corridor for a variety of birds such as acciptors, falcons, neo-tropical warblers, shorebirds, gulls, terns, and many waterfowl species. Periodic monitoring covers waterfowl and the threatened piping plover.

2. Endangered Species

Student Conservation Association Volunteer Jon Abreact arrived in late April and began surveys for piping plover in May. One to two plovers were observed throughout the month along the beach but no breeding behavior was observed. The Asheville Endangered Species Office assisted in this survey effort by allocating $2,000 to help pay the costs of the SEA Program. Surveys were continued through late July when several migrating plovers were seen, including one flight capable young-of-the-year. No piping plover nesting activity was observed this year.

There are no records of nesting sea turtles for Currituck but Jon did find three loggerhead nests just north of the Swan Island Tract this year. Two were about 1.5 miles south of the Virginia/North Carolina boundary with the other about 2 miles south of the line.

3. Waterfowl

Aerial surveys were conducted on a bimonthly basis to assess waterfowl use during the 1994-95 winter. Overall waterfowl use was up 49% over the 1993-94 season due to large increases in gadwall, widgeon, green winged teal, bufflehead, ruddy ducks and coots (Table 1). Canada geese numbers decreased 88%! Only fair waterfowl use was recorded in the Flats; the greatest use continued to occur on the north refuge boundary, Rainbow

Creek, and in the Hay Pond. The peak of the use again followed the same pattern as it has the previous two years. This included 4,000-5,000 snow geese frequenting the Hay Pond from mid-February until they leave mid-March. Duck use peaked once in November and then again in January through February.

TABLE 1
WINTERING WATERFOWL OCCURRENCE ON CURRITUCK NWR
1994-1995

GROUP	PERCENT	NUMBER OF USE-DAYS	%DIFFERENCE FROM 1993-1994	PEAK NUMBER	PEAK PERIOD
Tundra Swans	18.0	106193	-1	1,109	01/13/94
Canada Geese	1.7	7,035	133.7	150	02/16/94
Snow Geese	35.5	141,750	11.7	6,000	02/16/94
Ducks	33.5	133,805	88.4	1,410	03/07/94
Coots	2.5	10,045	>100.0	200	02/16/94
All Waterfowl	100.0	399,875	123	8,280	02/21-27/94

The increase in overall duck use may correspond to some improvement in the abundance of SAT in adjacent sound waters to the refuge and the Swan Island marshes. Beds of milfoil, naiads, wild celery, and sago pondweed expanded noticeably in aquatic areas cited above. These grasses were undoubtably responsible for holding the large flocks of coots that were observed in Refuge waters in 1995. While waterfowl numbers recorded in 1995 are low compared to historical use, if SAT beds continue to expand then waterfowl use should also increase.

TABLE 2
COMPOSITION OF DUCKS WINTERING ON CURRITUCK NWR
1994-1995

SPECIES	PERCENT	NUMBER OF USE-DAYS	% DIFFERENCE FROM 1993-1994	PEAK NUMBER	PEAK PERIOD
Gadwall	39.0	79,470	146	1255	01/05/95
Black Duck	13.3	27,053	-14	388	11/21/94
Greenwing Teal	26.2	53,297	102	1435	11/21/94
Mallard	6.1	12,361	-52	210	12/09/94
Pintail	1.2	2,400	-48	80	02/23/95
Widgeon	12.0	24,374	462	516	01/05/95
Ruddy	1.6	3,242	213	90	11/21/94
Shoveler	0.0	0	-100.0	0	11/04/94
Bluewing Teal	0.0	126	-91	6	01/05/95
Wood Duck	0.0	75	-94	6	03/13/95
Merganser	0.0	126	-55	6	01/05/95
Bufflehead	0.5	1,103	125	25	11/21/94
Scaup	0.0	0	N/A	0	11/04/94
Ringneck	0.1	210	N/A	10	11/04/94
All Ducks	100	203,835	57	11,331	02/23/95

4. Marsh and Water Birds

Many of the 20 species of marsh and water birds that use Mackay Island also frequent wetlands of Currituck NWR either year-round or seasonally. Most heron use is by great blue, little blue and green-backed herons. Common egrets, snowy, and cattle egrets are found on the refuge throughout the year. Glossy ibises and tri-colored herons seasonally frequent refuge marshlands. Other seasonal water bird use is derived from coots, pied-billed grebes, and double-crested cormorants. King and Virginia rails, are the most common rails on most refuge tracts. Infrequent marsh birds include sora, clapper rails, and least bitterns.

5. Shorebirds, Gulls, Terns, and Allied Species

The coastline of the Currituck Banks provides important habitat for a variety of shorebirds during their spring and fall migrations. The beach of the Currituck Outer Banks are especially valuable during shorebird migrations due to the lack of regularly

exposed tidal (i.e., lunar) mudflats in Currituck Sound and Back Bay where irregular wind tides infrequently expose mudflats in these areas. Several species using this beachfront, such as sanderling, least sandpiper, and black-bellied plovers, are recognized by the Service as species of special concern having suffered recent declines in their continental populations. Sanderling, ruddy turnstone, semipalmated plovers, and black-bellied plovers are among the most abundant migrants along the Currituck Banks during both migrations.

The Flats, high refuge marsh, and irregularly exposed mudflats on the Currituck Sound are foraged over by greater and lesser yellowlegs, solitary and spotted sandpipers, and by willet during spring and fall migrations. Exposed mudflats on the east side of Currituck Sound are heavily used by yellowlegs, semipalmated plovers, and other shorebirds for protection and forage zones during spring Noreaster storms.

A variety of gulls and terns use the beachfront and other water areas of the refuge tracts. Ring-billed, herring, great black-backed, and laughing gulls are the most common gulls. Common, royal, sandwich, Forester's and least terns frequent the refuge beachfront from spring through fall.

6. Raptors

Moderate numbers of raptors use the refuge during the fall migration. Stopovers are made by American kestrels, sharp-shinned hawks, merlin, and Cooper's hawks. In early October, several peregrine falcons were witnessed on a daily basis passing over the refuge. Northern harriers are commonly seen over marshlands from December through March.

15. Animal Control

Unfortunately several types of non-native animals including feral horses, feral pigs, and domestic cattle have been left to range over refuge tracts.

The origin of the wild horses on the Currituck Banks is unclear. Little has been done to control their numbers and competition with native plants and wildlife has been apparent in recent years (see Section F.2). Feral horses were commonly found in the Flats and beachfront of SIT grazing on grasses and herbs; their numbers generally ranged from 10-20 on this unit.

Free roaming cattle and horses continue to consume wetland and dune vegetation and impact refuge resources. Horse use of the refuge could be best described as daily. Infrequent visits to Currituck do not adequately document the horse use. Unfortunately, the Flats is also an area which was known to be a prime feeding area for waterfowl. In June, it was noted that horse numbers have increased with 18-20 horses regularly seen on the Swan Island Flats. This coincides with actions by the Corolla Wild Horse Fund this spring when fifteen horses were driven north of the fence separating Corolla from the undeveloped beaches to the north. Horses discontinued using the area shortly thereafter

due to two events: The Flats were disked as part of a habitat improvement project in June and July eliminating much of the forage. A contractor completed work in November on a smooth wire electric fence that excludes cattle and horses from the Flats.

Cattle trespass has been noted on the refuge as being serious since 1986, shortly after the refuge was established. Past refuge managers have attempted to deal with the owner who is also a Currituck County Commissioner through telephone calls, face-to-face meetings, and letters of warning. Unfortunately, each spring the owner would turn his cattle out to wander the area and they would be attracted to the refuge where the best grasses were located. By the time each refuge manager went through the procedures of calling, meeting, and finally presenting a letter of warning to the owner the damage would be done and the cattle would move on to other non-refuge areas.

With the first instance of cattle trespass this year on May 30, the owner was called with each subsequent trespass and allowed the opportunity to retrieve the cattle. The owner did round up the cattle and remove them from the refuge in a timely manner but did not repair his fences. Thus, the cattle continued to roam free and returned to the refuge within a few days. After thirty days, the owner was sent a letter of warning. This resulted in a telephone conversation between the owner and the refuge manager in which the owner stated that he was not going to take any action to keep his cattle off the refuge. Cattle trespass violations became less numerous after the letter was issued but this may have been related to the state of the vegetation after being grazed by the cattle and horses. The owner received five separate citations on September 2, 1994 for cattle trespass violations. The last cattle trespass violation in 1994 occurred on August 25. The owner was scheduled to appear in court on September 21 but received a continuance. As part of the continuance, the owner was advised by the magistrate that if any future violations occur before the owners next scheduled court date that he would be found guilty and fined. The owner was scheduled to appear in court early in 1995. A pre-trial settlement was reached between the U.S. District Attorney and the owner on January 30 in which it was agreed that cattle will not enter the Refuge during the next 12 months. In June, Refuge Officer Panz met with pre-trial diversion attorney (PDA), Richard Whittaker of the U.S. Attorney's Office to inspect the owners cattle fence. Several violations were found (though no cattle were found on the Refuge). The PDA subsequently met with the owners attorney to correct the violations and to amend the agreement to require that the cattle be securely contained and tagged. In July, a hearing between PDA Whittaker, the owner and his attorney resulted in the signing of an amended pre-trial diversion agreement.

In a related issue, the cattle owner called the Refuge in March complaining about snow geese depredating his pastures on the Outer Banks. The owner demanded that "the Service get its geese off his land". The owner was offered assistance consisting of equipment and technical advice but declined.

After the issuance of the permit in 1994 to construct an ocean to sound fence above Corolla, a committee was formed to develop a long range management plan which is a condition of the State permit. The committee is made up of representatives of Currituck

and Back Bay refuges, Corolla Wild Horse Fund, Currituck County, and NC Department of Environment, Health and Natural Resources. This committee met several times during the year to develop a management plan. As an initial step, the committee has decided to make the number one priority a basic census to determine how many horses are present, age and sex ratios, band composition, etc. This information will be used in future meetings to develop the long range management plan.

In order to obtain this information, the refuge conducted two aerial horse surveys this year. Mrs. Rowena Dorman of the Corolla Wild Horse Fund participated in the surveys which were conducted in September and November. A total of 36 horses were observed during the first survey and 39 during the second. The survey results differed in that twenty of the horses counted on the first survey were within the Refuge Boundary and only two were within the Refuge during the November Survey. This probably reflects the effectiveness of the newly constructed fence at the Flats.

As the horse management committee meetings continue, the refuge is exploring its options to exclude or remove the horses. A recent solicitors opinion confirmed the belief that the horses are not owned and the Service can remove them within the guidelines of 50 CFR. The realities are that independent removal by the Service would be very expensive, violate County ordinances, cause a public relations problem, and become a political nightmare.

It is hoped that this problem can be solved with a long range management plan which will meet the needs of the refuge and protected species on non-refuge lands in the near future.

Rooting by small numbers of feral pigs was very obvious in the late winter - spring period on the Flats and the Monkey Island Tract wetlands.

On occasion, free-roaming dogs range through the refuge and are a disruption to various wildlife.

Endangered Piping Plover.

Egrets nesting atop the trees on Monkey Island.

Sanderlings on the beach.

Cows and Wild Horses gathering in the fields.

H. PUBLIC USE

1. General

The refuge is open to beach activities, hiking, birdwatching and photography with visitation estimated at 5,000. Travel to the refuge is via NC 12 to Corolla and then northward on the beach between the dune line and the ocean. Over 30,000 vehicles travel the beach each year to access the communities of Ocean Beach, Seagull, Swan Beach, North Swan Beach and Carova Beach. It is also the only route for surfers, sunbathers and surf-fishermen. The refuge presently has no facilities or trails, bur visitors may freely explore the dunes and maritime forests during daylight hours. Camping, fires and free roaming pets are not permitted.

8. Hunting

The refuge is closed to public hunting. Waterfowl hunting rights were retained by the Swan Island Hunt Club when the Swan Island Tract was purchased.

Waterfowl hunting rights were acquired by the Service with the purchase of the Monkey Island Tract. Each year the refuge buys ten blind licenses from the county game commission and builds duck blinds along the shore. County regulations restrict hunting within 500 yards of a licensed blind, thereby providing a rest area between the refuge and float blind hunters.

17. Law Enforcement

Refuge Officers have patrolled on an irregular basis due to the 1.5 hour drive around Back Bay and down the beach to the refuge. A portable building was obtained from military surplus and trailered/dragged into place early in the spring. It holds two ATV's, posts, signs and tools to maintain nearly everyting. Travel time is now cut to 20 minutes by boat and patrols are accomplished by ATV. County Deputies enforce state and county laws along the beach strand and have been very cooperative in reporting violations of vehicular trespass above the dune line. NC Wildlife Officers patrol the refuge but did not encounter any violations this year. A total of 88 patrols were made, which resulted in 81 reported incidents and the issuance of 35 violation notices and 23 written warnings.

A breakdown of incidents by category:

Type of incident	# reported	# written warnings	# violation notices
Accident: Vehicle	1		
Assist Citizen	2		
Assist Other Agency	9	2	
Camping	3	4	5

Type of incident	# reported	# written warnings	# violation notices
Controlled Substance	1		1
Disorderly Conduct	1		
Fire: Bonfire	5	2	
Firearms	2		2
Hunting	1		
Littering	6	3	
Probation Violation	3		2
Property Found	2		
Traffic	7	3	5
Trespass: Cattle	1		
Horse	1	1	
Vehicle	32	8	20
Vandalism	3		
Wildlife Incident	1		
***TOTALS	81	23	35

***These are included in the Mackay Island Summary

I. EQUIPMENT AND FACILITIES

1. New Construction

A fence project to exclude cattle and horses from the Swan Island Flats was initiated in February with the clearing of fenceline. Arrangements were made with Region 5 to have the hydroaxe operator from Moosehorn NWR (already in the area working on other nearby refuges) complete the initial clearing of the fenceline. The hydroaxe cleared approximately 2 miles of fenceline. This was followed by clearing with the Refuge bulldozer (also Alligator River's D-7) and surveying of the line. The contractor, Everett Fence Builders, Greenville, NC, initiated construction in September and completed the work in November. A four-strand smooth wire electric fence was completed and proved to be highly effective in excluding horses. The fence was constructed to allow full access to white-tailed deer and this was verified with numerous observations of deer jumping the fence and numerous deer within the exclosure.

2. Rehabilitation

In January, the surplus CONEX box at Mackay was retrofitted as a secure storage unit to be placed near the Swan Island Flats. On February 22, it was hauled to Back Bay NWR for final preparations. The following week, it was hauled on a flatbed trailer by the D-4 dozer and placed near Ferebee Inlet. It holds two ATVs and support equipment for land management and law enforcement operations.

J. OTHER ITEMS

4. Credits

K. Merritt	Sections C, D, F, and G
G. Andres	Sections A, B, E and I
M. Panz	Section H
P. VanZant	Typing, Colating
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