

SAND LAKE NATIONAL WILDLIFE REFUGE
Columbia, South Dakota

ANNUAL NARRATIVE REPORT
Calendar Year 1989

NATIONAL WILDLIFE REFUGE SYSTEM
FISH AND WILDLIFE SERVICE
U.S. DEPARTMENT OF THE INTERIOR

REVIEW AND APPROVALS

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Columbia, South Dakota

ANNUAL NARRATIVE REPORT
Calendar Year 1989

Refuge Manager Date Refuge Supervisor Review Date

Regional Office Approval Date

INTRODUCTION

Sand Lake National Wildlife Refuge, located in northeastern South Dakota, was established in 1935 to preserve critical habitat for nesting and migrating waterfowl. The 21,498 acre refuge consists of 11,000 acres of marsh and open water, 7,417 acres of grassland, 2,581 acres of cropland, 200 acres of woodland, and 300 acres of administrative land. The refuge lies in the rich, rolling lowlands of the James River valley. The James River, running 600 miles north and south through the Dakotas, forms a natural flight path for migrating birds. Each spring and fall, thousands of ducks, geese, and other migratory birds stop at Sand Lake. The refuge is an important nesting area for ducks, Canada geese, and many species of marsh and water birds. This unique area also provides excellent habitat for resident game species, such as white-tailed deer, ring-necked pheasant, and furbearers. Each year, large numbers of people come to the refuge to observe, photograph, or hunt the abundant wildlife the refuge provides.

A nine-county Wetland Management District and Pocasse National Wildlife Refuge are also managed out of the Sand Lake Headquarters.

TABLE OF CONTENTS

A. HIGHLIGHTS

B. CLIMATIC CONDITIONS

C. LAND ACQUISITION

1. Fee Title.....Nothing to Report
2. Easements.....Nothing to Report
3. Other.....Nothing to Report

D. PLANNING

1. Master Plan.....Nothing to Report
2. Management Plan.....3
3. Public Participation.....Nothing to Report
4. Compliance with Environmental and
Cultural Resource Mandates.....3
5. Research and Investigation.....4
6. Other.....Nothing to Report

E. ADMINISTRATION

1. Personnel.....8
2. Youth Program.....Nothing to Report
3. Other Manpower Programs.....10
4. Volunteer Program.....11
5. Funding.....11
6. Safety.....11
7. Technical Assistance.....Nothing to Report
8. Other.....Nothing to Report

F. HABITAT MANAGEMENT

1. General.....12
2. Wetlands.....12
3. Forests.....16
4. Croplands.....16
5. Grasslands.....19
6. Other Habitats.....Nothing to Report
7. Grazing.....21

8.	Haying.....	22
9.	Fire Management.....	24
10.	Pest Control.....	10
11.	Water Rights.....	Nothing to Report
12.	Wilderness and Special Areas.....	Nothing to Report
13.	WPA/Easement Monitoring.....	Nothing to Report

G. WILDLIFE

1.	Wildlife Diversity.....	30
2.	Threatened and/or Endangered Species.....	31
3.	Waterfowl.....	31
4.	Marsh and Water Birds.....	36
5.	Shorebirds, Gulls, Terns, and Allied Species.....	36
6.	Raptors.....	37
7.	Other Migratory Birds.....	37
8.	Game Mammals.....	38
9.	Marine Mammals.....	Nothing to Report
10.	Other Resident Wildlife.....	39
11.	Fisheries Resources.....	39
12.	Wildlife Propagation and Stocking.....	40
13.	Surplus Animal Disposal.....	Nothing to Report
14.	Scientific Collections.....	Nothing to Report
15.	Animal Control.....	41
16.	Marking and Banding.....	41
17.	Disease Prevention and Control.....	41

H. PUBLIC USE

1.	General.....	42
2.	Outdoor Classrooms - Students.....	42
3.	Outdoor Classrooms - Teachers.....	44
4.	Interpretive Foot Trails.....	45
5.	Interpretive Tour Routes.....	45
6.	Interpretive Exhibits/Demonstrations.....	46
7.	Other Interpretive Programs.....	46
8.	Hunting.....	47
9.	Fishing.....	50
10.	Trapping.....	50
11.	Wildlife Observation.....	51
12.	Other Wildlife Oriented Recreation.....	Nothing to Report
13.	Camping.....	51

14. Picnicking.....	51
15. Off-Road Vehicling.....	Nothing to Report
16. Other Non-Wildlife Oriented Recreation.....	Nothing to Report
17. Law Enforcement.....	51
18. Cooperating Associations.....	Nothing to Report
19. Concessions.....	Nothing to Report

I. EQUIPMENT AND FACILITIES

1. New Construction.....	53
2. Rehabilitation.....	54
3. Major Maintenance.....	Nothing to Report
4. Equipment Utilization and Replacement.....	56
5. Communications Systems.....	Nothing to Report
6. Computer Systems.....	57
7. Energy Conservation.....	57
8. Other.....	Nothing to Report

J. OTHER ITEMS

1. Cooperative Programs.....	58
2. Other Economic Uses.....	Nothing to Report
3. Items of Interest.....	66
4. Credits.....	68

K. FEEDBACK

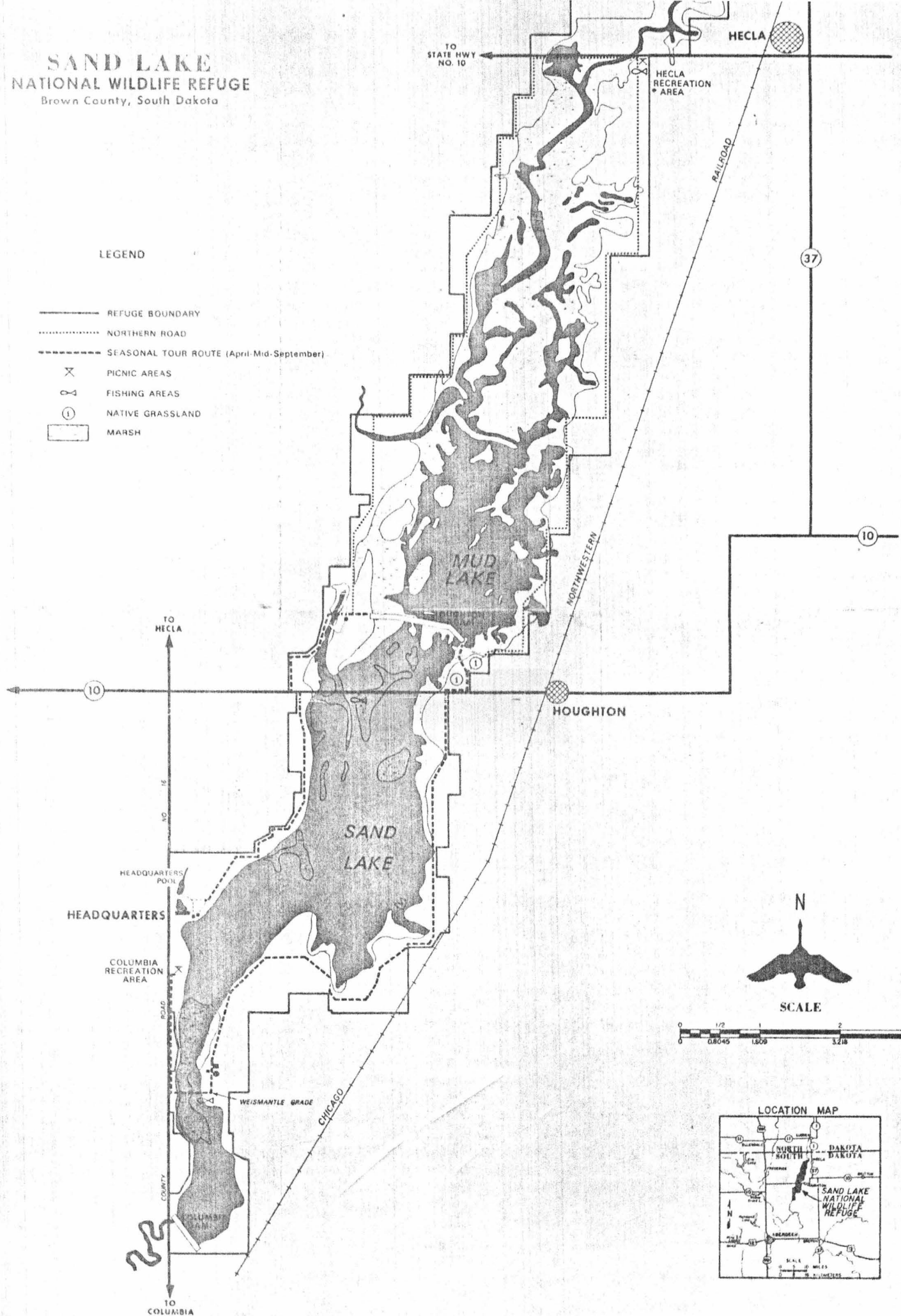
Nothing to Report

SAND LAKE NATIONAL WILDLIFE REFUGE

Brown County, South Dakota

LEGEND

- REFUGE BOUNDARY
- NORTHERN ROAD
- - - SEASONAL TOUR ROUTE (April-Mid-September)
- X PICNIC AREAS
- ⌵ FISHING AREAS
- ① NATIVE GRASSLAND
- ▭ MARSH



SCALE



A. Highlights

- Potential impacts to Sand Lake as a result of the Garrison Diversion Unit irrigation project continues to cause concern. Again this year, many hundreds of hours were expended on Garrison-related activities (Section J.1).
- Personnel changes included two retirements, one transferred out, another in, some achieved career mileposts, plus other actions (Section E.1).
- The spring snow goose migration was brief but spectacular as over 750,000 were in the vicinity of Sand Lake at one time (Section G.3).
- The refuge deer population is causing major problems with management as well as public relations (Sections G.8, F.4, and H.8).
- Prescribed burns were accomplished on both uplands and rather large marsh burns were accomplished in the fall (Section F.9).
- Waterfowl production on Sand Lake increased 114% from 1988. Most of the increase was due to the drought-related poor production in 1988 (Section G.3).

B. Climatic Conditions

This year, 1989, began with 13 inches of snow on the ground. Maximum snow depth on the ground during the first three months of the year was 21 inches. A high temperature of 55 degrees on March 26 caused rapid snowmelt and resulted in localized flooding in northern Brown County (**Figures 1, 2, & 3**). Timely thunderstorms throughout the summer provided much needed moisture in the Sand Lake area, resulting in good grassland and crop conditions. Conditions were dry at the year's end with only 1 inch of snow on the ground. Total precipitation for the year totalled 16.52 inches, approximately 2 inches below normal.



Figure 1. Rapid snowmelt this spring resulted in a lot of runoff,...
89-WAS

Figure 2. . . . with water "piling up" behind roads with culverts too small to handle the volume of water (Highway 16, south of headquarters),...

89-WAS



Figure 3. . . . and water overtopping the headquarter's pool structure.
89-WAS

The ice on Mud Lake and Sand Lake broke up on April 14 and April 16, respectively. Both pools froze over on November 16.

Table 1 provides a summary of the weather for 1989.

TABLE 1. Weather Summary, 1989

<u>Month</u>	<u>Precipitation</u> (<u>Inches</u>)	<u>Snowfall</u> (<u>Inches</u>)	<u>Maximum</u> <u>Temp (F)</u>	<u>Minimum</u> <u>Temp (F)</u>
January	.66	9.4	41	-31
February	.25	5.9	39	-31
March	1.50	14.0	55	-15
April	2.88	2.4	77	18
May	.87	T	82	23
June	1.70	-	92	36
July	2.01	-	99	51
August	2.83	-	97	42
September	2.44	-	89	25
October	.51	-	79	13
November	.72	8.0	66	-7
December	.15	1.3	42	-33
TOTAL	16.52	41.0	99 (Extremes)	-33

D. Planning

2. Management Plan

In October 1989, the station's Cropland Management Plan was revised by refuge staff. Total farmland on the refuge in 1989 included about 3,023 acres. Of this amount, 1,142 acres were retired back into wheatgrass and alfalfa (DNC). The annual water management plan was also revised and approved during the year.

4. Compliance with Environmental and Cultural Resource Mandates

During 1989, Refuge Staff completed refuge planning on its Operating Statement and Objectives for Sand Lake National Wildlife Refuge. The Operating Statement includes legal responsibilities, an operating statement, mission, and listing in priority order goals and objectives covering endangered species, migratory birds, other wildlife and interpretation and recreation. The operating statement and objectives were approved by the Regional Office in August. A copy is provided in the back of this narrative report.

5. Research and Investigation

Sand Lake NR89 - Evaluation of Duck Use, Preference and Production on Man Made Nesting Structures and Hay Bales

Poor duck nesting success in the Prairie Pothole Region of the United States and Canada has renewed interest in the use of artificial nesting structures to provide secure nesting sites for waterfowl. Additional data are needed to provide information on occupancy rates, nest success, costs, and durability of different structure types and materials.

In 1986, a waterfowl nesting study to determine duck use, nesting success and preference among different types of artificial nesting structures and hay bales was initiated by South Dakota State University (SDSU). The study is being conducted in a 7-county area in northcentral and eastern South Dakota. Wetland variables such as classification, size and vegetation species composition were recorded. Structural variables such as distance to shore, to emergent vegetation, and to open water were measured as well as depth of water at the structure. These variables were primarily measured prior to the nesting season.

In 1989, 165 baskets, 224 bales, 54 culverts, and 30 self-maintaining tubs were available for monitoring, but only 133 baskets (80.6%), 106 bales (47.3%), 42 culverts (77.8%), and 28 self-maintaining tubs (93.3%), were surrounded by water and considered "usable". A total of 76 duck and 82 goose nests were found on structures in 1989. Four species of waterfowl, Canada geese, mallards, redheads, and ruddy ducks, nested on these structures. In addition, one great horned owl (fate unknown) and one American coot (successful) nest was found on a basket and bale, respectively.

Overall occupancy rates of all structure types were 24.6% by ducks (88.2% mallards, 10.5% redheads, and 1.3% ruddy ducks), 28.8% by Canada geese, and 44.8% by both groups combined. Overall nest success of all structure types was 48.7% by ducks, 87.8% by geese and 69.0% by both groups combined. Occupancy rates and nest success for ducks overall was 15.0% and 75.0% on baskets, 36.8% and 28.3% on bales, 23.8% and 90.0% on culverts. Comparable data for geese is 11.3% and 100.0% on baskets, 46.2% and 80.0% on bales, 40.5% and 100.0% on culverts. No nests occurred on self-maintaining tubs in 1989.

Increased structure occupancy this year over last year was explained by improved water conditions in the northern regions of the state and to exceptionally high occupancy of newly placed structures located in Brookings, Deuel, Hamlin, and Lake Counties. In addition, it should be noted that no muskrats were observed during our field work, which lasted from May till

August; the lack of muskrat houses may have increased structure occupancy by forcing geese to utilize structures or, at least making them more attractive.

The evaluation continued on SDSU's test of whether treating flax straw with a green color dye might attract nesting waterfowl to flax than on straw of natural coloration. Nest initiation on green straw averaged ten days earlier than on brown straw. In 1989, initiation also averaged two weeks earlier on green than on brown. Earlier initiation on green straw supports observations that early nesting hens often select nesting sites near clumps of early green growth.

The drought once again inhibited the growth of vegetation on the self-maintaining tub structures, and as no nests were found on this structure type, the data were not included in the tables. Future plans are to develop a self-maintaining structure that will wick moisture up to the soil as an irrigation source. Nest fate on structures on Sand Lake National Wildlife Refuge in 1989 is reported in **Table 2**).

Table 2. Nest fate on structures on Sand Lake National Wildlife Refuge, Brown County, South Dakota, 1989

			Structure					
Study Area			No.	Type		Species	Fate	
Sand	Lake	HQ	352	Bale		Mallard	Abandoned	
Sand	Lake	HQ	352	Bale		Mallard	Successful	
Sand	Lake	III	068	Wire	Basket	C. Goose	Successful	
Sand	Lake	III	072	Wire	Basket-g	Mallard	Successful	
Sand	Lake	III	077	Wire	Basket-g	Mallard	Abandoned	
Sand	Lake	III	078	Wire	Basket-g	Mallard	Successful	
Sand	Lake	III	079	Wire	Basket	C. Goose	Successful	
Sand	Lake	III	270	Wire	Basket	Mallard	Successful	
Sand	Lake	III	285	Wire	Basket-g	Mallard	Successful	

* -g- basket containing green dyed nesting materials.

Sand Lake NR89 - Evaluation of Carp in James River Waterfowl Refuge and Effects On Submerged Macrophytes

This study was initiated in 1988 and is designed as a two year study. The study is being conducted by researchers from the Cooperative Fish and Wildlife Research Unit at South Dakota State University (SDSU), Brookings, South Dakota.

The study is a spinoff from the Garrison Diversion Unit of the Pick-Sloan Missouri Basin Program. This U.S. Bureau of Reclamation (Bureau) water development project will divert Missouri River water to the James River for irrigation, municipal and industrial water supply, fish and wildlife habitat, recreation, and flood control. This project was

reauthorized in 1986. The reauthorization included the requirement that eight environmental studies be conducted. This research project addressed certain projected impacts of the project on Sand Lake National Wildlife Refuge located on the James River. Three objectives studied at Sand Lake include:

1. Determine the biomass of adult common carp in Sand Lake NWR during two summers and relate the biomass to catch-per-unit effort data from various capture techniques.
2. Evaluate the relative impact of small carp, large carp, and bullheads on submerged vegetation, especially during the early development of the vegetation stand.
3. Review the literature on the production of suspended sediment caused by bottom disturbance of fish and waves, and determine the feasibility of studying this relationship.

The biomass of common carp in Sand Lake was estimated with three methods in 1988 and 1989: (1) a large-area (about 250 ha) mark and recapture, (2) a small-area (6-15 ha) mark and recapture, and (3) a cove (1 ha) rotenone sampling. The three population estimates were undertaken at three different locations within the refuge. Biomass (Kg/hectare) estimates of adult common carp in Sand Lake NWR is reported in **Table 3**.

Table 3. Biomass (Kg/hectare) estimates of adult common carp from three different areas of Sand Lake NWR.

Site	Year	Biomass Estimates	95% Conf. Limits
Large Area	1988	2409.4	643.7 - 4175.3
	1989*	91.5	49.7 - 168.9

Small Bay	1988	78.7	51.8 - 103.7
	1989	34.7	0.0 - 97.6

Cove-Rotenone	1988	7.7	--- ---
	1989	0.0	--- ---

*Due to winterkill during 1988-89, the 1989 common carp population had low density and low biomass.

In order to evaluate objective #2, twelve enclosures (pens) were placed within the study bay (Mud Lake) by mid-April. Enclosures were octagon and decagon in shape, (**Figures 4 and 5**) and adjusted to scale for each size group of fish in order

to confine them at standing crops of 675 kg per hectare. A total of nine enclosures were stocked with fish; three enclosures served as controls and did not receive fish.



Figure 4. Ground view of fish enclosure pens used by SDSU researchers in Mud Lake. Photo views northeast. 89-JWK

Figure 5. Aerial view of fish enclosure pens used by SDSU researchers in Mud Lake. Photo views northwest. 89-SJY



While 1988 data were inconclusive, in 1989 SDSU researchers observed that large common carp enclosed at 675 kg per hectare reduced sago pondweed density by 85% over 60 days. The enclosures containing large common carp also had the greatest amount of uprooted plants, indicating that reduced plant production was probably the result of foraging activities by the fish in search of benthic organisms.

Unique to the SDSU experiment is the observation that overabundant populations (675kg/hectare) of smaller common carp and black bullheads also hamper submerged aquatic plant growth (15-22% reduction in density at 60 days), although not as severely as large common carp. In addition, the enclosed fish appeared to alter the seasonal growth pattern of sago pondweed by reducing the "summer maximum" biomass. This observation has been reported by other researchers.

E. ADMINISTRATION

1. Personnel

Some said, "Enough's enough!", others said "More, more!". On April 1st, two long-time employees, Marv Elsen and Jack Cantwell, retired. Marv had been at Sand Lake since October, 1962 and Jack since September of 1967. On May 6th, Dave Hilley (**Figure 6**) headed south to take on additional responsibilities as Project Leader at Quivira National Wildlife Refuge. Dave had been at Sand Lake since April, 1986. Mark Heisinger (**Figure 7**) took Dave's place, arriving here on August 7th from C. M. Russell National Wildlife Refuge.



Figure 6. Dave Hilley accomplished a multitude of tasks while at Sand Lake. 89-WAS

Other personnel actions included Ron Frohling's reclassification and promotion, Todd Frerichs' conversion from a 180 day appointment to a one year appointment and Mark Gruebele's conversion to PFT.

Berle Meyers received a 20-year and Bob Wright received a 30-year length-of-service pin.

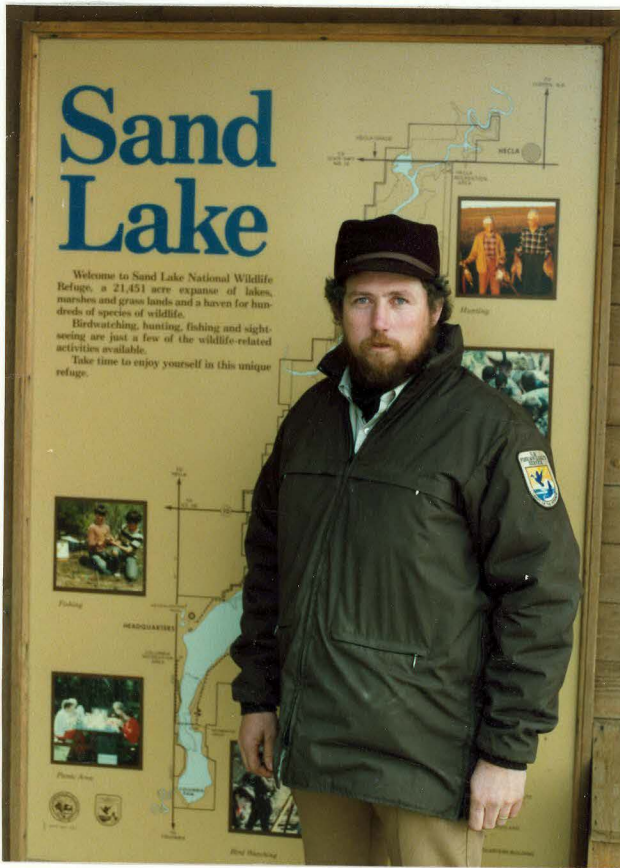


Figure 7. Mark Heisinger started at Sand Lake on August 7th. He had been at CMR since May, 1987.

89-WAS

Figure 8 portrays the people who were present during the past summer.



Figure 8. Sand Lake NWR Staff, Summer, 1989

89-WAS

Back Row, left to right:

Scott McLeod, Biological Aid,	GS-4	May-Aug/89	PFT
Ron Sanders, SCA Volunteer		May-Aug/89	VOL
John Koerner, Manager	GS-12	EOD 4/88	PFT
Ron Frohling, Carpenter	WG-9	EOD 5/77	PFT
Steve Young, Assistant Refuge Manager	GS-9	EOD 3/85	PFT
Brett Tully, Biological Aid	GS-4	May-Nov/89	TPT
Bill Schultze, Biological Technician	GS-8	EOD 5/76	PFT

Front Row, left to right

Bob Wright, Assistant Refuge Manager	GS-11	EOD 2/77	PFT
Mark Gruebele, Biological Technician	GS-6	EOD 11/87	PFT
Suzy DeHoet, S. D. Job Service		Jun-Aug/89	TEM
Marcia Haaland, Refuge Assistant	GS-6	EOD 8/88	PFT
Becky DeHoet, S. D. Job Service		Jun-Aug/89	TEM
Todd Frerichs, Biological Technician	GS-5	EOD 3/89	TFT
Berle Meyers, Equipment Operator	WG-10	EOD 4/71	PFT

Not pictured are:

Marv Elsen, Automotive Mechanic	WG-10	Retired 4/89	PFT
Jack Cantwell, Maintenance Work	WG-8	Retired 4/89	PFT
Dave Hilley, Assistant Refuge Manager	GS-11	EOD 4/86	PFT
		Transferred to Quivera NWR 5/89	
Mark Heisinger, Ass't. Refuge Manager	GS-11	EOD 8/7	PFT

Table 4 shows the Refuge staffing pattern for the last five years.

Table 4. Sand Lake NWR Staffing, 1985-1989

Year	Permanent		Temporary	Total FTE
	Full Time	Part Time		
1989	11	0	6	11.7
1988	11	0	5	11.9
1987	10	0	3	10.6
1986	10	0	3	10.4
1985	10	0	3	10.4

3. Other Manpower Programs

Suzy DeHoet, who had worked here in 1988, and her sister, Becky, who had worked here in 1987, were hired through the South Dakota Job Service. While here they worked on a variety of maintenance projects.

Also employed during the year were two biological aids, Scott McLeod, who had worked at Sand Lake previously, and Brett Tully.

4. Volunteer Programs

Ron Sanders was employed under the Student Conservation Association Volunteer Program during the period May 22 through August 11.

5. Funding

Funding for the complex for the last several years is shown in **Table 5.**

Table 5. Sand Lake NWR Funding, 1985-1989

Year	1260	1230	6860	2821	8610	1929	1120
1989	494,000		4,000		30,000		12,500
1988	549,000		4,000		11,100	2,400	
1987	421,915	8,003	4,019		2,457	3,920	
1986	429,408				7,900		
1985	350,000			2,376	6,092		

6. Safety

Safety meetings were held monthly.

Lyme disease tests were conducted on thirteen employees -- all tests were negative.

Todd Frerichs, Marcia Haaland, Ron Sanders, Brett Tully, as well as folks from Tewaukon and Waubay Refuges, attended a defensive driving course at Sand Lake in July.

Radon checks were made in Q-195 and the office. Both places had less than 4 uc/l.

Step tests were taken by seven people involved in prescribed burning.

Domestic water samples were sent to the S. D. Health Lab for bacteriological checks. No problems were found.

SCA Volunteer Sanders injured his leg. Only first aid was required.

Maintenance Worker Frohling injured his back while handling stop logs. He required medical treatment and was off duty for 6 days.

The pump on one of the new above ground fuel tanks was electrically defective and was releasing static electricity down the pump hose. The manufacturer promptly replaced it.

F. Habitat Management

1. General

Spring runoff provided excellent conditions in northern Brown County for migrating waterfowl. Although drought conditions continued in much of the state, the Sand Lake area was fortunate to receive enough timely moisture to produce good grassland cover and fairly decent crops.

2. Wetlands

High temperatures near the end of March resulted in a rapid snowmelt. Although this caused some problems with localized flooding, it filled all of the wetlands in the surrounding area (**Figure 9**). Elm River flows entered Sand Lake from the south for five days, prior to James River flows bringing both pool levels to approximately one and one-half feet above full pool level. Both pools were brought down near full pool level by the first part of May, and both structures remained closed for the remainder of the year. Water levels fell gradually throughout the summer. At freeze-up, Mud Lake was 1.3 feet below full pool level and Sand Lake was 1 foot below full pool level.



Figure 9. Wetlands throughout the Sand Lake area were filled to overfull from the rapid spring runoff. 89-JDH



Figure 10. Ever see a river run backwards? The Elm dumped so much water into the James that the James flowed backwards the 10 miles between the confluence and the Sand Lake Refuge.

89-JWK

What appeared to be two small leaks under Mud Lake structure were noted in September. Water was boiling up just below the downstream apron of the structure in two separate areas. Regional Office engineers were notified and the leaks were monitored through the remainder of the fall, with no increase in flows noted.

Sago pondweed growth in both pools was good to excellent (Figure 11). Some sago beds remained below the water's surface. The cattail and phragmites density in northern Sand Lake continued to decrease.



Figure 11. Pondweed growth appeared a little better than 1988 and provided waterfowl and marsh birds with a lot of use.

89-JWK

With the low fall water levels in Mud Lake, we mowed blocks and paths through the cattail in northern Mud Lake to provide openings for breeding pairs next spring and more attractive waterfowl habitat in general. These paths and openings are also used by refuge deer hunters to gain access deeper into the marsh.

On October 17, we burned approximately 800 acres of cattail choked marsh in the middle of Mud Lake. This was done to reduce the density and accumulation of cattail to improve breeding pair habitat; to recycle nutrients tied up in the years of accumulation of marsh vegetation; and to eliminate deer habitat and make the deer more available to hunters, thus reducing the deer herd in the refuge area. Approximately 80 more acres of marsh vegetation were burned around Mud Lake Island on October 24 to facilitate predator control efforts in 1990.

Our attempt to open up the dense stand of cattail in the 280-acre floodpool north of the Hecla grade was partially successful. The floodpool was burned and much of the area was disced in the fall of 1988. Low spots in the dike surrounding the floodpool were filled in to increase the water depth in an attempt to flood out the burned cattail. The floodpool was completely filled this spring and held water throughout the summer (Figures 12, 13 & 14). Initially, the cattail stand

Figure 12. The floodpool north of the Hecla grade filled this spring from local runoff and high James River levels. 89-JDH



Figure 13. The area was used heavily during the migration... 89-WAS

Figure 14. and provided excellent pair and brood habitat this season.

89-WAS



appeared to have been dramatically reduced; but by mid-summer, the open areas began filling in. The cattail stand was not as thick as before, but the results were not what we had hoped for. The area got excellent pair and brood use this season, and also was used during the migration.

Adjacent wetlands and floodpools were filled from spring runoff and high water levels in the James River. Several of the flap gates and screw gates on culverts used to fill the floodpools were rehabilitated.

Ducks Unlimited was scheduled to replace the leaking Dry Run structure this year, but complications in obtaining a flowage easement on private land along Dry Run's flowage prevented DU from starting the project. Negotiations are continuing with the adjacent landowner to come to an agreement on the wording in the flowage easement. Meanwhile, DU's interest in the project may be fading.

3. Forests

Plans were made to begin rehabilitating some of the old shelterbelts on the refuge. One plot east of Silo Bay was worked up in preparation to planting in 1990. SCS assisted in the planning and will provide the trees.

4. Croplands

The Sand Lake Refuge Cropland Management Plan was revised and approved by the Regional Office.

Crops are grown on the refuge primarily for use by waterfowl during the fall and spring migrations and secondly for resident wildlife species. A total of 1,881 acres of cropland was farmed in 1989 by 12 cooperative farmers. **Table 6** shows this year's crops and average yields.

TABLE 6. Crop Acreage and Yields, Sand Lake NWR, 1989

Crop	Total Acres	Coop Share	FWS Share	Ave. Yield
Barley	349	129	220	30 bu/ac
Barley & Sweet				
Clover	39	13	26	30 bu/ac
Corn	578.75	272	306.75	75 bu/ac
Wheat	462	451	11	22 bu/ac
Wheat & Sweet				
Clover	94.5	94.5	0	22 bu/ac
Sorghum	263.25	207.75	55.5	1,000 lbs/ac
Oats	77.5	77.5	0	55 bu/ac
Oats & Sweet				
Clover	17	17	0	55 bu/ac

In an attempt to decrease weed problems and increase soil fertility without the use of chemicals, sweet clover was planted with 150.5 acres of small grain. The sweet clover will be plowed down as green manure in 1990.

Due to snow in the fields, the spring waterfowl migration moved through the area before the standing corn could be chopped. Although much of the corn was already consumed by deer, cooperative farmers were allowed to harvest any corn left on a 50-50 split with the refuge. Three cooperators delivered approximately 300 bushels of corn to the refuge elevator.

Sorghum acreage on the refuge increased from 76 acres in 1988 to 263.25 acres in 1989. This increase was due to the fact that, unlike corn, the deer do not eat the sorghum plant while it grows (**Figure 15**). Cooperators in deer problem areas figured they had a better chance to come out ahead with sorghum as their share, rather than corn. The sorghum also provided us with both resident and migratory bird feed (**Figure 16**). There were a few problems with some of the sorghum fields this year. The sorghum fields planted with a drill, rather than a corn planter, were taken over by weeds. Several fields were killed by a frost before the sorghum was fully mature. Northern South Dakota is apparently on the northern edge of the area with a long enough growing season to grow sorghum. Also, deer did begin to eat some of the heads along the edge of some fields before the sorghum was mature. But, overall, sorghum worked well in our cropping program.



Figure 15. A field stripped with 4 rows of corn and 4 rows of sorghum resulted in 4 rows of weeds and 4 rows of sorghum. The deer devastated the corn as it developed, but let the sorghum grow.

89-WAS



Figure 16. Fall migrating snow geese utilized several of the partially harvested sorghum fields on the refuge. 89-WAS

High deer populations continued to have an effect on our farm program, heavily damaging corn fields in some areas. In several areas where we needed corn available for migratory bird use, cooperators were reluctant to take any corn as their share due to extreme deer damage. The result was total corn fields as our share. We purchased a used corn picker to open up such fields and make the corn available to migratory waterfowl (**Figure 17**). The ear corn will be used for banding bait and also be available for winter deer depredation problems.



Figure 17. A corn picker was purchased to open corn fields for waterfowl use. 89-WAS

SCS conservation plans for farming highly erodible land were implemented on all refuge farm ground east of the James River. This ground falls into the highly erodible category due to it's sandy texture and it's vulnerability to wind erosion. These plans were incorporated with our Cooperative Farming Agreements this spring.

David North began farming refuge fields previously farmed by Bob Bonzer, in the northwest corner of the refuge. Bob Bonzer retired after farming in the refuge for many years. As a condition of his permit, we required David to farm without the use of any pesticides. Although results were not encouraging, we are continuing to look at nonchemical weed control on refuge farm ground. This and other pesticide reduction efforts will be discussed in section F.10.

Refuge personnel broke fourteen acres of brome on Hanson's Point and planted forage sorghum in preparation to seeding the area to native grass. Thirteen acres of rye, fourteen acres of rye and alfalfa, and seventy-eight acres of rye and DNC were seeded this fall by refuge personnel. The rye provides green browse for migrating geese.

Approximately 3000 bushels of corn were elevator transferred to Sand Lake from DeSoto NWR. The corn will be stored at the refuge elevator and be available for feeding the captive Canada goose flock, bait for banding, and deer depredation problems.

5. Grasslands

Grasslands on the refuge are dominated by cool season exotics. During 1989, we used haying, grazing, burning, burning and seeding clover, and reseeding DNC to manage the grasslands. There was sufficient moisture during the growing season to provide good growth of cover.

In an attempt to provide more diversity of grassland cover, 14 acres of brome, on Hanson's Point, were broken out and seeded to forage sorghum in preparation to seeding the area to natives (**Figure 18**). We plan to seed the 14 acres again in 1990, to get good control of the brome, before seeding the natives in 1991. Once this 14 acres is established, we plan to convert the remaining area on Hanson's Point (approximately 16 acres) to natives. Hanson's Point was divided into these two units to prevent wind erosion due to the sandy soil.



Figure 18. Fourteen acres of brome were broken out on Hanson's Point in preparation to seeding the area to native grasses.
1989-WAS

Seventy-eight acres of old DNC was hayed and reseeded by refuge personnel this fall. The DNC mixture was 4 pounds of tall wheatgrass, 3 pounds of intermediate wheatgrass, and 4 pounds of alfalfa. This was seeded along with rye as a nurse crop.

Approximately one-half of the 43 acres of brome, burned in the headquarter's pool area on April 19, was interseeded with sweet clover in an attempt to provide some diversity in a straight stand of brome (**Figure 19**). An additional 10 acres of brome, hayed in the fall of 1988, was also interseeded with sweet clover. A dry period right after the seeding may have thinned out the stand; but some clover could be found in July and August.



Figure 19. Sweet clover was interseeded in part of a burned stand of brome to provide more diversity and structure than a straight brome stand.
89-WAS

7. Grazing

A total of 399 acres of grasslands was grazed on the refuge during 1989 (**Figure 20 and 22**). Most of the units grazed were heavily matted. Several of the units were native areas, badly invaded by brome and bluegrass. Other units were brome and old DNC in locations along the marsh that are hard to manage any other way. It was hoped the cattle would also open up the cattail along the marsh edge. Sheep were used on the 15 acre unit of old DNC as an experiment on leafy spurge control.



Figure 20. Pulfrey's Island, a 45 acre island in Mud Lake, was grazed this spring to get rid of the thick mat of dead vegetation and reinvigorate the nesting cover. 89-WAS

Seven grazing units were originally planned during 1989: three spring grazes, three fall grazes, and 1 sheep/leafy spurge control graze. Ten local farmers applied for the grazing units. The spring grazes went as planned, but due to low water levels in the lake, we had to do some adjusting on the fall units (**Figure 21**). We had to enlarge one unit to reach a water source; we completely changed the second unit; and there was no interest in the third unit due to access problems.



Figure 21. Polychord electric fence worked well in extending the fall grazing unit boundaries to reach water. 89-WAS

Grazing units, periods, and AUM's during 1989 are shown in **Table 7**. The price for grazing was \$9.20/AUM minus deductions for fencing, etc.

TABLE 7. 1989 Grazing, Sand Lake NWR

Unit	Acres	Total AUM's	Grazing Period
1	45	56	May 17-June 22
2	60	113	June 1-July 17
3	48	68	June 5-July 7
*4	15	16	May 26-June 26
*4	--	6	Aug. 15-Sept. 7
5	100	187.5	Sept. 30-Oct. 30
6	<u>131</u>	<u>185.5</u>	Sept. 15-Oct. 28
	399	632	

*Sheep/leafy spurge control unit (sheep turned in twice)

8. Haying

Twelve permittees hayed 194 acres on the refuge. Of this total, 34 acres were alfalfa, 125 acres were brome/DNC, 9 acres were goback, and 26 acres were reed canary grass. Seventy-eight acres of the brome/DNC and the nine acres of goback were disced and reseeded with rye and DNC.

Figure 22: 1989 Habitat Management



Unlimited cattail mowing was offered to several local farmers who had previously shown an interest in using cattail as bedding, but they turned it down.

9. Fire Management

Prescribed burning plans for 7 different areas (one area was submitted both in the spring and fall), totalling 1230 acres, were submitted and approved by the Regional Office. Burns were completed on 5 of these areas, totalling 980 acres. Two burns were completed in the spring and three in the fall. The other 2 proposals were not completed due to unfavorable conditions.

Spring Burns

Headquarters Pool--Approximately 43 acres of mainly brome, north of the headquarters entrance road, were burned on April 19. The objectives of the burn were to eliminate the vegetative mat and rejuvenate deteriorated nesting habitat. The burn did not completely eliminate the mat of old vegetation, due to an increase in wind speed and shift in wind direction. But overall, the area should benefit from the burn. Sweet clover was interseeded in approximately one-half of the burn area.

Sand Lake East--Approximately 57 acres of brome, Kentucky bluegrass, and remnants of natives, one mile south of Highway 10 on the east side of the refuge, were burned on April 19 (**Figure 23**). Burn objectives were to eliminate the vegetative mat and rejuvenate deteriorated nesting habitat. The burn was fairly complete.



Figure 23. Dave Hilley lights a strip fire on the Sand Lake East burn.

89-WAS

Fall Burns

Four Mile (South)--Approximately 300 acres of cattail and phragmites, south of the four-mile grade in Mud Lake, were burned on October 17 (**Figures 24, 25, 26, & 27**). Burn objectives were to open a dense, overgrown marsh, recycle nutrients tied up in years of accumulation of marsh vegetation, and to eliminate deer habitat to make deer more available to hunters, thus reducing the deer herd in the refuge area. The burn went well and was very complete, burning all standing and residual cattail. The only stalks left standing were along open water.

Four Mile (North)--Approximately 500 acres of cattail and phragmites, north of the four-mile grade in Mud Lake, were burned on October 17, immediately after the Four-Mile (South) burn (**Figure 28**). Objectives and results of this burn were similar to the Four-Mile (South) burn. The upland on Pulfrey's Island did not burn due to the spring graze. Cattail ash from these two burns fell as far away as Aberdeen (30 miles southwest). Deer were observed on the combined 800-acre burn area the morning after the burn. Both deer and pheasants were observed on the area in the weeks following the burn. Gulls also made use of the area. Snow geese were only observed on the area once, when less than 1000 landed along the channel as they came back into the refuge. Most of the birds in the flock landed in the water.

Mud Lake Island--Approximately 80 acres of cattail and phragmites around Mud Lake Island were burned on October 24. The objective of this burn was to remove the emergent vegetation from around the island to facilitate complete predator removal from the island during the spring of 1990. The burn was complete and went very well.



Figure 24. After getting several backing fires going on the Four Mile (South) burn, the head fire was ignited along the Four Mile grade.
89-WAS



Figure 25. Once the headfire was lit, the burn went rapidly . . .
89-WAS



Figure 26. . . . leaving an open sea of black ash.
89-WAS



Figure 27. The sun heated up the blackened area on the day following the burns, causing whirlwinds to dance through the area throughout the afternoon.
89-WAS



Figure 28. Four Mile (South) and Four Mile (North) Burns.

89-RLW

The two 1988 fall burn areas north and south of the Hecla Grade provided excellent waterfowl habitat when it reflooded this spring (See section F.2.).

A pickup belonging to the Aberdeen Area Recreation Center burned along the refuge tour route on the evening of June 8 (Figures 29 & 30). The pickup and trailer were used to haul bicycles to the refuge for a bike tour, sponsored annually by the AARC.

Figure 29. After pulling off the tour route road to turn around, the pickup became stuck and started on fire.

89-RLW



Figure 30. The pickup was a total loss.

89-RLW

A wildfire occurred on private land just southwest of the refuge on October 21. Three refuge personnel used the two refuge pumpers to assist five local fire departments in controlling the fire. The fire reached the landowner's buildings; but we were able to get the fire out before any of the buildings began burning. The fire was started by hunters driving along the marsh edge. The hunter's pickup and shotgun were destroyed by the fire.

Payments to Hecla and Columbia were made according to the Cooperative Fire Agreement between the refuge and each fire department.

10. Pest Control

Pest control at Sand Lake consists mainly of force account noxious weed control and cooperative farmer weed control in crops. Over the past several years, we have been working at reducing herbicide use on the refuge and, contrary to popular belief, we have made progress. The total pounds of active ingredient of herbicides applied on the refuge in 1989 was reduced 41% from 1988. Since 1983, we have reduced use from 3036 pounds of active ingredient (9 different chemicals) to 1008 pounds of active ingredient (3 different chemicals).

Noxious weed control on the refuge was contracted out to Control Services, Inc., out of Marion, Iowa. They provided one man, one four-wheel drive pickup with a sprayer, and one ATV four-wheel drive with a sprayer. They completed the job, but not without some problems. The sprayer was inexperienced and quality control was difficult since we were spraying only "problem areas". Timing their one visit with weed development was also a problem. This saved us time and manpower, but due to the cost and associated problems, we probably won't go this route again.

In 1988, we mowed some patches of Canada thistle during the summer and sprayed the regrowth with a lesser rate of 2,4-D in the fall. We had mixed results with this method. Some areas were nearly clear of thistle in 1989, while other areas were just as bad or worse. We continued this practice during 1989.

During 1989, we began experimenting with sheep to control the spread of leafy spurge (**Figures 31, 32, 33, & 34**). Eighty sheep were turned into a 15 acre grassland area, with leafy spurge scattered throughout the grassland. We stocked the area heavy with sheep because all of the spurge was headed out by the time we turned the sheep in (May 26). The sheep utilized the spurge quite readily. Most of the seedheads were nipped off the spurge plants within 10 days. By the end of the grazing period (June 26), all of the spurge had been grazed down or had all of the leaves stripped off. Forty sheep were returned to the area from August 15 to September 7 to check the regrowth of spurge.



Figure 31. Sheep were utilized in controlling leafy spurge on the refuge. The sheep were contained in the area by 4 strands of polychord electric fence.
89-WAS



Figure 32. An enclosure was erected prior to the graze to monitor the effect sheep would have on leafy spurge.
89-WAS



Figure 33. Within 10 days all of the spurge seed heads were nipped off.
89-WAS



Figure 34. This was the result of 10 days of exposure to sheep. 89-WAS

We feel the use of sheep can be a tool to meet state noxious weed control laws, reduce the spread of leafy spurge, and reduce herbicide use on the refuge. At the least, the sheep kept the leafy spurge from going to seed. With the removal of all foliage from the spurge for most of the season, food reserves in the root should have been depleted. We will monitor the area to see if any actual decrease in density will occur.

There are several logistic problems that must be worked out before we can use this method for large-scale spurge control. Many of the areas containing spurge are tree strips and out-of-the-way places scattered over the refuge without fences or water access. We plan to continue working with the current permittee to develop a system to fit in with our objectives.

We are doing all we can to encourage the use of other weed control methods, besides chemicals, by our cooperative farmers. We required David North, a new cooperative farmer, to use no herbicides during 1989. He was eager to try this, but the results were not encouraging. The decreased costs in not applying herbicides did not make up for the decrease in yields. We are looking at using different crops in the rotations which may provide better weed control, such as alfalfa, millet, rye, or forage sorghum. But we must consider how these crops fit in with other refuge programs and objectives. We are working on developing a system that will provide both a profit for the cooperator and meet our objectives.

G. Wildlife

1. Wildlife Diversity

Sand Lake National Wildlife Refuge, with its vast expanses of emergent vegetation mixed with open water, illustrates the unequaled diversity of a prairie marsh ecosystem. The slow-moving James River is the key in providing this habitat to the diverse wildlife species on the refuge.

Efforts made in opening thick stands of cattail in the northern part of Mud Lake should increase the diversity of wildlife in those areas.

2. Threatened and/or Endangered Species

Bald eagles are normally observed on the refuge in conjunction with the spring and fall waterfowl migrations. Bald eagle numbers peaked at 45 in April, and again at 20 in November.

A timber wolf was killed northwest of the refuge near Frederick. It was shot by a farmer while it was chasing a sick cow. The skull was sent to the Smithsonian to verify that it was a wolf. It was verified as a gray wolf (Canis lupis).

3. Waterfowl

a. Production

Duck production increased to 18,372, a 114% increase from last year (**Figure 35**). The large increase is mainly attributed to the poor production in 1988 due to the drought. Spring water conditions on the refuge provided excellent pair and brood habitat. Floodpools and adjacent wetlands were filled by the rapid spring runoff and high water levels in the James River. Estimated production by species is shown in **Table 8**. **Figure 36** illustrates duck production since 1976.



Figure 35. Nesting hens have a long, tough road in trying to raise a brood where ag practices conflict with nesting. 89-RLW

Annual Duck Production, 1976-1989

Sand Lake National Wildlife Refuge

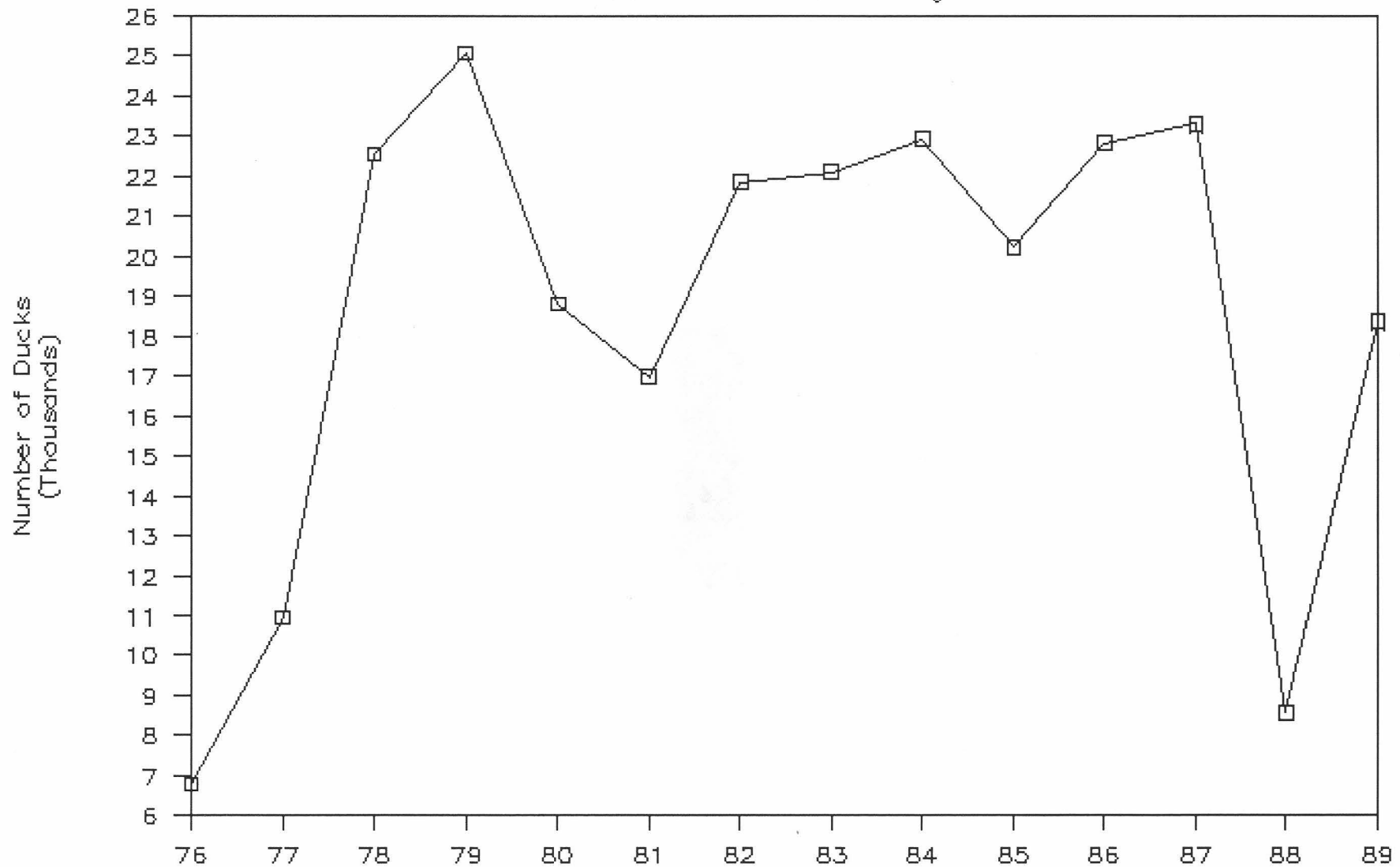


Figure 36. Annual Duck Production, 1976 - 1989, Sand Lake NWR.

TABLE 8. 1989 Sand Lake NWR Duck Production

Species	Estimated Population
Mallard	2,021
Northern pintail	92
Gadwall	1,286
Wigeon	92
Shoveler	551
Blue-winged teal	4,501
Ruddy duck	3,582
Redhead	5,879
Canvasback	92
Lesser Scaup	184
Woodduck	92
TOTAL	18,372

Canada goose production was estimated at 225, nearly the same as 1988. Water levels were relatively stable during the goose nesting season. The first Canada goose broods were observed on May 14.

Approximately 25 nesting baskets were usable during 1989. Four out of five mallard nests were successful and two Canada geese were successful in bringing off broods from the baskets.

b. Migration

The first spring mallards showed up on March 25. By the end of the month, pintails, lesser scaup, ringnecks, redheads, canvasbacks, goldeneyes, common mergansers, and hooded mergansers had made their appearances. The rapid spring runoff provided ideal conditions around the refuge for the migrating ducks.

The Canada goose migration began on March 9, but didn't really get going until March 20. The population peaked at 21,000 on March 30.

The spring migration of white-fronted geese peaked at 10,000 on April 15 (**Figure 37**).

Snow Goose Population Peaks 1976-1989

Sand Lake National Wildlife Refuge

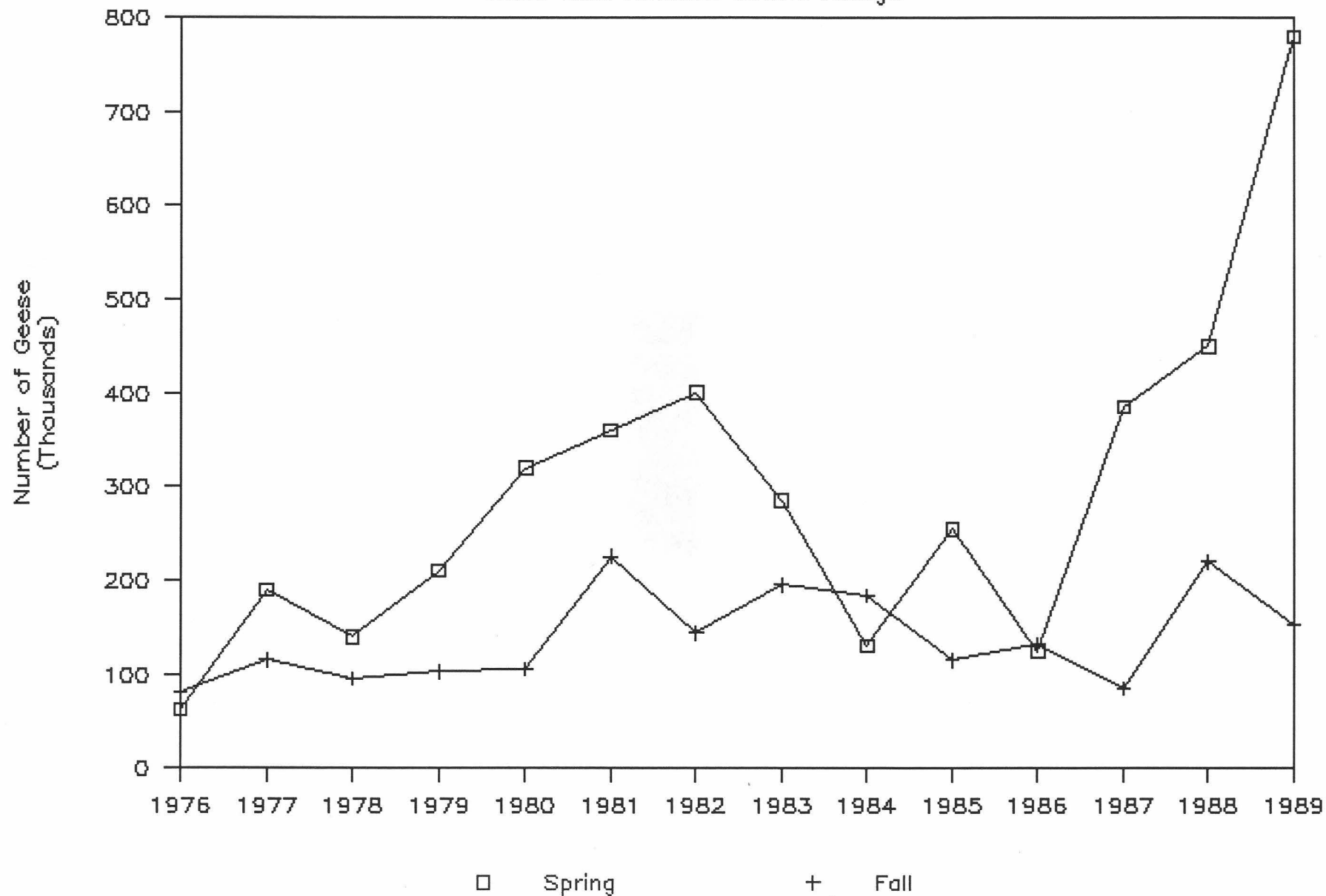


Figure 37. Spring and Fall Snow Goose Population Peaks - 1976-1989, Sand Lake NWR.



Figure 38. An albino white-fronted goose was observed several times in the display pool this spring. 89-TAF

The first snow geese were observed on March 25, and numbers in the area rose rapidly. An aerial count on March 30 revealed over 780,000 snow geese in northern Brown County, the Renziehausen area in Marshall County, and the Dakota Lake area. Few geese used the refuge due to the iced-covered pools and ideal wetland conditions surrounding the refuge (**Figure 39**). Numbers in the area began declining on March 31.



Figure 39. Over 780,000 snow geese took advantage of the excellent wetland conditions surrounding the refuge this spring. 89-WAS

The fall migration of snow geese began at Sand Lake on September 22. Goose numbers had only climbed to 18,000 by October 25, but jumped to 57,500 by the 29th. Snow goose numbers peaked at 152,000 on November 6. Numbers began dropping by November 10 and were down to 62,000 by the 13th. Strong, cold north winds on the 15th, and frozen lakes that night, moved more geese south. Most geese were gone by November 20. Total fall goose-use days were estimated at 1,982,000.

Brown County was included in a half-day goose hunting zone from October 7-27. The few geese that were here during this time used fields near the refuge, but had no set feeding pattern. Most of the geese arrived after full-day hunting had already begun. During this time, the geese used fields further and further away from the refuge. There was also a large, daily movement of geese into North Dakota.

Canada goose numbers peaked at 8,500 on October 30. Five hundred fifty Canada geese remained on the refuge until mid-December, when the only remaining area of open water froze over.

Fall duck numbers peaked at 145,000 on November 3. Five hundred mallards remained on the refuge until mid-December, when the last open water froze over.

The tundra swan migration peaked at 4,500 on November 3.

4. Marsh and Water Birds

The cattail and phragmites in northern Sand Lake provide nesting habitat for marsh and water birds. The acreage and density of emergents continued to decline. Total numbers of nesting marsh and water birds were similar to 1988.

No nesting was attempted by American white pelicans. Pelican numbers built to approximately 5,000 in August. Double-crested cormorants nested in small groups on thick mats of uprooted cattail along the southeast edge of cattail in northern Sand Lake.

Nesting great blue herons and black-crowned night herons were also concentrated in northern Sand Lake. Approximately 40 cattle egrets and several pairs of great egrets and snowy egrets were also observed. Several pairs of white-faced ibis nested in this same area.

5. Shorebirds, Gulls, Terns and Allied Species

Large numbers of ring-billed gulls spent considerable time on the refuge this spring (**Figure 40**).



Figure 40. Ring-billed gulls took full advantage of the fish winterkill this spring. 89-WAS

An estimated 50,000 Franklin gulls set up a nesting colony in the same areas of northern Sand Lake used during the last three years. The late-summer population was 130,000 in August.

Colonies of Forster's terns and black terns were scattered throughout some areas of Sand Lake. Numbers of these two species were down from previous years.

Overall, shorebird use decreased slightly from 1988, but remained fairly high due to receding water levels and exposed mudflats.

6. Raptors

Major hawk migrations occurred in the Sand Lake area during the last week of March and the last week of September.

A snowy owl was observed in the area in December.

7. Other Migratory Birds

Twenty-three bluebird houses were put up along the tour route this spring. The houses were probably put up a little late to get good use by bluebirds during 1989. Bluebirds used two of the houses, but tree swallows, house wrens, and house sparrows made up the majority of the use.

8. Game Mammals

The white-tailed deer population in and around Sand Lake caused major problems this year. Heavy snow cover forced the deer to rely on some of the local farmers' haystacks and other livestock feed. We began receiving depredation complaints about February 1. We assisted the state in distributing alfalfa bales and corn to strategic areas to cut off the deer before they got to the farmers' stacks (**Figure 41**). This helped to ease the pressure, but it wasn't until the snow cover left near the end of March that most of the depredation problems stopped. Depredation to growing corn crops was also a problem in certain areas in and around the refuge.



Figure 41. We tried to keep the deer fed on the refuge to decrease depredation on neighbors' haystacks. 89-WAS

A special deer depredation season is planned for January, 1990, in an attempt to reduce the deer herd. Deer hunting seasons are discussed in Section H.8.

A moose was sighted on and adjacent to the refuge in early October.

Several coyotes were observed on the refuge during the year. Coyote observations seem to be increasing with each passing year.

10. Other Resident Wildlife

The annual pheasant crow count was down 66% from last year's count. The harsh winter probably had some influence on this decrease. Sharptailed grouse numbers appeared to increase from 1988.

11. Fisheries Resources

The winter of 1988/89 was a tough one relative to fish survival within Sand Lake major pools (**Figure 42**). Maximum depths within the refuge pools is approximately 6 feet. Therefore, the existing fisheries has its sporadic highs and lows depending on the severity of winter. In January, February and March dissolved oxygen readings were taken at several sites on Sand Lake and Dakota Lake NWR's and the James River (**Figure 43**). Most readings were at or near 0 ppm. The February readings ranged from 0 ppm to 2.50 ppm. The 2.50 reading was taken directly downstream from the Dakota Lake spillway.

Figure 42. Fish kill observed at Columbia Grade Water Control Structure. Most fish perished in early January. 89-SY

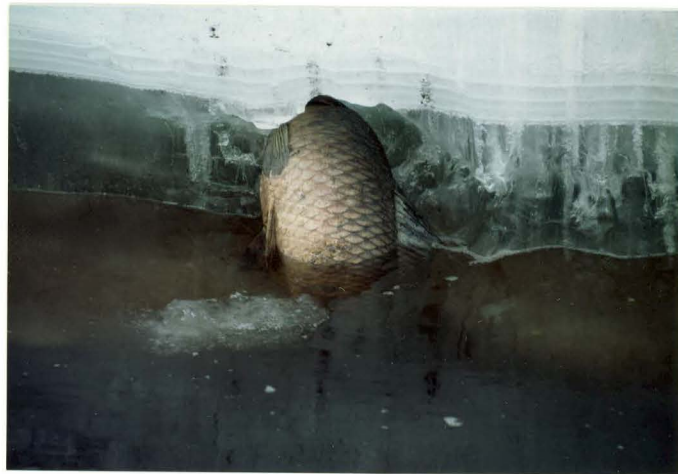


Figure 43. Dissolved oxygen sample taken down stream from Dakota Lake spillway by Frank Pfeifer, Valley City NFH 89-SY

Discussions with area fishermen indicate that fishing activity all but ceased by mid-to-late December. One fisherman reported observing black bullheads leaping out of fishing holes. At any rate it was a tough year for our Cyprinus carpio (**Figure 44**) winter residents!

Figure 44. A remnant of a James River "haug".

89-WAS



Because of increased emphasis on water quality and the Garrison Diversion Unit project development on the James River, upstream from Sand Lake (See Section J), additional parameters were measured in 1989. Careful measurements were taken with a Hydro lab Unit and Winkler titrator to collect dissolved oxygen, field conductivity, temperature and PH. Alkalinity and CO2 measurements were also taken using the standard Hach Water Ecology Kit (Model AL-36B). Additional checks were completed by U. S. Geological Survey and South Dakota Department of Natural Resources personnel.

During spring ice out some natural restocking of the refuge pools occurred when the Elm River a southern tributary to the James River backed water into Sand Lake Refuge pools.

12. Wildlife Propagation and Stocking

The South Dakota Department of Game, Fish and Parks continued it's Canada goose release program. The captive flock maintained at Sand Lake Refuge currently consists of approximately 170 geese. The geese are normally allowed to hatch their first clutch and remain with the adults until just before they reach flight stage. The State then transplanted the goslings to selected restoration areas elsewhere in the state. A cooperative agreement with the State Game, Fish and Parks covers the administrative responsibilities regarding the captive flock, and extends through 1991.

This year the captive geese began laying on April 7. One hundred five eggs were picked up from 27 nests along the shoreline of the display pool, due to predation problems, and placed in an incubator. Seventy-three goslings hatched from these eggs. Seventy-two goslings hatched from the 24 nests in the pens. Approximately 126 of the total made it to flight stage.

Facilities in the display pool area were upgraded this summer. The building where the captive flock is kept during the winter was painted and the roof repaired and stained, the top of the winter pen was replaced, the winter pen feeder was replaced,

fences were repaired, individual pools were tarred, and a split-rail fence was erected to improve the public's view of the area.

15. Animal Control

Several skunks were removed from the headquarters and the captive goose pen area during the year.

Trapping of mammalian predators on a 40 acre island in Mud Lake was initiated on April 9 and terminated on July 1 in an effort to increase waterfowl nest success. Five raccoons, one skunk, and one fox were removed from the island. Mayfield success on the 24 nests located was 21% (43% apparent). The minimum distance from the mainland to dense emergent cattails surrounding the island is less than 200 feet at the north end. Once on the island, the dense cattail and phragmites provides excellent refuge for these predators. The emergent vegetation around the island was burned this fall to facilitate predator removal during the spring of 1990.

16. Marking and Banding

Three temporary personnel and the SCA volunteer assisted S.D. Game, Fish, and Parks with rounding up and banding molting Canada geese at Waubay. A total of 2200 Canada geese was banded during the day.

A total of 2,199 ducks was banded during the pre-season duck banding at Sand Lake. Fifty-four percent of the mallards banded were males and only 12.5% were immature. **Table 9** summarizes the species, sex and age of the ducks banded.

TABLE 9. Ducks Banded in 1989

Species	Age	Sex	Number Banded	Percent
Mallard	AHY	M	1034	48.5
Mallard	HY	M	129	6.0
Mallard	AHY	F	837	39.0
Mallard	HY	F	142	6.5
Woodduck			35	
Pintail			20	
Wigeon			2	

17. Disease Prevention and Control

Sixty birds (mostly mallards and woodducks) were picked up in both Mud Lake and Sand Lake between July 21 and August 22. Botulism was the suspected problem. Most of the sites where

birds were picked up this year have been involved in previous botulism problems. Temperatures were in the 80's and 90's during the peak of the die-off.

H. PUBLIC USE

1. General

An estimated 72,805 people visited Sand Lake Refuge during 1989 (**Figure 45**) which represents a decrease of over 13,700 visitors from the 1988 estimate. The visitors who stopped at the headquarters and signed the guest register came from 32 states and 2 foreign countries. The spring and fall snow goose migrations continue to provide the featured attraction for the public.

2. Outdoor Classrooms - Students

Sand Lake provides an excellent opportunity for local school groups to conduct environmental education programs. Scout groups, 4-H clubs, church groups, YMCA clubs and elementary, secondary and college students all use the refuge for nature study opportunities.

Throughout the year Sand Lake was used by various elementary, high school and college school groups for outdoor field trips and environmental educational programs. School groups from Groton, Aberdeen Central and Northern State University were given some hands on experience (**Figure 46**).



Figure 46. Learning the ropes of rocket netting.

89-WAS

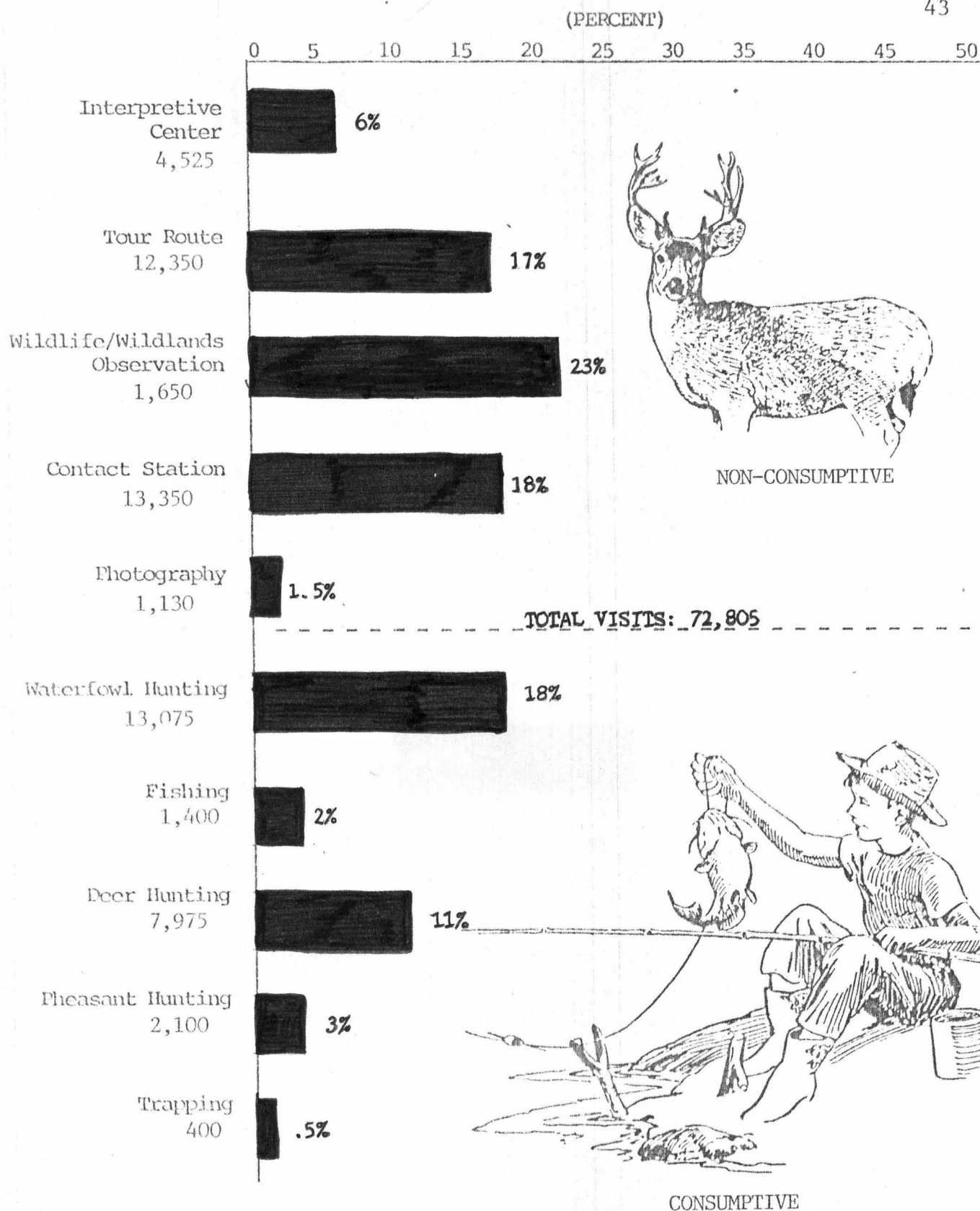


Figure 45. Visits to the Sand Lake National Wildlife Refuge, 1989.

3. Outdoor Classrooms - Teachers

In June, a Project WILD workshop was hosted at the refuge for elementary and secondary school teachers to provide the teachers with environmental education activities they could use in the classroom for helping students develop awareness, knowledge and skills to formulate informed decisions for wildlife and the environment. Areas of study dealt with various aspects of wetland ecology, including values of wetlands, identification of invertebrates, as well as emergent and submergent vegetation. Project WILD is sponsored in South Dakota by the S. D. Game Fish and Parks and this workshop was the first formal class taught in the state since the program was initiated. Approximately 20 teachers from the surrounding area participated in the program (**Figures 47, 48 & 49**).



Figure 47. Graduation of the first formal project WILD teacher facilitator workshop at Sand Lake NWR 89-SJY

Figure 48. Sand Lake Project WILD Teacher Workshop exercise in invertebrate collecting, and... 89-SJY



Figure 49. Sand Lake Project WILD Teacher Workshop exercise in invertebrate identification. 89-SJY

4. Interpretive Foot Trails

Plans were finalized and required compatibility statements were approved to develop a self-interpreted hiking trail adjacent to Sand Lake within the refuge. By years end, the interpretive signs were ordered and received and construction of the trail should be completed by early summer of 1990.

5. Interpretive Tour Route

Sand Lake Refuge contains a 15 mile self-guided auto tour route. The tour route starts at headquarters and winds through the refuge with numbered stops, and with the accompanying tour leaflet, gives visitors an insight into refuge history and management.

The auto tour route was opened to the public on April 4th this year. The spring and fall snow goose migrations are the main attractions for visitors on the auto tour route. In 1989, approximately 12,350 visitors used the route, accounting for 17% of the total refuge visits (**Figure 45**).

An updated version of the auto tour leaflet was received and made available for the public at the start of the 1989 season.

In addition to the self-guided tours, the refuge provides conducted tours, upon request, for special groups. In 1989, tours were conducted for the Hecla and Eureka Boy Scouts, Aberdeen Parks and Recreation, Glacial Lakes Tourism Association and the Aberdeen Adjustment Training Center.

The Executive Board of the Brown County Sportsman's Club was given an informational tour in August. This annual event has been very helpful for dispensing information and dispelling rumors about refuge programs.

6. Interpretive Exhibits/Demonstrations

In October, Maurice Wright, Regional Interpretive Specialist, visited the refuge to discuss the potential for I & R development. Preliminary designs for exhibits at refuge headquarters, the development of a nature trail, a visitor turnout with an observation deck and other exhibits were finalized.

Visitor contact stations are located at the headquarters' entrance and on Highway #10, which crosses the refuge. The unmanned stations provide visitors with leaflets, maps and information on the goose flocks when the refuge office is closed. Photographic displays at the stations are changed to depict the various seasonal changes on Sand Lake.

7. Other Interpretive Programs

Media contacts via interviews during 1989 included 4 radio stations, 3 television stations and 2 newspapers. A total of 19 news releases were issued from the refuge and 24 personal appearances were made by refuge personnel. An estimated 3500 public inquiries were answered throughout the year.

Other interpretive or informational programs were presented to the following: Leola Sportsman Club, Day County Izaak Walton League, Aberdeen Parks and Recreation, Groton Kiwanis, Aberdeen Cub Scouts, St. Anthony Church group, Brown County Historical Society, YMCA, Aberdeen Alliance Church, Lutheran Pastors Conference and Northern State University. Additionally, duck identification workshops were presented to the Hecla and Aberdeen Sportsmans Clubs. John Koerner was featured banquet speaker at the Eureka Sportsmans Landowner Appreciation dinner as well as a speaker to the South Dakota State University senior wildlife students on career opportunities with the Fish and Wildlife Service. He also serves on the board of the Aberdeen Convention and Visitors Bureau.

8. Hunting

a. Waterfowl

Waterfowl hunting on Sand Lake is restricted to 300 public blinds, with adjacent retrieval zones, that are located along the refuge boundary.

The primary goose species hunted at Sand Lake is snow geese with a few Canada geese harvested early and late in the season. Snow goose season opened on October 7 and closed on December 31 with half-day hunting regulations in effect from October 7 through 27 for many of the northeastern counties of South Dakota including the Sand Lake area. Although half-day goose hunting has been established in this area since 1986, it continues to be a controversial subject among the hunters. The fall goose population peaked on November 6 with 152,000 snow geese and 8,000 Canada geese. This compares to 220,000 snow geese and 9,500 Canada geese on October 30, 1988. Nearly all the geese continued their southerly migration by November 16 when cold arctic weather froze the lake.

Duck hunting is mostly an opportunistic event with only a few hunters specifically hunting ducks. Duck hunting was generally poor throughout the area with many of the wetlands dry due to the drought. Hunters using the public blinds along the refuge boundary did manage to shoot a few ducks but success was sporadic as the birds became wary of the established blind areas. Waterfowl hunting provided 18% of the total visitation to the refuge in 1989 and is the predominant consumptive use (**Figure 45**).

b. Deer

The Sand Lake archery deer season was open from November 1-11 and December 11-31, 1989. Anyone possessing a 1989 South Dakota archery license may hunt the refuge as no special refuge permits are required. The popularity of the Sand Lake archery season continues to grow each year with more resident and non-resident hunters observed in the field. Although no harvest data are available specifically for the refuge, a total of 277 deer (191 males and 96 females) was harvested throughout Brown County according to data obtained by the South Dakota Game, Fish and Parks.

Five scheduled fall rifle deer seasons with two permit options were available to Sand Lake hunters in 1989. The first season is limited to the use of muzzleloading rifles only (**Figure 50**) with the remaining 4 seasons available to center fire rifles. The number of hunters

has remained at a maximum of 135 people per season as a safety factor. Non-residents are allowed 7.4% of the deer licenses available on the refuge.



Figure 50. Muzzleloading is a popular sport at Sand Lake.
89-JWK

Because of the expanding deer herd and the depredation problems experienced in January and February, the number of tags available to the hunters was increased by 4.7% in 1989. An increase in the number of tags in both 1988 and 1989 did not achieve the amount of harvest necessary to maintain a stable population so additional reduction seasons were authorized from January 4-8 and 9-14, 1990, on the refuge and January 4-14, 1990, outside the refuge boundary. A total of 125 double tag antlerless only licenses were issued for each of the seasons on the refuge and 500 single tag antlerless only tags were issued outside the refuge boundary. **Table 10** lists the deer seasons, licenses and success for Sand Lake in 1989.

Table 10. 1989 Sand Lake Firearms Deer Season Data

Season	Dates	Single Tags	Double Tags	Total Tags Available	Hunter Success	Estimated Deer Harvest
#1	Nov 12-16	27 *	108 **	243	53%	129
#2	Nov 17-21	27 *	108 **	243	76%	184
#3	Nov 22-26	27 *	108 **	243	67%	164
#4	Nov 27-Dec 3	27 *	108 **	243	67%	163
#5	Dec 4-10	27 *	108 **	243	60%	146
#6 Reduction	Jan 4-8, 1990	--	125 ***	250	60%	150
#7 Reduction	Jan 9-14, 1990	--	125 ***	250	47%	117
				1715	61%	1053

* Authorized hunter to harvest one any deer.

** Authorized hunter to harvest one any deer plus one antlerless deer.

*** Authorized hunter to harvest two antlerless deer.

c. Pheasants

Pheasant season on the refuge begins the day following the close of the last deer season on the refuge. This year the season was conducted from December 11-31. Pheasant season outside the refuge was conducted from October 21-December 10. Lack of snow cover made hunting success rather poor as the birds were very wary and could out-maneuver the hunters.

d. Raccoon

The refuge raccoon season was conducted from January 1-February 28, 1989. A total of 5 permittees was selected to participate in the hunt (Table 11). This hunt is designed to help reduce the raccoon population and thereby reduce their impacts on nesting waterfowl. Hunters are allowed to hunt from 8 a.m. to 5 p.m. using dogs trained to trail raccoons. A total of 117 raccoons was harvested in 1989. This compares to 205 in 1988.

Table 11. Raccoon dog harvest by hunter, Sand Lake NWR (1989)

Raccoon Harvested					
	Adult Male	Adult Female	Total Adults	Juvenile	Total
	6	3	9	2	11
	5	4	9	10	19
	6	5	11	13	24
	4	5	9	22	31
	*	*	7	25	32
Total	21	17	45	72	117

*Did not differentiate between adults harvested.

9. Fishing

Fishing is allowed at three locations on the refuge, the Hecla Recreation Area, along Highway 10, and the Weismantle Grade. The most sought after fish is the Northern pike, with occasional catches of yellow perch, bullheads or walleye.

Fishing was poor to terrible on the refuge in 1989. The winter of 1988-1989 allowed a fairly extensive and thorough winterkill of most of the fish species throughout the refuge. Although this is extremely important to reduce the carp population for waterfowl habitat maintenance, it also reduces the fishing opportunities. In 1989 an estimated 1,400 fishing visits were reported on the refuge as compared to 4,925 visits in 1988.

10. Trapping

Only one trapping season was conducted on Sand Lake NWR in 1989. This year the season commenced on November 6 and ended November 30. Only two trappers expressed an interest in trapping on the refuge. Permittees were allowed to harvest mink, long tailed weasel, red fox, striped skunk, raccoon and coyote. The trappers received 100% of the harvest and were required to release any non-target animals (**Table 12**). A decision was made to suspend the muskrat trapping in 1989 due to low numbers of muskrats harvested in 1988 and a reduction in the number of houses observed in 1989.

Table 12. Fur Harvest on Sand Lake NWR 1979-1989

Year	Fox	Raccoon	Striped Skunk	Spotted Skunk	Coyote	Mink	Badger	Muskrat
1989	47	45	8	-	1	-	4*	-- **
1988	43	27	7	-	-	1	-	510
1987	26	42	41	-	-	2	-	3524
1986	35	45	41	-	-	11	1	3547
1985	40	48	37	-	-	4	4	717
1984	149	118	36	-	1	8	3	2836
1983	120	82	23	-	-	7	4	1798
1982	66	73	9	-	1	14	6	3523
1981	81	110	41	1	-	1	6	2128
1980	22	92	47	-	-	4	3	2125
1979	56	109	54	2	-	8	2	-- **

* Caught and released

** No Season

11. Wildlife Observation

Approximately 750,000 snow geese used the refuge and surrounding areas during their 1989 spring migration. Although the birds only stayed for a few days, this high concentration of geese attracted a large number of visitors. Approximately 23% of the refuge visitation is attributed to wildlife observation. An additional 1,230 visits were made by photographers, from the novice to the professional.

The Aberdeen Parks and Recreation Department, the Glacial Lakes Tourism Association and other local groups sponsor various tours of the refuge.

13. Camping

Public camping is not allowed on Sand Lake but special groups have been issued permits to camp at the recreation area south of headquarters. In June the youth group from St. Anthony's Catholic Church in Hecla was permitted to camp on the refuge. The group also participated in a church service since the recreation area has the historical significance of being the site of the first Catholic mass celebrated in South Dakota (1845).

14. Picnicking

Picnic tables, a shelter, and grills are available to the visiting public at the refuge recreation area just south of headquarters. Use of the facilities occurs mainly on summer weekends by families and groups touring the refuge.

It is expected that picnicking will increase with the construction of a hiking trail in 1990 which will start and end at the recreation area.

17. Law Enforcement

Five refuge personnel, special agents and state conservation officers patrol Sand Lake primarily during the waterfowl and big game hunting season. Minimum time is devoted to enforcement on the wetland district. A preventative law enforcement program is incorporated on the refuge utilizing news releases, personal contacts and leaflet dispensers with refuge maps and hunting information placed at parking lots and high use areas. However, the number of violation notices increased to 34 which compared to 25 violations in 1988. **Table 13** summarizes the violation notices issued in 1989.

Table 13. 1989 Violation notices issued by Refuge Officers.

Number	Violation Description	Disposition
5	Possession of Toxic Shot	\$50/each
2	Vehicle trespass	\$35/each
1	Vehicle trespass on State GPA	Referred to State: \$45.
2	Unplugged gun	Referred to State: \$30/each
3	Unauthorized taking of big game	\$100/each
2	Hunting in No Hunt Zone	\$50/each
1	Hunting without license	\$50
1	Improper state license	Referred to State: \$30
1	Hunting before legal hours	Referred to State: \$20
1	Hunting after legal hours (geese)	\$100
4	Failure to display license	1 - \$35
	Referred to State: 3 - No disposition	
1	Hunting during closed season (archery)	\$100
1	Failure to wear hunter orange	Referred to State: \$30
2	Shooting big game from maintained road	Referred to State: \$80/each
1	Hunting in wrong unit	Referred to State: \$55
1	Hunting big game without license	Referred to State: \$100, 1 year license revoked
1	Unlawful possession of big game	Referred to State: \$100, 10 days jail (suspended)
2	Violation of refuge regulations	\$50 each
	(a) party hunting	
	(b) failure to check traps	
1	Unauthorized take of migratory bird (cormorant)	Juvenile - Referred to State: \$50.
1	No duck stamp	\$50

Unfortunately, one of the more serious violations which occurs on the refuge primarily during deer season is referred to as "Hi-grading". Hi-grading is a hunter's insurance policy where an animal is harvested and then the hunter attempts to harvest a bigger buck or larger deer. If unsuccessful, the original animal harvested is tagged. If, however a better animal is harvested, the original one is discarded (**Figure 51**). Even with increased public awareness of the problem and increased law enforcement efforts, the practice continues.



Figure 51. "Hi-grading" of deer occurs too often on the refuge. 89-MJH

I. EQUIPMENT AND FACILITIES

1. New Construction

Two new kiosks were constructed for better refuge orientation. The kiosks were constructed in the shop (Figures 52 & 53) during the winter and then moved to the different locations and secured to the cement slab in late spring.



Figure 52. Kiosks were built in the shop and . . . 89-JWK



Figure 53. . . . moved to the location. 89-JWK

2. Rehabilitation

The "birdhouse", a former research building on the refuge, was converted to a bunkhouse/dormitory for temporary personnel in 1988. This year the building received a facelift with steel siding (Figures 53 & 54).



Figure 54. Off with the old . . .

89-JWK



Figure 55. . . . and on with the new.

89-JWK

Refuge staff completed renovations at the captive goose display pool and winter pen by replacing old deteriorated fence with a new split rail fence. The winter pen building required roof repairs and stain and the individual breeding pen fences and ponds required maintenance as well. To help prevent the captive goose flock from luring birds into the headquarters' pond which is located 1/2 mile from private goose blinds, an overhead concealment netting was supplied by the State Game, Fish and Parks Department and installed on the winter pen.

The regional tree spade was used to plant trees along the north and south end of the goose breeding pens to provide a visual barrier from the public and allow a more secluded area for the rearing of the goslings (**Figure 56**). The tree spade was also used to grow instant trees around the north residence.



Figure 56. The refuge made use of the regional tree spade.

89-JWK

Numerous gallons of paint were spread on many of the buildings around headquarters by the Job Service enrollees thereby providing an earth-tone appearance to all the buildings.

A contract was let and work commenced in early December to remove, insulate and install steel siding on Quarters #194, #195, and #196 and replace the windows in Quarters #17. Work was curtailed in mid-December because of below zero weather.

A small leak was detected in the Mud Lake water control structure in the fall of 1989. A video tape of the leak was sent to Engineering and an engineer visited the site. A repair plan was formulated and will be implemented in the spring/summer of 1990.

To facilitate the refuge grazing program approximately 1 mile of interior and boundary barbed wire fence was repaired with an additional 3/4 mile of old fence removed. Because of the speed of installation and ease of movement, electric fence is being used more each year.

4. Equipment Utilization and Replacement

Two above ground fuel storage tanks were purchased from ConVault Industries at a cost of approximately \$5,000 each (**Figure 57**). The two new tanks replaced four underground fuel storage tanks, two of which had suspected leaks (**Figure 58**). The old underground tanks will be removed and discarded and the surrounding soils will be tested for contamination and removed if necessary in 1990.



Figure 57. Four underground fuel storage tanks . . .

89-MJH



Figure 58. . . . were replaced with two above ground self-containing storage tanks. 89-MJH

Other equipment received during 1989 included:

- 1989 Chevy 3/4 ton 4x4 pickup
- 1989 Chevy 1 ton 4x4 pickup
- 1989 Chevy 1/2 ton 4x2 pickup
- used 1 row corn picker
- 15 ton equipment trailer primarily for WMD activities
- television, VCR, and cabinet
- metal detector
- Lietz automatic level and tripod

6. Computer System

A Zenith laptop Supersport 286, a WIN desktop computer with Casper VGA monitor, a NEC pinwriter P5300 printer, a Hewlett Packard LaserJet II printer, and a computer cabinet were purchased in 1989.

7. Energy Conservation

As part of the siding contract for the refuge residences, styrofoam insulation panels compatible with the steel siding were installed to further reduce energy consumption.

J. OTHER ITEMS

1. Cooperative Programs

a. Christmas Bird Count

On December 27th nine observers took to the field, on foot and by car, to participate in the Audubon Society's 90th Christmas Bird Count. Sand Lake has joined in the count since 1978.

This year 23 species (1,312 individuals) were seen. A year ago 33 species (18,339 individuals) were seen. What happened, you ask? Well, for one thing, on December 21, 1988, there were 16,000 mallards and 500 snow geese here. This year there were none. Also, about 50% more party-hours and party-miles were used in the '88 count.

b. Garrison Diversion Unit (ND)

The Garrison Diversion Unit (GDU) in North Dakota constitutes one of the principal developments of the Pick-Sloan Missouri River Basin Program. The initial stage of GDU was authorized on August 5, 1965, and construction began in 1967. The project was authorized to provide for: (1) the irrigation of 250,000 acres, (2) municipal and industrial water, (3) fish and wildlife, (4) recreation, and (5) flood control. In the 24 years since GDU was authorized, substantial opposition to the project has been voiced. In an effort to resolve the economic, environmental and international controversies surrounding the project, the 98th Congress of the United States passed Public Law 98-360. This law directed the Secretary of the Interior to establish a Commission to examine the current water needs of the state of North Dakota. The Garrison Diversion Unit Commission was appointed on August 11, 1984. The 12 member Commission was specifically directed to evaluate GDU and propose modifications which would lead to an early resolution of the problems that have delayed construction. After considering various alternatives, the Commission provided recommendations to the Secretary of the Interior in its Final Report, dated December 20, 1984. The Commission recommended a plan which included a 130,940 acres of irrigation, municipal, rural and industrial water for up to 130 communities, recreation development, and a wildlife mitigation and enhancement plan. The recommendations contained in the final report were reviewed by Congress and approved with modifications. Public Law 99-294 which was signed by the President on May 12, 1986, authorized the construction of the GDU substantially in accordance with the recommendations of the Commission's Final Report. P.L. 99-294 known as the Garrison Diversion Unit Reformulation Act of 1986 (HR 1116), is intended to meet the contemporary water needs

of the State of North Dakota, including municipal, rural and industrial water needs, while specifically preserving any existing rights of the state to use water from the Missouri River. Specific provisions are included in HR 1116 to minimize the environmental impacts of constructing and operating GDU, especially impacts to fish and wildlife resources.

The new authorization includes about 71,000 acres of irrigation that will either deliver project flows and/or irrigation return flows into the James River. About 37,000 acres (52%) will be located below Jamestown Dam upstream of the ND-SD border. The old 1965 authorization included about 33,000 acres in the basin.

The project alternatives most degrading to wildlife are those that include an open-water conveyance system through the Refuge. Impacts would include those associated with (1) decreased ability to control water levels to manage for vegetation, overwater nesters, and carp control; (2) unnatural fluctuations in water levels when storms add water to Garrison flow; (3) increasing carp survival on the Refuge; (4) introduction of contaminants associated with irrigation return flows; (5) altering the existing nutrient balance in the marsh ecosystem; and (6) foreclosure of future opportunities to utilize existing and new marsh management strategies.

The project increasingly takes more time away from other refuge and wetland management activities (**Table 14**). Throughout the year, refuge staff has provided written review comments on numerous planning documents. Many interagency and public meetings were also attended by staff members. Major activities that refuge staff worked on during the year included:

- . Evaluation of James River Comprehensive Report
- . Intra-agency coordination with Fish and Wildlife Enhancement Division on its Fish and Wildlife Coordination Report on GDU impacts to James River National Wildlife Refuges
- . Evaluation and development of offsite and onsite refuge bypass canals around Sand Lake NWR
- . Coordination with SDSU and Bureau personnel on various ongoing investigations, and;
- . Coordination with Service and Bureau personnel on West Oakes Irrigation Test Facilities Activities (**Figures 59 through 63**).



Figure 59. Bureau's solution in capturing additional flows at Dakota Lake NWR, is the use of sandbags for capture and diversion of streamflows to its West Oakes Area Irrigation Test Facility. 89-JWK

Figure 60. Stream flows are diverted from the James River (foreground) and gravity fed down the canal inlet to the Oakes Pumping Plant to provide irrigation water to agricultural lands within the 5,000 acre Oakes Test Facility (OTA). This test area prototype is located immediately upstream from Sand Lake NWR and adjacent to Dakota Lake NWR in North Dakota. Photo views east.

89-SJY



Figure 61. Aerial view of the Oakes Pumping Plant, Oakes irrigation area in southeastern North Dakota.
89-SJY



Figure 62. Aerial view of irrigation lands within the OTA Irrigation facility. Photo views west with irrigation lands in foreground and Oakes inlet canal and pumping plant in background.

89-SJY

Figure 63. Aerial view of irrigation return flow drain entering Dakota Lake NWR from the east. This is one of several drains that are either constructed or proposed when and if the 23,660 acre West Oakes irrigation area is fully developed. Photo views northeast from Dakota Lake NWR. 89-SJY



Even with the modifications to the project as a result of HR1116, there appears to be a great deal of dissatisfaction from various segments of the public. In particular, local South Dakota residents are not pleased that bypass canals around Sand Lake NWR are being seriously considered as mitigation features of the project. Local residents in the Oakes-Cogswell, North Dakota, areas are very dissatisfied with the Kraft Slough NWR proposal called for under the reformulated project. Opposition to the project is well organized and has been effective in again, questioning the merits of this water development project.

The President has recommended no funding for the FY 91 budget and a recent Interior Inspector General's report has severely criticized the irrigation features of the project.

Table 14. Planning Activities on the Garrison Diversion Unit, Completed by Refuge Staff at Sand Lake NWR (January - December 1989)

Month	Activity
January	<p>Coordinated activities with U.S. Geological staff on water monitoring readings on Sand Lake.</p> <p>Coordinated activities with Valley City NFH personnel in the completion of water quality evaluation on Dakota Lake, James River and Sand Lake National Wildlife Refuge.</p> <p>Met with Bismarck Field Office (FWE) and SDSU staff to discuss aspects on the Garrison fisheries study.</p> <p>Provided comments on Regional Office GDU briefing statement and Preliminary draft Fish and Wildlife Coordination Act report on James River Refuges to Bismarck Field Office (FWE).</p> <p>Provided background information on GDU by-pass canal alternative (refuge on-site) to Regional Office.</p> <p>Attended interagency Garrison meeting in Bismarck, ND, and interdivisional Regional office briefing in Denver, CO.</p>
February	<p>Coordinated activities with U.S. Geological Survey personnel on water quality testing in Sand Lake.</p> <p>Coordinated activities with Valley City NFH personnel in the completion of water quality</p>

February (cont.) evaluation of Dakota Lake NWR, James River and Sand Lake NWR.

Met with Bureau, and North Dakota Game and Fish personnel on guidance on constructing office/shop facilities at the Bureau's Lonetree Reservoir site in North Dakota.

Completed a preliminary assessment on the east and west side Garrison Bypass canals. The assessment was prepared and provided to the Regional Office for review.

Coordinated activities with Bismarck Field Office (FWE), Denver Regional Office (FWS), and Bismarck Bureau project office personnel on Garrison (Bypass) public meeting held in Hecla, SD.

March Coordinated activities with U.S. Geological Survey and South Dakota Department of Water and Natural Resources personnel on water quality testing in Sand Lake.

Coordinated activities with Valley City NFH personnel in the completion of water quality evaluation of Dakota Lake and Sand Lake NWR's and James River.

Attended the annual refuge interagency refuge monitoring meeting in Jamestown, ND.

Provided written comments to Bismarck Field Office (FWE) on Garrison James River Comprehensive (Chapter IX) and draft FWCA reports.

Provided written comments to SDSU on its two year GDU carp study at Sand Lake NWR.

April Coordinated activities with Bureau, U.S. Geological Survey and Bismarck Field Office (FWE) personnel on water quality and biological studies to be completed at Sand Lake NWR.

Attended an intra agency meeting with Refuges and Wildlife and FWE staffs to discuss issues surrounding the use of bypass canals at Arrowwood and Sand Lake NWR's.

April (cont.)	Provided written comments to Bismarck Field Office (FWE) on its draft FWCA report on James River Refuges.

May	Coordinated activities with Bureau, U.S. Geological Survey, SDSU and Bismarck Field Office (FWE) personnel on water quality and biological studies ongoing at Sand Lake NWR.
	Completed revised Garrison bypass (on site) analysis evaluation for Denver Regional Office. Prepared Special Use Permits for GDU Biological activities to be completed at Sand Lake NWR.

June	Coordinated activities with Bureau, U.S. Geological Survey, SDSU and Bismarck Field Office (FWE) personnel on water quality and biological studies ongoing at Sand Lake NWR.
	Met with Bureau personnel on water withdrawals from Dakota Lake NWR for West Oakes GDU irrigation operations.

July	Coordinated activities with Bureau, U.S. Geological Survey, SDSU, and Bismarck Field Office (FWE) personnel on water quality and biological studies ongoing at Sand Lake NWR.

August	Coordinated activities with Bureau, U.S. Geological Survey, SDSU, and Bismarck Field Office (FWE) personnel on water quality and biological studies ongoing at Sand Lake NWR.

September	Coordinated activities with Bureau, U.S. Geological Survey, SDSU, and Bismarck Field Office (FWE) personnel on water quality and biological studies ongoing at Sand Lake NWR.
	Met with Bureau personnel to discuss aspects of the Sand Lake Bypass Canal.

October	Coordinated activities with Bureau personnel on tuber sampling in Mud and Sand Lake refuge pools.

November	Provided comments to Bismarck Field Office (FWE) with comments on its fish indexing and trace elements (heavy Metals) draft reports.

December	Coordinated activities with U.S. Geological Survey personnel on its water quality monitoring activities on Sand Lake NWR.

c. SD Breeding Bird Atlas Project

In 1988, we initiated work on the SD Breeding Bird Atlas (BBA) project. The purpose of the SD BBA is to document the current (1988-1992) distribution and status of all species of birds breeding within the state's boundaries and to publish the results as a permanent record.

The project involves the systematic collection of breeding evidence by volunteer observers within 300, 3 mile by 3 mile blocks, as well as within many managed areas: national forests and grasslands, and waterfowl and game production areas.

Cooperating observers will work under the direction of state and regional coordinators to assure uniformity and accuracy of the data as well as adequacy of the coverage. Data will be reviewed by the regional coordinators before entry into the project data storage and retrieval system by the state compiler.

d. Wildlife Agreements

The Canada goose propagation agreement between the FWS and the South Dakota Game, Fish and Parks was continued.

e. Fire Agreements

Fire agreements with the Columbia and Hecla Fire Departments were continued. We pay a retainer of \$100 per year and an additional \$100 for each fire they attend. Hecla responded to the Bikethon fire on June 8th.

f. Farm Bill

Continued effort has been made to resolve the disagreement as to the date of commencement of a drainage installation in Clark County.

Possible Swamp-buster activities have been referred to various county ASCS offices. We have received no feedback.

One "minimal effect" problem in Hyde County was resolved when the owner removed the fill from some wetlands and filled a ditch.

g. Over-the-Horizon Backscatter (OTH-B) Radar System

This past year refuge staff met several times with consultants and/or Pierre State Office (FWE) personnel regarding planning and development of the Department of Defense OTH-B radar system. Several "NEPA" scoping meetings were also held in the project area. The site is located about 10 miles northeast of the refuge near the SD-ND state line.

Issues of concern include bird strikes, wetlands and wetland value losses, proposed threatened and endangered species (prairie fringed orchid), and prairie chickens. The issue with bird strikes is the most significant because of the high concentration of waterfowl and other migrants in the proposed area.

A Special Use Permit was issued in September 1989, to allow consultants to complete soil boring tests and ground control for aerial photography on the Hayes Waterfowl Production Area which lies adjacent to the project area.

The project will include some 2,600 acres and have several towers that may extend upwards to 135 feet in height. The project cost is approximately \$600 million and life expectancy is 20 years.

Initially the project had a great deal of support from the local public due to the fact that a willing seller was available. However, opposition to the project is growing. The Air Force recently admitted that the project could not detect cruise missiles and with the ever changing developments in Eastern Europe, many people are questioning the need for the project. The opposition is now well organized and includes activists from Minnesota, North and South Dakota. Area Congressional Representatives are now very "cool" to the proposal.

3. Items of Interest

Lisa Marie Young was born on December 2. She is the first descendant of Steve and Kim Young (**Figure 64**).

Ron Frohling completed the S130/S190 fire training held at LaCrosse, Wisconsin, in May. Bill Schultze completed the S390 fire training held in Denver, Colorado, in March.

Berle Meyers attended the Equipment Operators Instructor's School at Wheeler NWR in September. He certified operators at Waubay NWR and Madison WMD.



Figure 64. Permanent refuge staffing increased by one when Lisa Marie was born. 89-SJY

Several employees attended the Law Enforcement refresher sessions at Marana, Arizona, and at Sioux Falls, South Dakota.

Mark Heisinger served as a firearms instructor at Glynco and at CMR and Tewaukon.

Marcia Haaland and Bob Wright attended a pre-retirement seminar in Bloomington, Minnesota.

Bill Schultze and Marcia Haaland attended computer training in Jamestown, North Dakota.

The refuge was host to the annual regional meeting of the South Dakota Department of Game, Fish and Parks held in December.

The station was visited by former manager Lyle Schoonover and his daughters on October 8th (**Figure 65**).



Figure 65. Lyle Schoonover and daughters, Judie, on his left, and Sandy, on his right, visited Q-17 where they had lived while Lyle was manager from 1959 to 1972. 89-JWK

4. Credits

Bill Schultze wrote Sections B, F, and G; Steve Young wrote Sections D, J 1b, J 1c and the part concerning Pocasse NWR. Bob Wright wrote Section E and those parts of Section J not written by Young. Mark Heisinger wrote Sections H and I. Marcia Haaland assembled the leaflet packet and processed the report. John Koerner reviewed and highlighted the entire report.