

REVIEW AND APPROVALS

**SAND LAKE NATIONAL WILDLIFE REFUGE
Columbia, South Dakota**

**ANNUAL NARRATIVE REPORT
Calendar Year 1988**

<u>John W Koerner</u>	<u>4/1/89</u>	<u>Rae Rauch</u>	<u>8/22/89</u>
Refuge Manager	Date	Refuge Supervisor Review	Date
<u>Ralph F. Fries</u>		<u>8/24/89</u>	
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.

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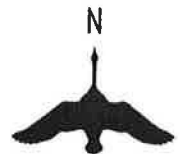
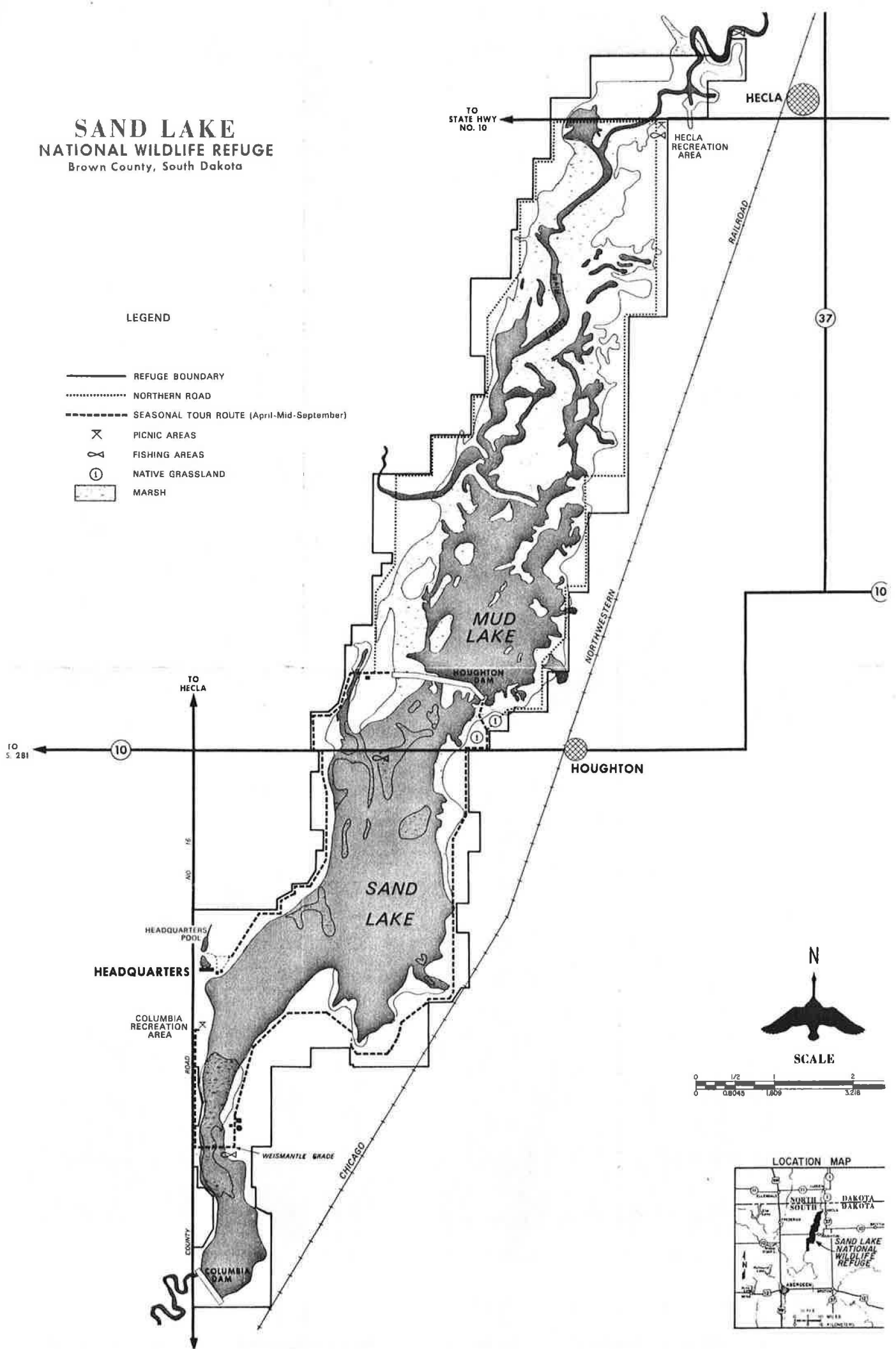
Nothing to Report

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



LOCATION MAP



A. Highlights

- Drought conditions caused severe wind erosion problems for farmers around the refuge.
- John Koerner, former manager at the Waubay NWR, was selected as Project Leader for Sand Lake (Section E.1).
- Lack of moisture had a major impact on refuge grasslands and crops (Section F).
- Prescribed burns, totalling 410 acres, were accomplished in two cattail choked areas of the refuge (Section F.9).
- Almost a half-million snow geese used Sand Lake during the spring migration (Section G.3).
- Waterfowl production took a nose dive due to the drought conditions over most of the region (Section G.3).
- Refuge impacts from North Dakota's Garrison Diversion Unit irrigation project continued to cause a lot of work and concern for Sand Lake (Section J.1).

B. Climatic Conditions

The weather during 1988 stirred the memories of those folks in the area that lived through the "dirty thirties". Although annual precipitation totaled 18.37 inches, which is normal for this area, timely distribution was far from normal. Following a dry fall in 1987, only .77 of an inch of precipitation was received during the first four months of the year. High winds in March through May had the dry dirt blowing throughout the Area (**Figures 1, 2**). Moisture finally started arriving in late-May, but drought conditions persisted through the summer. A thunderstorm brought golfball sized hail to the headquarters area on July 23, causing some damage to buildings. Two fires were started by lightning during a thunderstorm on August 7. A winter storm on December 25-26 dropped 10 inches of snow on the refuge. Thirteen inches of snow were on the ground at year's end.



Figure 1. High winds and unprotected soil produced clouds of dirt that on several occasions darkened the sun. U. S. Highway 281 south of Aberdeen was closed due to zero visibility from blowing dirt. 88-WAS



Figure 2. Our neighbor's field . . . The only problem is it's on the wrong side of the fence. 88-WAS

The ice on the main lake broke up on March 28 and froze over on November 17.

Table 1 provides a summary of the weather for 1988.

TABLE 1. Weather Summary, 1988

Month	Precipitation (Inches)	Snowfall (Inches)	Maximum Temp (F)	Minimum Temp (F)
January	.27	4.5	43	-24
February	.14	3.4	57	-28
March	.26	2.5	62	-1
April	.10	.5	83	10
May	3.03	-	89	24
June	1.19	-	106	48
July	3.97	-	100	48
August	2.70	-	102	37
September	5.09	-	86	36
October	.21	T	76	15
November	.61	6.2	53	-2
December	.80	15.4	49	-15
TOTAL	18.37	32.5	106 (Extremes)	-28

D. Planning

4. Compliance with Environment and Cultural Resource Mandates

In June 1988, a Section 10/404 application was submitted to the Corps of Engineers (Corps) for the development of boat ramp facilities into Sand Lake. The ramp will provide access for refuge boats onto Sand Lake and will not be open to the general public.

A Corps nationwide permit was issued in July and work was completed by force account in October.

5. Research and Investigation

Sand Lake NR88 - 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 is 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. The study is being conducted

in a 7-county area of 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 1988, 160 baskets, 175 bales, 20 culverts, and 30 new, self-maintaining tubs were available for monitoring, but only 134 baskets (83.3%), 24 bales (13.7%), 15 culverts (75.0%), and 30 self-maintaining tubs (100.0%) were surrounded by water and considered "usable". A total of 25 duck and 23 goose nests were found on structures in 1988. Three species of waterfowl, Canada geese (*Branta canadensis*), mallards (*Anas platyrhynchos*), and redheads (*Aythya americana*) nested on these structures. (In addition, a pair of barn swallows (*Hirundo rustica*) incubated four eggs in a mud nest on the underside of a self-maintaining tub; fate unknown.) Overall occupancy rates of all structure types were 12.3% by ducks (92% mallards), 11.3% by Canada geese, and 23.6% by both groups combined. Overall nest success of all structure types was 60.0% by ducks, 91.3% by geese, and 75.0% by both groups combined. Occupancy rates and nest success for ducks overall was 11.2% and 80.0% on baskets, 25.0% and 0.0% on bales, 20.0% and 100.0% on culverts, and 3.3% and 0.0% on the new, self-maintaining tub structure. Comparable data for geese are 11.2% and 93.3% on baskets, 25.0% and 83.3% on bales, 13.3% and 100.0% on culverts, and 0.0% on self-maintaining tubs.

Occupancy, nest success and nest fate of waterfowl on nest structures at Sand Lake NWR are listed in **Tables 2 and 3**.

Table 2. Occupancy and nest success of ducks¹ and geese on wire open-topped cone baskets in the Sand Lake NWR.

	N Available	N (%) in Water ²	N (%) Use	N (%) Success
Ducks	26	17 (65.4)	3 (17.6)	2 (66.7)
Geese	26	17 (65.4)	2 (11.8)	2 (100.0)
Combined	26	17 (65.4)	5 (29.4)	4 (80.0)

1. 100% Mallards

2. Only structures in water were considered useable in 1988. Two goose nests were dry underneath, but were surrounded by water in an island situation.

Table 3. Nest fate on structures on the Sand Lake NWR.

Study Area	Structure		Type	Species	Fate
	No.				
Sand Lake III Brown	070		Wire Basket	C. Goose	Successful
Sand Lake III Brown	078		Wire Basket	C. Goose	Successful
Sand Lake III Brown	076		Wire Basket	Mallard	Abandoned
Sand Lake III Brown	269		Wire Basket	Mallard	Successful
Sand Lake III Brown	081		Wire Basket	Mallard	Abandoned

An evaluation was performed to test whether treating flax straw with a green color-dye might attract nesting waterfowl to open-topped baskets. This is based on reports that early nesting ducks often select nesting sites near clumps of early green growth. Nest initiations on green-dyed flax straw averaged two weeks earlier than those on straw of natural coloration.

The 1988 drought had a huge impact on this years results. Of 436 total structures, only 203 (52.7%) were surrounded by water and in "usable" condition during the May nest searches. These were termed "usable" for statistical analysis. By September, only 41 (9.4%) remained in water. The drought also inhibited the growth of vegetation on self-maintaining structures (tubs and culverts) until after most of the nesting season was over. Other drought/water level effects were evidenced by a decline in the number of nests initiated on structures in comparison to those documented in 1987. In 1987, researchers found 224 nests on 384 structures, as compared to 48 nests on 203 (usable) structures monitored during 1988.

Sand Lake NR88 - 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 Fish and Wildlife Cooperative Research Unit at South Dakota State University.

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 study 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 proportion of suspended sediment caused by bottom disturbance of fish and waves, and determine the feasibility of studying this relationship.

The standing crop of large carp (greater than 200mm) in Sand Lake was determined by (1) a Peterson mark-recapture estimate in a large area, (2) a Peterson mark-recapture estimate in a small bay and (3) a small bay census using rotenone. Carp were captured by seine and electric shocker at the south end of the refuge below the water control structure. The fish were anesthetized, weighed, measured and tagged then returned to the Sand Lake pool (Figures 3 to 8). After sufficient numbers of fish were captured a Peterson mark-recapture population estimate was completed in Sand Lake large pool area. Biomass estimated for adult common carp in Sand Lake is reported in Table 4.

Table 4. Biomass estimates of adult common carp (≥ 200 mm) from three different areas at Sand Lake NWR for the summer of 1988.

Refuge	Site	95% CI	95% CI	95% CI
Sand Lake	Large Area	91,834 \pm 67,304	909 \pm 666	2,409 \pm 1,766 (mean=2.65 kg)
	Small Area	244 \pm 80	41 \pm 14	79 \pm 26 (mean=1.92 kg)
	Cove Rotenone	4	3	7.7 (7.3 <200 mm) (mean=2.42kg)

Twelve enclosures (pens) were placed within the study bay by mid-April, before macrophytes appeared. In mid-May, large common carp (0.9 to 2.7 kg) were stocked in three 0.18 ha pens, while small common carp (0.2 to 0.7 kg) and adult black bullheads (0.2 to 0.7 kg) were stocked in three 0.12 ha pens, respectively.



Figure 3. Under existing conditions carp are controlled in Sand Lake and lower James River by winter kill. Post Garrison operations will remove this nature means of rough fish control. 88-JWK

Figure 4. The channel below the structure is blocked while carp are responding to moving water flowing over the radial gates. 88-JWK



Figure 5. Captured carp are hauled to anesthesia holding tank for processing. 88-JKW

Figure 6. Once anesthetized carp are measured, weighed, and tagged and/or finclipped.
88-JWK



Figure 7. Data are recorded.
88-JWK



Figure 8. After processing carp are returned to the lake prior to completing the Peterson-mark-recapture population estimate.
88-JWK



Fish of each group were stocked at a rate of 675 kg/ha, and the remaining three pens served as controls. Some mortality of bullheads and small carp was evident immediately after stocking but fish of appropriate size and weight were introduced to replace the dead fish.

Lack of adequate control on the enclosure pens inhibited determination of fish effects on sago pondweed production.

A comprehensive literature review on turbidity caused by fish and/or wave action is nearly complete and will be available for next year's report. A number of changes will be incorporated into the 1989 field season in an attempt to improve study results.

1. Researchers are evaluating alternative study locations for the 1989 field season. Although this would make comparisons between years difficult, it is believed the change is warranted. Also, in order to assure the presence of an adequate stand of sago pondweed within the enclosures, the experiment would start following plant emergence.

2. In addition, a change in the experimental design, i.e. enclosure arrangement, from a completely randomized design to a randomized block design may be warranted in order to reduce experimental error as influenced by a variability of sago pondweed densities within the study area.

3. A more efficient method of blocking the river channel will be incorporated at the Weismantel grade bridge and additional gill nets will be used in an effort to improve upon the bio mass population estimate for Peterson-mark-recapture estimate in the large area.

E. Administration

1. Personnel

After six years as manager of the Waubay National Wildlife Refuge, John Koerner took over as manager of Sand Lake. He replaced Sam Waldstein who had been here since 1977.

Ramona Hurin took the opportunity to move west in August when she transferred to the FWE office at Reno, Nevada. Ramona had been here since December, 1980.

Marcia Haaland (**Figure 9**) replaced Ramona on August 29th. Previously she had worked with the Indian Health Service (DHEW) in Aberdeen.



Figure 9. Refuge Assistant, Marcia Haaland. 88-WAS

Mark Gruebele's appointment as Biological Technician was extended for another year.

Figure 10 illustrates the folks who were here in mid-summer.



Figure 10. Sand Lake NWR Staff, 1988. 88-WAS

Back Row, left to right

Ramona Hurin, Refuge Assistant, GS-6, Transferred 8/88	PFT
Marv Elsen, Mechanic, WG-10, EOD 10/62	PFT
Steve Young, Assistant Refuge Manager, GS-9, EOD 3/85	PFT
Jack Cantwell, Maintenance Man, WG-8, EOD 9/67	PFT
John Koerner, Manager, GS-12, EOD 4/88	PFT
Dave Hilley, Assistant Refuge Manager, GS-11, EOD 4/86	PFT
Ron Frohling, Maintenance Man, WG-7, EOD 5/77	PFT
Bob Wright, Assistant Refuge Manager, GS-11, EOD 2/77	PFT
Bill Schultze, Biological Technician, GS-8, EOD 5/76	PFT

Front Row, left to right

Mark Gruebele, Biological Technician, GS-5, EOD 11/87	TFT
Loren Hanson, Biological Aid, GS-4 May-Aug. 1988	TPT
David Reinhold, SCA Volunteer May-Aug. 1988	Volunteer
Susy DeHoet, S.D. Job Service June-Aug. 1988	Temp
Dan Alto, SCA Volunteer May-Aug. 1988	Volunteer
Scott McLeod, Biological Aid, GS-4, May-Aug. 1988	TPT
Berle Meyers, Equipment Operator, WG-10, EOD 4/71	PFT

TABLE 5. Sand Lake NWR Staffing, 1984-1988

Year	Permanent		Temporary	Total FTE
	Full Time	Part Time		
1988	11	0	5	11.9
1987	10	0	3	10.6
1986	10	0	3	10.4
1985	10	0	3	10.4
1984	10	0	0	10.0

3. Other Manpower Programs

Susy DeHoet was hired through the South Dakota Job Service. She worked under a 270 hour appointment from June 6th through August 9th, doing a variety of projects from building maintenance to easement file reorganization. Also employed during the summer months (May - August) were two biological aids, Scott McLeod and Loren Hanson. They worked on a variety of maintenance projects.

4. Volunteer Programs

Daniel Alto and David Reinhold were employed under the Student Conservation Association Volunteer Program. They were involved in nest searches, building and grounds maintenance, and vehicle maintenance during the period May 30 - August 19.

5. Funding

Funding for the complex for the last several years is shown in Table 6.

TABLE 6. Sand Lake NWR Funding, 1984-1988

Year	1260	1230	6860	2821	8610	1929
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	-
1984	375,207	-	-	18,100	4,987	-

6. Safety

There were no lost time accidents this year.

Safety meetings were held monthly.

Chemical analyses of the refuge water supplies were made. No problems were detected.

Radon tests were made at the office and at Q-195. Radon levels measured were in the safe zone.

The step test was passed by those involved in prescribed burning.

Thirteen staff members took a defensive driving course.

7. Technical Assistance

Technical assistance in the nature of habitat management advice was given to a hunting club which was established on the west side of the refuge in the "4 mile" area.

Nesting data were provided for the S.D. Breeding Bird Atlas project.

8. Other

In April the Regional Director and the Associate Regional Director visited the refuge (**Figure 11**).



Figure 11. RD Galen Buterbaugh and RDA Kris LaMontagne observed waterfowl habitat in the Mud Lake Area. 88-JWK

Zone Supervisor Jim Matthews and Appraiser Ken Shelton visited the refuge in July.

Maury Wright and Sheri Fetherman visited the refuge in August regarding future interpretive/public relations options.

Regional Office engineers C. W. Smith and M. C. Herrick inspected Sand Lake and Perch Lake impoundment structures in August. No significant problems were noted.

K. Fox inspected the Sand Lake and Mud Lake bridges. Minor problems were noted.

F. Habitat Management

1. General

Overall, habitat conditions suffered due to the drought, but provided an opportunity to manage marsh areas not normally accessible and grasslands not normally acceptable for haying or grazing by local farmers.

2. Wetlands

There was very little spring runoff in the local James River basin to recharge refuge pools, but we did receive enough water from releases from Pipestem Dam in North Dakota in late March and April to bring levels in Mud Lake and Sand Lake to just above full pool. Once this water passed, both structures remained closed the rest of the year to hold as much water as possible. Water levels fell gradually during the summer. At freeze-up, Mud Lake was over 1½ feet below full pool level and Sand Lake was just over 1 foot below full pool level. Late summer rains prevented the pools from dropping even further.

Sago pondweed growth in both pools was good. The pondweed was thickest in the shallower back bays, with sparse growth in and near the channel. The cattail and phragmites density in northern Sand Lake continued to decrease.

With Mud Lake down 1½ feet from full pool level, most of the cattail in the pool was high and dry. This gave us the opportunity to try to open up some of the thick stands of cattail in northern Mud Lake. We had several mowers, both rotary and sickle bar, going through October, mowing blocks and paths through the cattail (**Figure 12**). We also mowed approximately 125 feet of cattail completely around Pulfrey's Island in Mud Lake. We attempted to disc some of the cattail with a large, offset disc borrowed from Kirwin NWR. But the

years of accumulation of cattail plugged the disc, preventing it from turning any dirt. We're hoping that we have enough water in the spring of 1989 to flood out the mowed cattail providing openings for breeding pairs and more attractive waterfowl habitat in general.



Figure 12. Openings were mowed into thick cattail stands to improve the emergent/open water ratio for breeding pair habitat. 88-MG

On October 21, we burned 130 acres of cattail choked marsh on the west side of the river channel, just south of the Hecla grade. We hope to reduce the density and accumulation of cattail to improve breeding pair habitat.

On October 30, we burned 280 acres of cattail in the flood control pool north of the Hecla grade to improve breeding pair habitat. After the burn, we disced most of the area hoping to further reduce cattail reinvasion (**Figure 13**). To insure sufficient water depth to flood out the burned cattail, low spots in the dike surrounding the flood pool were filled in with a scraper.



Figure 13. A combination of burning, disking, and increased water depth next spring should make this area more attractive to breeding and resting waterfowl. 88-DH

Adjacent wetlands and floodpools failed to fill completely this spring due to the limited runoff and relatively low peak water levels in the main pools. Most of these wetlands were dry or nearly so by late summer.

Dry Run impoundment received little runoff and was dry most of the year. Ducks Unlimited is planning to reconstruct the dike and structure which washed out in 1987. The rehab work will be completed in 1989.

4. Croplands

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 1,804 acres of cropland was farmed in 1988 by 12 cooperative farmers. Nineteen acres of marginal cropland were seeded by refuge personnel to DNC this spring. **Table 7** shows this year's crops and average yields.

TABLE 7. Crop Acreage and Yields, Sand Lake NWR, 1988

Crop	Total Acres	Coop Share	FWS Share	Ave. Yield
Barley	379	165.5	213.5	15 bu/ac
Corn	729	452	277	45 bu/ac
Wheat	480	480	0	6 bu/ac
Sorghum	76	8.5	67.5	900 lbs/ac
Winter Wheat	55.5	50.5	5	10 bu/ac
Oats & Sweet Clover	23	12	11	10 bu/ac
Millet	17	17	0	1,000 bu/ac
Rye	28	23	5	10 lbs/ac
Fallow*	16.5	-	-	-

*Cooperator didn't get crop in

Two hundred twenty seven acres of standing corn were chopped this spring to make it available to migrating waterfowl. The majority of the corn was utilized by the large population of geese using the refuge.

The drought had a drastic effect on the refuge farm program this year with the small grain suffering the most. There was almost no barley available for the fall waterfowl migration. The barley that had enough moisture to set heads had very few kernels in the heads. Several fields in the sandy soil on the east side of the refuge blew out during the dust storms in May and produced nothing but weeds.

The lack of moisture also stressed the corn on the refuge, but timely rains later in the summer produced some surprising yields in some fields (Figure 14). But because of the drought, deer depredation on the already stressed corn was especially evident. There were several fields the deer hit especially hard leaving nothing for the fall migration of waterfowl or harvest by the cooperator.



Figure 14. The drought had a dramatic impact on refuge crop.
88-WAS

We asked several cooperators to plant grain sorghum as a food source for deer and pheasants this winter in fields not normally used by migrating waterfowl (**Figure 15**). It was interesting to note that, unlike corn, deer did not eat the sorghum plant while it grew. It wasn't until after the grainhead had matured that they began eating the grain. We are planning to use it more in our rotations if cooperators are interested in it for their share.



Figure 15. Grain sorghum developed well despite the drought and was not bothered by deer until it was mature. 88-WAS

Several other factors presently affecting the refuge farming program are SCS plans for highly erodible land and the Service's policy to reduce chemical use on refuge lands. We are currently in the process of implementing these into our farming program.

5. Grasslands

Grasslands on the refuge are dominated by cool season exotics. During 1988, we used haying, haying and light disking, and grazing to manage the grasslands. The drought restricted the growth of all but the lowland grasses. Lack of sufficient moisture also prevented much regrowth after management.

Refuge personnel spring seeded 2 areas of marginal cropland totalling 19 acres to nesting cover (tall wheatgrass and alfalfa). There was a poor catch on both fields due to dry weather.

7. Grazing

A total of 825 acres of grasslands was grazed on the refuge in 1988 (Figures 16, 17, 18, and 19). All 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. Fall grazing rates were heavier to further reduce the matt of dead vegetation in the units.

The drought also impacted our grazing program. There was intense interest in the units from the local community. Twenty-five local farmers applied for the four spring grazing units. The permittees were willing to do extra fencing to get the grazing. For the fall grazing, this amounted to quite a bit of work due to receding water levels. There was little regrowth on the spring grazed units due to lack of moisture.

Grazing units, periods, and AUM's during 1988 are shown in Table 8. The price for grazing was \$8.20/AUM minus deductions for fencing, etc.

TABLE 8. 1988 Grazing, Sand Lake NWR

<u>Unit</u>	<u>Acres</u>	<u>Total AUM's</u>	<u>Grazing Period</u>
SG-1	100	125	May 15-June 15
SG-2	90	115	May 15-June 15
SG-3	60	75	May 15-June 15
SG-4	18	25	May 15-June 15
FG-1	70	105	Sept. 15-Oct. 20
FG-2	40	70	Sept. 16-Oct. 14
FG-3	92	202	Sept. 17-Oct. 20
FG-4	110	164	Sept. 16-Oct. 14
FG-5	147	190	Sept. 26-Oct. 27
FG-6	68	134	Sept. 14-Oct. 22
FG-7	<u>30</u>	<u>55</u>	Sept. 23-Oct. 28
	825	1,260	



Figure 16. Small areas along the marsh that haven't been touched for years were grazed to reduce the mat and increase vigor. 88-WAS

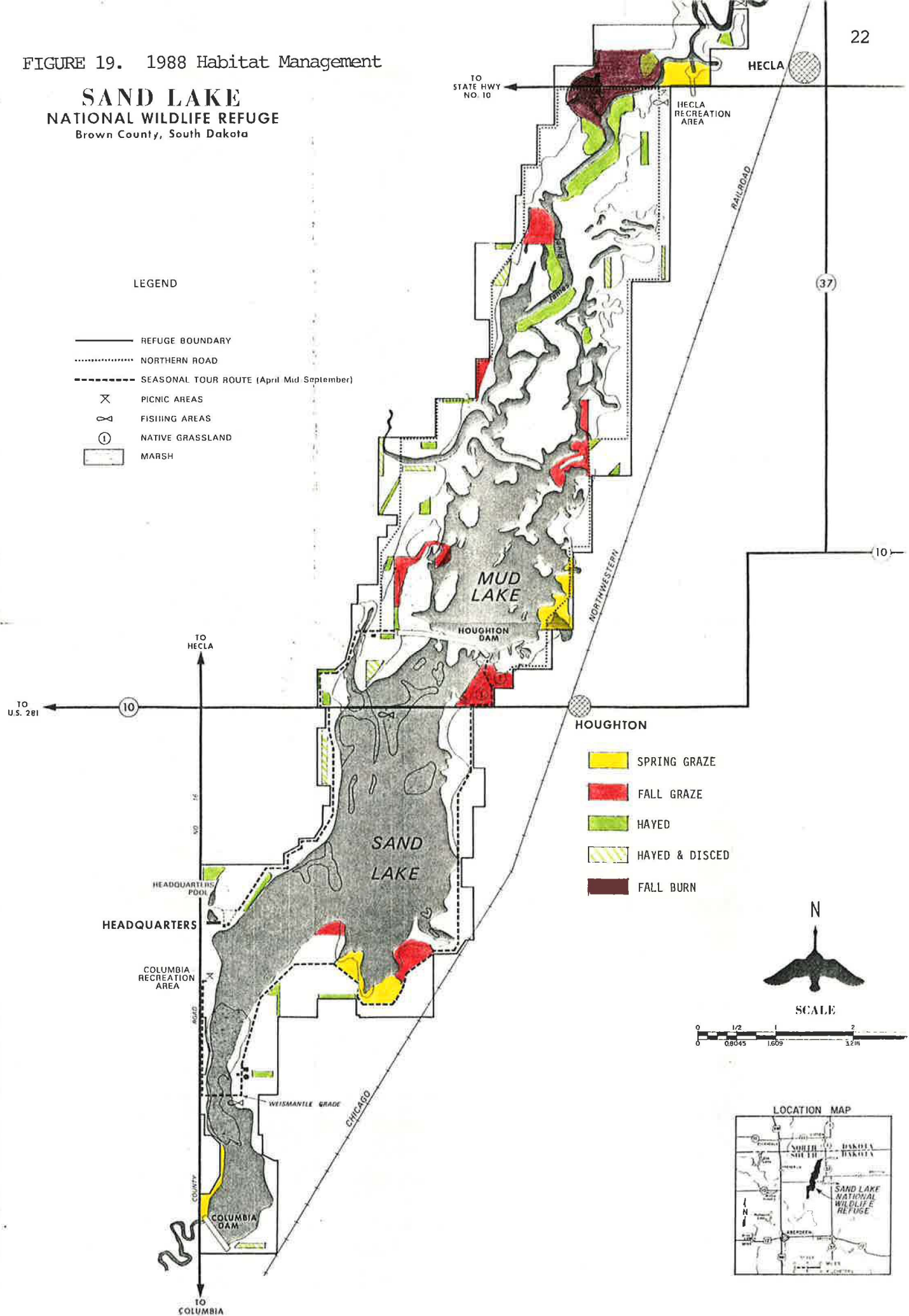
Figure 17. Cattail was mowed in some of the grazing units to allow access to the receding water levels in the refuge pools. 88-WAS



Figure 18. Polychord electric fence was used to totally enclose some units and subdivide others. 88-WAS

FIGURE 19. 1988 Habitat Management

SAND LAKE NATIONAL WILDLIFE REFUGE Brown County, South Dakota



8. Haying

Thirty four permittees hayed 657.5 acres on the refuge (Figures 19, 20, and 21). Of this total, 99.5 acres were alfalfa, 235 acres were brome/DNC, and 323 acres were lowland vegetation prone to flooding. A total of 138 acres of the hayed upland was lightly disced to break up any mat left and to help stimulate the remnant alfalfa.



Figure 20. Permittees haying upland areas were required to use a wheel rake to remove most of the mat of dead vegetation and to disturb the soil surface. 88-WAS



Figure 21. We took advantage of the drought to hay parts of wetlands and low ground subject to flooding. 88-WAS

In an effort to get rid of some cattails in northern Mud Lake, we advertised in the local papers that cattail was available for harvest. With the dry year, we thought someone might bite; but we had no takers.

9. Fire Management

Prescribed burns were accomplished on 2 areas of the refuge totalling 410 acres (**Figure 19**). Fire breaks were disced and burned prior to the burns. The first burn was conducted on October 21. It covered 130 acres just south of the Hecla grade, west of the James River channel (**Figures 22, 23, and 24**). The vegetation consisted of dense cattail, some phragmites and some bulrushes with a thick accumulation of dead vegetation. The primary objective of the burn was to improve waterfowl breeding pair habitat by reducing the density of the cattails. The burn went well, but the ground was too wet to do any discing that we had planned after the burn.

The second burn was conducted on October 30. This burn covered 280 acres of mainly cattail in the flood pool north of the Hecla grade (**Figures 25, 26, and 27**). The objective of this burn was to decrease the density of cattails to improve waterfowl breeding pair habitat. This burn also went well with very little residual cattail remaining after the burn. Most of the area was disced and low spots in the dike surrounding the pool were filled in anticipation of needing to hold more water over the cattail next spring. Once we get control of the emergents, then the water level can be regulated to achieve the desired interspersions.



Figure 22. Mark Gruebele lights a backfire along a firebreak on the south Hecla burn. 88-DH

Figure 23. John Koerner lights the headfire just south of the Hecla grade. 88-DH



Figure 24. And away she goes. 88-JWK

Figure 25. The north Hecla burn area was mainly choked cattail marsh. 88-DH



Figure 26. The burn removed nearly all of the residual cattail. 88-DH

Figure 27. View of the north and south Hecla burns (from the northeast). 88-WAS



A severe lightning storm passed through the refuge area the morning of August 7, starting 2 fires on the refuge. One fire burned 7 Heston stacks put up by a refuge haying permittee. The other fire burned approximately .1 acre in a dry wetland. The Hecla Fire Department responded to both fires.

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

10. Pest Control

Up to 1988, we used mainly Tordon to control leafy spurge on the refuge. But with growing concern about it's movement through sandy soils and the Service's growing concern about herbicide use on national wildlife refuges, we terminated Tordon use. This year, we sprayed critical areas near the refuge boundary with 2,4-D, the only chemical we received approval to use. In an effort to reduce 2,4-D use, we mowed Canada thistle in late July to prevent seed spread and then sprayed the regrowth with a lesser rate of 2,4-D (**Figure 28**).



Figure 28. Ron Frohling mowing one of the many patches of Canada thistle on the refuge. 1988-DH

G. Wildlife

1. Wildlife Diversity

Sand Lake National Wildlife Refuge, with its vast expanses of emergent vegetation mixed with open water, illustrates the unequalled 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. But pressure to "modify" the river continues, as the State of South Dakota continues to search for ways to "improve" the river. Garrison Diversion looms on the northern horizon, threatening to send return flows from North Dakota irrigation down the James River or bisecting Sand Lake's upland with a by-pass canal. Concerns over Garrison's effect on vegetation and wildlife diversity are increasing as this massive project continues to take shape.

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 50 in March, which was unusually high. The fall peak reached 10 in early December.

3. Waterfowl

a. Production

Duck production dropped to 8,575, a 63% decrease from last year. The decrease is attributed to poor pair habitat, due to no spring runoff or flooding and poor cover conditions due to the drought. Dry conditions throughout the entire prairie pothole region were the probable cause for the overall decline in duck numbers on the refuge. Estimated production by species is shown in **Table 9**. **Figure 29** illustrates duck production since 1971.

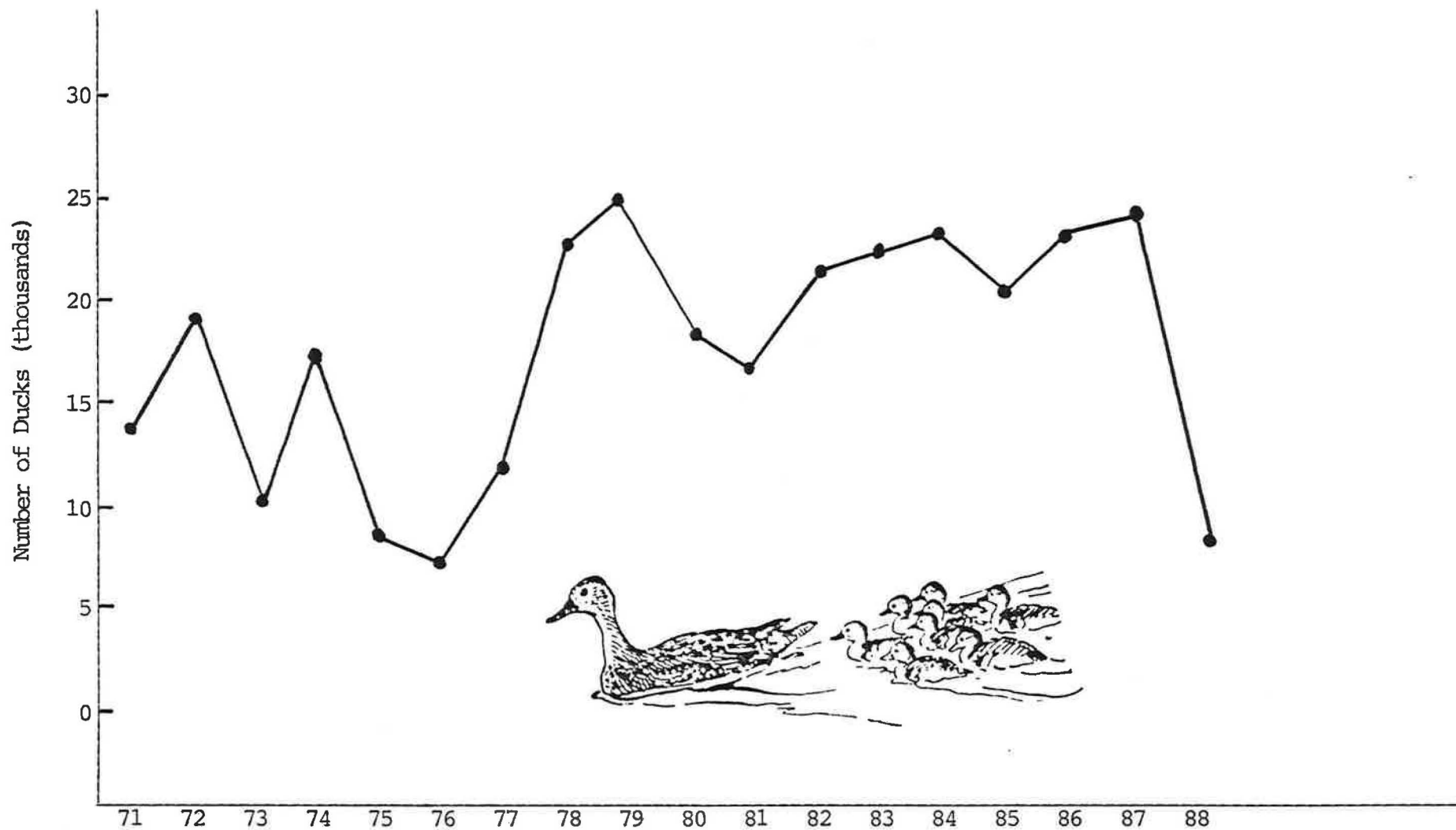


FIGURE 29. Annual Duck Production, 1971 - 1988, Sand Lake National Wildlife Refuge

TABLE 9. 1988 Sand Lake NWR Duck Production

Species	Estimated Population
Mallard	925
Northern pintail	540
Gadwall	1,380
Wigeon	70
Shoveler	880
Blue-winged teal	2,625
Green-winged teal	135
Ruddy duck	520
Redhead	1,400
Canvasback	50
Ring-necked duck	10
Lesser Scaup	20
Woodduck	<u>20</u>
TOTAL	8,575

Canada goose production was estimated at 220, a 12% decrease from 1987. Water levels were relatively stable during the goose nesting season. The first Canada goose broods were observed on May 10.

Only 17 nesting baskets were usable during 1988 due to low water conditions. Two out of three mallard nests were successful and two Canada geese were successful in bringing off broods from the baskets.

b. Migration

Five hundred mallards overwintered on the refuge with numbers building when the weather warmed in late February. By the first week in March, common mergansers, pintails, common goldeneyes, and lesser scaup had joined these birds. Cold weather in mid-March slowed the progress of the migration and pushed some ducks back south; but the migration continued in force on March 22.

Three hundred Canada geese overwintered with numbers starting to build in late February. The population peaked at 45,000 on March 24.

The spring snow goose migration was one of the most spectacular ever, here at Sand Lake, possibly due to the lack of open water further north and the abundant feed available here (**Figure 30**). The first snow

geese arrived on March 10, but cold weather during

31

mid-March prevented any build-up until March 22. By the 24th, 235,000 geese were on the refuge and numbers continued to climb to over 450,000 in the area on the 29th and 30th. The main flock spent most of their time resting on the main body of Sand Lake and feeding on the chopped corn on the refuge and in local fields off the refuge. Numbers began dropping on March 31st and only 2,000 snow geese remained by April 21.



Figure 30. Snow goose numbers built to over 450,000 this spring. 88-WAS

The fall migration of snow geese began at Sand Lake on September 21. Goose numbers had only climbed to 13,000 by October 23 but quickly grew to a fall peak of 220,000 by October 30 (**Figure 31**). One hundred thirty-two thousand remained on the refuge until November 16 when snow and cold weather pushed all but 26,000 further south. Several hundred remained through mid-December. Total fall goose-use days were estimated at 3,468,000. Age ratio counts indicated 36% young snow geese compared to 11% last year.

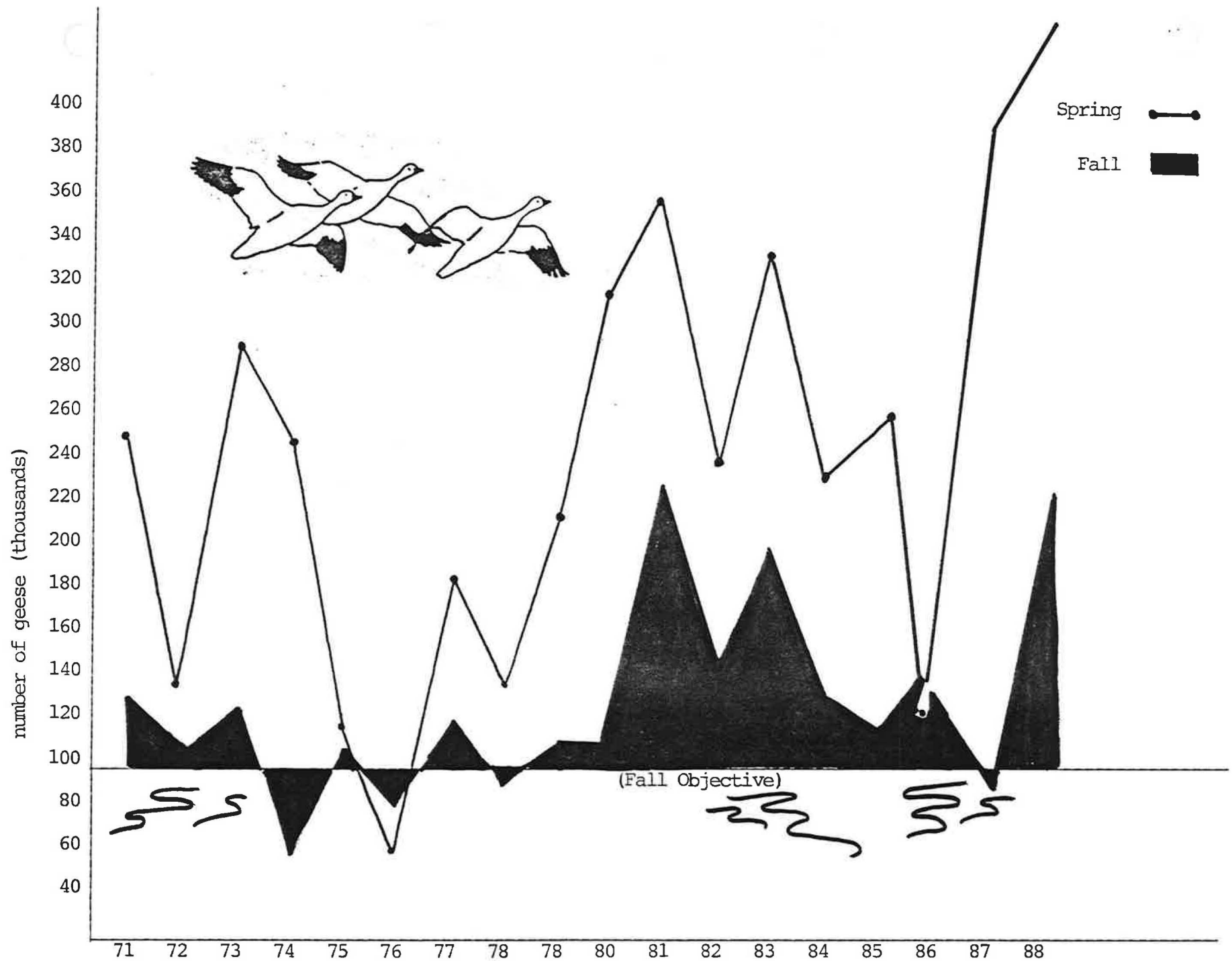


FIGURE 31. Spring and Fall Snow Goose Population Peaks - 1971 - 1986, Sand Lake NWR

This is the third year that Brown County was included in a half-day goose hunting zone through October. The geese exhibited similar feeding behavior as last year. The geese that were here when the season opened spent most of their time in small flocks, feeding in adjacent fields west of the refuge. As the population built, they continued feeding and resting, often for most of the afternoon, in these and other nearby fields. On November 1 (first day of full day hunting), the geese continued using these areas, but were pushed back into the refuge in the afternoon.

On November 2, the birds moved completely out of these areas and began feeding east and north of the refuge, some going on into North Dakota and into Marshall County. There was almost no small grain available for the geese due to the drought. The geese did spend some time on several of the hayed areas and fall grazed areas.

Canada goose numbers peaked at 9,500 on October 30 (Figure 32). Five hundred Canada geese remained on the refuge until December 26 when a cold front froze all remaining open water and snow covered most available food.



Figure 32. Canada geese spent a lot of time this fall resting on sand bars in the river channel in Mud Lake. 88-DH

Fall duck numbers peaked at 170,000 on October 29. Approximately 16,000 mallards remained on the refuge until the snow and cold pushed them out on December 26.

The tundra swan migration peaked at 6,800 on October 30.

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 down slightly from 1987.

No nesting was attempted by American white pelicans. Pelican numbers built to 6,000 in August. Several dead pelicans were picked up during a botulism outbreak.

Double-crested cormorants nested in small groups on thick mats of uprooted cattail along the southeast edge of cattail in northern Sand Lake. An albino cormorant was observed on August 30 (Figure 33).



Figure 33. An albino double-crested cormorant was observed just north of Columbia Dam on August 30. 88-DH

Nesting great blue herons were also concentrated in northern Sand Lake. One great egret was observed with the nesting great blue herons. Several white-faced ibis appeared to be nesting in this same area.

Black-crowned night heron numbers remained low, probably due to the thinning stand of cattail in Sand Lake.

5. Shorebirds, Gulls, Terns and Allied Species

An estimated 55,000 Franklin gulls set up a nesting colony in the same areas of northern Sand Lake used during the last two years. The size of the colony decreased from last year. The late-summer population was 120,000 in August.

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

Overall, shorebird use was up due to an increase in shallow water and exposed mudflats (**Figure 34**).



Figure 34. Yellowlegs were common during the late summer as water levels receded. 88-DH

6. Raptors

Snowy owls were observed in the area in March and December. An osprey was observed on the refuge on April 26 approximately 2 miles north of the headquarters.

State Game, Fish & Parks personnel from Aberdeen turned an injured barred owl over to the refuge for treatment. The bird was later transferred to a raptor rehabilitation facility in Pierre where it is recovering from a broken humerus. The bird will probably be donated to a zoo since it will unlikely recover sufficiently to be released. Barred owls are very uncommon in this area.

7. Other Migratory Birds

An albino mourning dove was observed on July 15.

8. Game Mammals

The white-tailed deer population in and around Sand Lake continues to be in excellent condition (Figure 35). Twin fawns were the norm, with occasional triplets being observed. A fall count indicated an increase in deer numbers from fall, 1987. Heavy snows during the last week of December covered a lot of available food which will probably result in deer concentrating around what food they can find.



Figure 35. White-tailed deer play an important role in our management at Sand Lake.

88-DH

Although we had few deer depredations complaints, deer damage was evident on the drought-stressed corn both on and off the refuge. Several fields in high deer concentration areas on the refuge were not worth harvesting.

Deer hunting seasons are discussed in Section H.8.

The number of fox observed throughout the year was up. Fourteen active fox dens were located this spring.

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 up 130% from last year's count. Two consecutive open winters had some influence on this increase. Sharptailed grouse and prairie chickens were observed on the refuge during the fall.

Two bobwhite quail were observed along the refuge boundary on December 23. This is a very unusual sighting as this species is seldom recorded this far north in South Dakota.

11. Fisheries Resources

The winter of 1987/88 was a mild winter relative to fish survival within Sand Lake major pools. In January and February, dissolved oxygen readings were taken at several sites on Sand Lake NWR. Readings ranged from 4ppm to 19ppm. Standard Hach Water Ecology Kit (Model AL-36B) was used to determine all readings. Instream flows, later than normal freeze-up (November 20), clear ice, no snow, and mild winter conditions all contributed to the high readings.

We did, however, achieve a winter kill on the Headquarter's subimpoundment, which is quite shallow and received no winter inflows. Over 500 carp were observed dead along the shoreline after iceout. Carp had gotten into this subimpoundment the last several springs during high water conditions. The last recorded winter kill within the two major refuge pools occurred during the winter of 1984/85.

Numerous small to medium size northern pike were caught on Weismantel grade and Highway 10 public fishing areas this spring.

South Dakota State University and Bismarck (FWE) field office staffs spring and summer fish catch results (Figure 36) included catches of white sucker, buffalo, carp, yellow perch, walleye, northern pike, shortnose gar, black crappie, black bullhead, channel catfish, among others.



Figure 36. Fisheries investigations were completed by SDSU and Service (FWE) field stations in an attempt to qualify and quantify the fisheries resource in Sand Lake NWR. 88-SY

The James River is a typical prairie stream and the fisheries resource fluctuate with given winter condition and subsequent spring flows. It is hopeful that the winter of 1988 - 1989 will be less "friendly" to our Cyprinus carpio winter resident friends!

12. Wildlife Propagation and Stocking

The South Dakota Department of Game, Fish and Parks continued its Canada goose release program. The captive flock maintained at Sand Lake Refuge was reduced to 45 pairs in 1985. Rather than artificially incubating eggs and collecting 2 clutches from a pair, the geese were allowed to hatch their first clutch. The goslings remained with the adults until just before they reached flight stage. The State then transplanted the goslings to selected restoration areas elsewhere in the state.

Water was pumped from a well into the display pool to bring the water level up near the recommended level because there was virtually no runoff. Water from the display pool is then used to fill ponds in individual pens.

This year the captive geese began laying on April 2. Of the 28 pairs that attempted to nest, 23 pairs hatched out 101 goslings. Approximately 80 of these made it to flight stage.

We have a cooperative agreement with the State Game, Fish and Parks to cover administrative responsibilities regarding the captive flock. The agreement was extended through 1991 and incorporated the consolidation of two separate flocks into one now located at Sand Lake. Ninety-one Canada geese from the Faulk County facility were transported to Sand Lake in November, bringing the total at Sand Lake now to about 170.

An effort was made to address concerns that the birds in the captive flock were decoying wild birds into the area, thereby benefitting nearby goose hunters. Camouflage netting was placed over the winter pen and the captive flock was moved into the pen before the waterfowl season began.

14. Scientific Collections

Refuge staff collected coot eggs and young of the year coot and double-crested cormorants for Bismarck FWE in its effort to complete baseline heavy metal/trace element studies on the James River system. This is discussed further in Section J.

15. Animal Control

An effort was made this spring to remove predators from an island in Mud Lake.

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

16. Marking and Banding

The two SCA volunteers assisted S.D. Game, Fish, and Parks with rounding up and banding molting Canada geese in several northeastern counties of South Dakota.

A total of 1,454 ducks was banded during the pre-season duck banding at Sand Lake. Fifty-three percent of the mallards banded were females and only 15% were immature. Table 10 summarizes the species, sex and age of the ducks banded.

TABLE 10. Ducks Banded in 1988

Species	Age	Sex	Number Banded	Percent
Mallard	AHY	M	414	40.0
Mallard	HY	M	67	6.5
Mallard	AHY	F	461	44.5
Mallard	HY	F	92	9.0
Woodduck			403	
Pintail			16	
Black Duck			1	

17. Disease Prevention and Control

Three hundred birds (mostly mallards and woodducks) were picked up in both Mud Lake and Sand Lake between July 20 and August 30. Botulism was confirmed by the National Wildlife Health Center. Temperatures were into the 90's during the peak of the die-off.

A sick white-tailed deer was observed in the headquarters area in the spring and early summer (Figure 37). The deer's health gradually deteriorated until it died in late summer. There was a large growth in the deer's neck possibly from a previous injury.



Figure 37. This deer was observed near the lake drinking just minutes before it climbed the shore and died. 88-DH

H. Public Use

1. General

During 1988, an estimated 86,567 people visited the Sand Lake National Wildlife Refuge (**Figure 38**). The visitors that signed the guest register at headquarters came from 32 states and 5 foreign countries. The spring and fall snow goose migrations through the refuge provide the main attraction for the visiting public.

2. Outdoor Classroom - Students

Sand Lake provides an excellent opportunity for local schools to conduct environmental education programs. Scout groups and 4-H clubs also use the refuge for nature studies.

In October, the 6th grade science classes from Howard Hedger Elementary School, Aberdeen, conducted a four-hour EE workshop on Sand Lake. Fifty students collected and analyzed marsh samples, wrote creative stories on their findings and generally had a great time while learning (**Figure 39**).

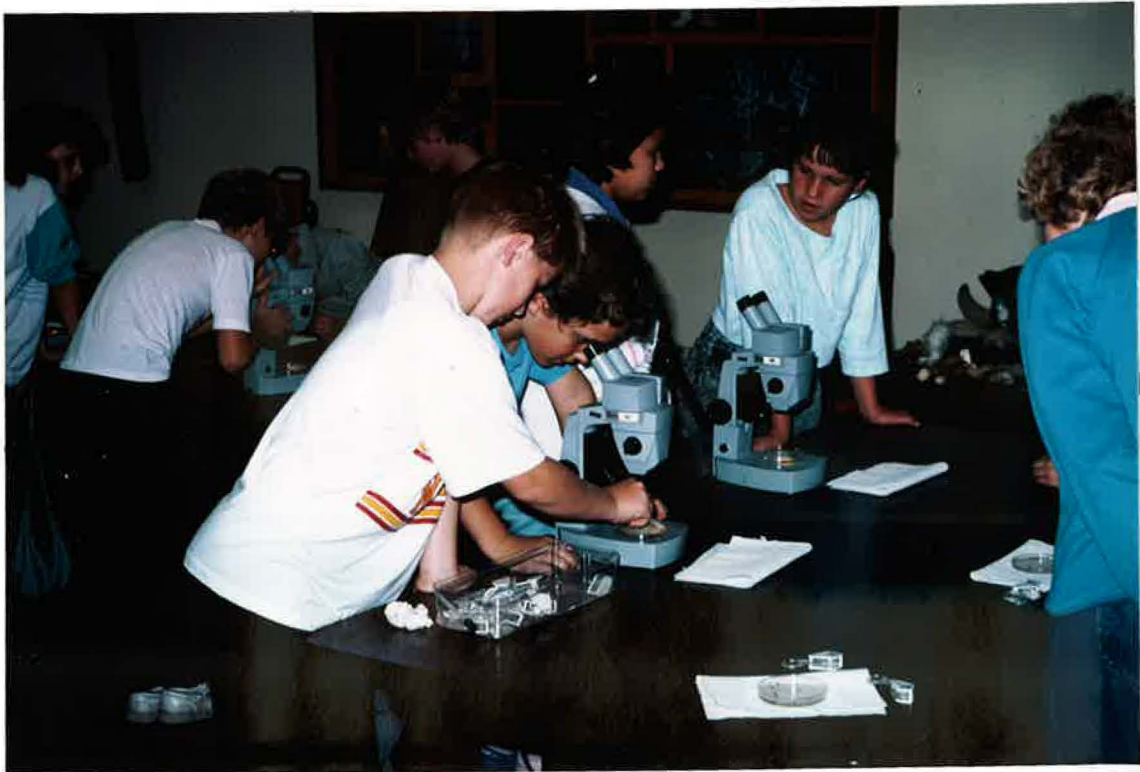


Figure 39. Sixth graders taking a close look at all the "critters" in a sample of marsh water. 88-JWK

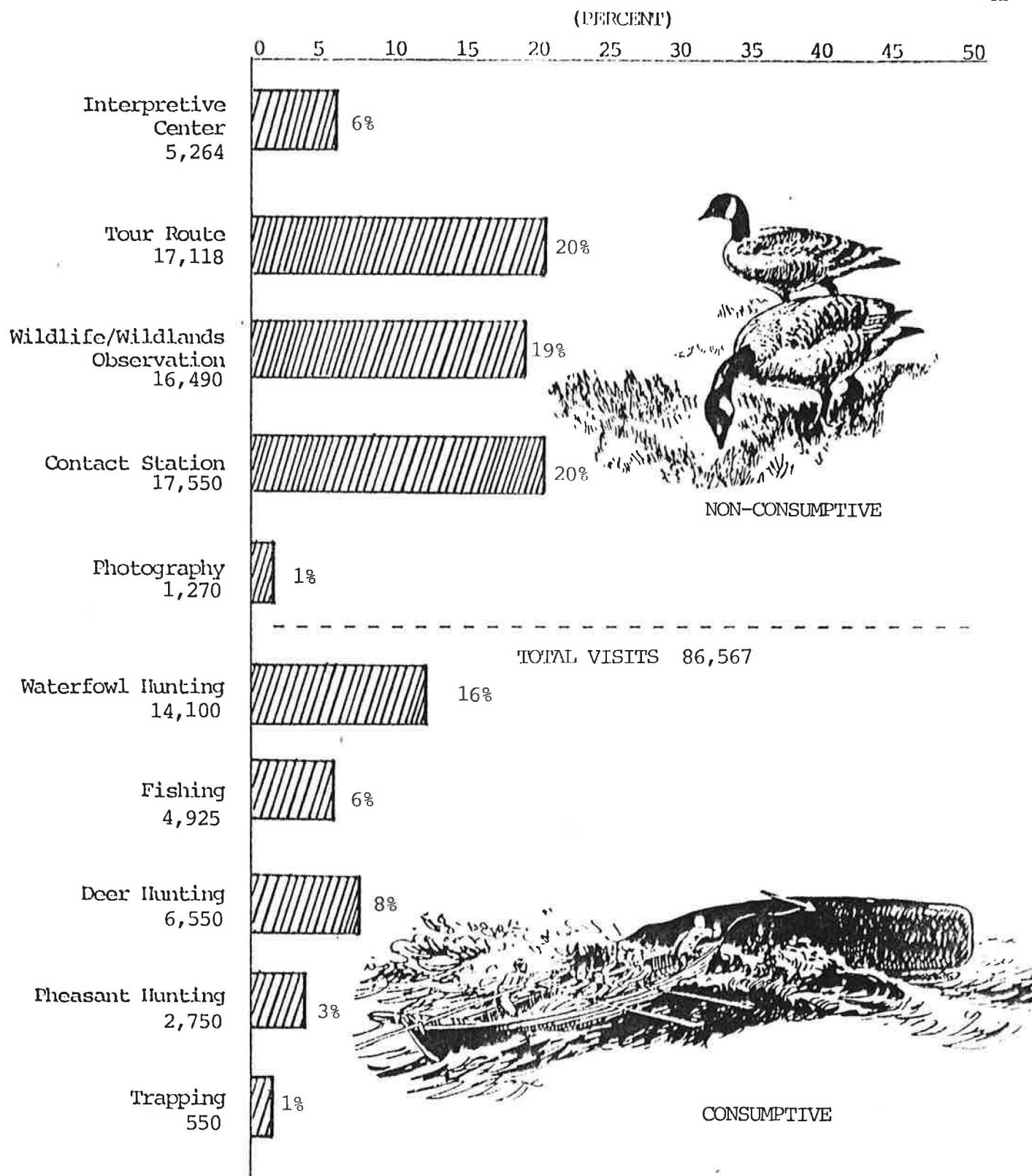


FIGURE 38. Visits to the Sand Lake National Wildlife Refuge, 1988

Several college and university classes visited the refuge as part of their curriculum. During March and April, the University of Minnesota wildlife management class and the biology class from MacAllester College, St. Paul, Minnesota, toured the refuge to view the snow goose migration. The wildlife class from South Dakota State University visited the refuge in September and discussed the management program.

During the pre-season waterfowl banding, biology students from Northern State College, Aberdeen, visited the refuge. The students were given "hands on" experience with using a cannon net and banding ducks.

4. Interpretive Foot Trails

Plans were developed during 1988 for a nature trail along the edge of Sand Lake. A site was picked and construction will start in early 1989. The trail will be adjacent to the auto tour route and will provide the visitors with a good overview of the lake. We also plan to interpret the grasslands and the nearby marsh ecosystems.

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 spring and fall snow goose migrations are the main attractions for visitors on the auto tour route. In 1988, approximately 17,118 visitors used the route, accounting for 20% of the total refuge visits.

During the year, an updated version of the auto tour leaflet was developed and ordered. The new leaflet should be available for the public by the start of the 1989 season.

In addition to the self-guided tours, the refuge provides conducted tours, upon request, for special groups. In 1988, tours were conducted for the First Baptist Christian School, the Sierra Club Board, the Aberdeen Nursing Home, the Langford Senior Citizens, and the Britton Cub Scouts.

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 August, Sheri Fetherman and Maurice Wright, Regional Interpretive Specialists, 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 started.

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

The large snow goose concentrations on the refuge attracted a lot of media coverage in 1988. The three local radio stations plus a Watertown, South Dakota, station and the local affiliates of the three networks all carried news releases on the refuge. Newspaper articles on Sand Lake appeared in the Aberdeen, Watertown, Rapid City, South Dakota, and Omaha, Nebraska, papers.



Figure 40. KABY-TV (ABC) filmed several news features on Sand Lake during 1988. 88-JWK

Information and brochures on Sand Lake were submitted for inclusion in the new Mobil Oil Travel Guide series. Sand Lake was also selected as a feature story for the publications of the Glacial Lakes Tourism Association.

Prairie Public Television visited the refuge in March to film the snow goose migration for a segment of the South Dakota Outdoor Guide TV program.

Other interpretive or informational programs conducted during 1988 included the following:

- Bill Schultze and Steve Young presented a program entitled "Overwater Colonial Nesting Birds at Sand Lake NWR" to the annual meeting of the S. D. Wildlife Society.
- Refuge programs were provided for the Groton Kiwanis Club, and the Aberdeen Optimists, Lions, and Sertoma Clubs.
- Classroom programs were given to the Northwestern School District, 6-8th grades and the Howard Hedger and May Overby Elementary School 6th graders.
- John Koerner was the featured speaker at the Marshall County Sportsman's Club annual banquet.
- Presentations were also given at the Brown County and the Hecla Sportsmen's Clubs concerning refuge operations.
- Wildlife programs were presented to the Aberdeen Family YMCA, the Frederick Senior Citizens Center, Aberdeen Cub Scouts and the Farmers Union Day Camp.

8. Hunting

a. Waterfowl

Waterfowl hunters around Sand Lake are restricted to 300 public blinds, with adjacent retrieval zones, which have been established along the refuge boundary (Figure 41).



Figure 41. Waterfowl hunters using one of the public blinds around the refuge. The blinds help control the number of hunters in an area. 88-JWK

Snow goose hunting in 1988 was much better than during the previous several years. The fall population peaked at 220,000 geese on October 30 which is over a week earlier than normal. The large flocks remained in the area longer than in recent years. With more geese in the area for a longer period of time, the harvest increased accordingly.

Whether the half-day goose hunting regulations, established by the State in 1986, had an impact on the increased harvest is hard to positively determine. However, after November 1, when the shooting hours changed to full-day, the geese started going back into North Dakota to feed or leaving the area entirely, which makes a strong case for the half-day rule.

Duck hunting was poor around the refuge as most of the smaller wetlands dried up due to the drought. Hunters using the public blinds along the refuge boundary did manage to shoot a few ducks but success was very spotty as the birds are wary of the established blinds.

Visitation due to waterfowl hunters increased as word of the many successful goose hunts spread. In 1988, 14,100 visits were attributed to waterfowlers, an increase of 4% over 1987.

b. Deer

The Sand Lake archery deer season was open from November 1-11 and December 5-31, 1988. Anyone holding a 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. Hunters from all over the midwest and as far away as Colorado visited the refuge in 1988 to try their luck (**Figure 42**). Success rates for the archers generally run over 25%. ?



Figure 42. Part of the opening week archery crowd camping on state land adjacent to the refuge. 88-BA

Four rifle deer seasons, with two permit options, were available to Sand Lake hunters in 1988 (**Table 11**). The first season is limited to the use of muzzle-loading rifles only. Overall hunter success for Sand Lake was projected at 73%, with 634 deer harvested for those hunters responding to the State's harvest questionnaire.

The number of hunters is maintained at a maximum of 135 per season as a safety factor. However, because of an expanding deer herd and the possibility of depredation problems, the number of tags available to these hunters was increased 7.5% in 1988.

TABLE 11. 1988 Firearms Deer Seasons, Sand Lake NWR

Season	Dates	Deer Tags Available*
1	Nov. 12-Nov. 17	232
2	Nov. 18-Nov. 22	232
3	Nov. 23-Nov. 27	232
4	Nov. 28-Dec. 4	<u>232</u>
TOTAL		928

*A total of 135 hunters was allowed on the refuge each season, 38 with any deer tags and 97 with a tag for any deer plus an antlerless deer tag.



Figure 43. Trophy bucks are available for those hunters who are willing to put in the extra effort and who have a lot of luck. 88-JWK

c. Pheasants

Pheasant season generally starts on Sand Lake after the season outside the refuge closes. This year the refuge season ran from December 5-31. Lack of snow cover during the first three weeks of the season made hunting difficult as the pheasants could quickly out maneuver their pursuers in the thick cattails. Heavy snow during the last week of the season greatly improved the success but made for some very cold, wet hunting.

d. Raccoons

The refuge raccoon season was conducted from January 1 - February 29, 1988. A total of 15 permittees was selected to participate in the hunt. This hunt is designed to reduce the raccoon population and therefore minimize their predation on nesting waterfowl. Hunters are allowed to hunt from 8:00 a.m. to 5:00 p.m. using dogs trained to trail only raccoons. A total of 205 raccoons was harvested during the season.

9. Fishing

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

Fishing was good during the early spring, with some five to six pound northerns taken. As the water levels began to drop due to the drought, fishing interest also decreased. A few hardy individuals tried ice fishing but the sporadic success dampened their enthusiasm to stay out in the cold. In 1988, an estimated 4,925 fishing visits were reported on the refuge, down 2,250 visits from the previous year.

10. Trapping

Two trapping seasons were conducted on Sand Lake NWR in 1988. Trappers during Season I, November 7-30, were allowed to take raccoon, fox, skunk, mink and weasel. Five trappers were selected by public drawing. During Season II, December 1-31, trappers could take the same species as in Season I with the addition of muskrats. Three permittees were selected from a public drawing for the second season. The Government's share of the muskrats was 1/3 of the harvest with the trapper receiving 100% of the other species trapped. Fur harvest totals are shown in **Table 12** for both seasons.

**TABLE 12. Fur Harvest for Seasons I & II, Sand Lake NWR
1985-1988**

Year	<u>Number Harvested</u>					
	Fox	Raccoon	Skunk	Badger	Mink	Muskrat
1988	43	27	7	-	1	510
1987	26	42	41	-	2	3,524
1986	35	45	41	1	11	3,547
1985	40	48	37	4	4	717

11. Wildlife Observation

Almost a half-million snow geese used the refuge during their spring migration. This large concentration of birds attracted a lot of visitors to Sand Lake (**Figure 44**). During 1988, approximately 16,490 visits were attributed to people out to view the wildlife. Over 1,200 visits were made by photographers, from the most serious professionals to the common shutterbug.



Figure 44. The snow goose concentrations provided a spectacular sight for refuge visitors during 1988. 88-MG

The local communities take advantage of the wildlife viewing opportunities at Sand Lake in their tourism promotions. The Aberdeen Parks and Recreation Department sponsors birding and bicycling tours on 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 Sioux Council Boy Scouts held their "Spring Camporee" at Sand Lake. Scout campers came from Britton, Aberdeen, Mobridge and Selby troops (**Figure 45**). The refuge provided a tour and program for the scouts and in turn was presented an appreciation placque by the group.



Figure 45. The Spring Camporee on the refuge provided the scouts with an opportunity to sleep very little, eat a lot of hot dogs, and learn about wildlife. 88-SY

The youth group from St. Anthony's Catholic Church, Hecla, was also permitted to camp on the refuge. The recreation area on the refuge has a special historic significance as the site of the first Catholic mass ever celebrated in South Dakota. It was conducted in 1845.

14. Picnicking

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

17. Law Enforcement

Refuge officers attempted to maintain high visibility and to be available to answer questions during the hunting seasons. To further provide information and prevent law enforcement problems, leaflet dispensers with refuge maps and hunting regulations were placed at high use areas around the refuge. With all the attempts made to prevent problems, the five staff members with law enforcement authority still spent a very busy year. **Table 13** summarizes the violation notices issued during 1988.

TABLE 13. 1988 Violation Notices, Sand Lake NWR

#	Violation Type	Case Status
9	Possession of Toxic Shot	8 - Paid Fine - \$50 1 - Juv. - Called Parents
1	Swan Shooting	Paid Fine - \$150
1	Vehicle Trespass	Paid Fine - \$35
4	Unplugged Gun	3 - Paid Fine - \$35 1 - Juv. - Referred to State
2	Hunting on Closed ROW	1 - Paid Fine - \$50 1 - Referred to State
1	Spotlighting	Paid Fine - \$100
1	No Duck Stamp	Paid Fine - \$50
2	Refuge Trespass	Paid Fine - \$35
1	Hunting in Closed Area	Paid Fine - \$50
3	Hunting in Wrong Unit	2 - State Fines - \$50 1 - Juv. - Declined by State

Noteworthy cases during the year included the gentleman who replaced the steel shot in his shotshells with #4 lead buckshot and swore he purchased them that way from the local department store. He paid up quickly. Two tundra swans were shot by some hunters who thought the swans were large snow geese. Luckily, the act was observed by another hunter who reported the violation and gave a description of the vehicle. The individuals were contacted and after some discussion, took the officers to the location where they had dumped the swans. Sometimes we do get lucky (Figure 46).



Figure 46. Dave Hilley holding the two tundra swans mistaken for "large snow geese" by a Sand Lake hunter. 88-WAS

I. Equipment and Facilities

1. New Construction

A new boat ramp was constructed near the refuge shop to allow better access for the airboat into Sand Lake. An old building foundation was removed, the ramp was graded and graveled and concrete pads will be added in early 1989.

2. Rehabilitation

Because of heavy traffic and high water periods, the roads around the refuge require a lot of attention. In 1988, 605 cu. yds. of gravel and 300 cu. yds. of crushed rock were hauled and dump spread by G & C Gravel, Westport, South Dakota, to rehab the refuge roads.

To facilitate the refuge grazing program, 840 rods of interior and boundary fences were rehabed during the year. Trees and brush were removed from the fence lines to lessen the problem of snow buildup damaging the fences.

The time lag between the old and new refuge managers provided an opportunity to get some rehab work accomplished on the manager's quarters. Several rooms were painted, the bathroom was remodeled and refloored and numerous small maintenance jobs were accomplished.

In addition, the "Birdhouse" a former research building on the refuge, was converted to a bunkhouse for temporary personnel and SCA volunteers. The building interior was panelled, painted, a new countertop installed along with a new shower installed in the bath. New steel siding was purchased and will be installed in early 1989.

The well water system for three of the refuge residences plus the headquarters building had been inadequate and unreliable for years. In 1988, rural water finally came to Sand Lake. The Walworth-Edmunds-Brown (WEB) water line now supplies a safe and adequate water supply.

Personnel from Regional Office Engineering conducted an inspection of the refuge dams and bridges during the year. With the exception of some touch up suggestions, all facilities passed.

3. Major Maintenance

The solar heating system for the headquarters required major maintenance in 1988. In June, the day before the Regional Director was to visit, the system's water storage tank sprang a leak and dumped 1,500 gallons of 100°F water into the

headquarters basement. The hot water condensed on the basement ceiling making its own rain storm as it fell. Records, books, and office supplies got soaked not only from the flood but also from the condensation. Schwan Welding Company, Aberdeen, welded new $\frac{1}{4}$ inch steel to the lower half of the tank. With the new steel and a less corrosive water supply, hopefully, this problem won't reoccur.

Antennas were installed on each of the refuge residences to receive cable TV transmissions from the local rural electric cooperative. Reception improved from only two channels to being able to get "Mr. Ed" as clear as possible.



Figure 47. When the rope on the flagpole breaks and you can't take the flagpole down, then you have to be creative. 88-WAS

4. Equipment Utilization and Replacement

Flint Hills NWR, Kansas, was in need of a 125+ hp. tractor to pull some heavy equipment. Sand Lake temporarily loaned our IH 1086 to Flint Hills and received a Case 1494 to use while they have our big tractor. While the tractors were being moved, Sand Lake also picked up, on loan, a 10 ft. Rhino disc from Kirwin NWR, Kansas. The heavy disc was to be used to cut up thick cattail stands in areas of the marsh dry due to the drought. Even with the heavy disc however, the cattails were too thick and clogged the equipment.

A new tag axle was added to our 1980 White Semi in order to allow equipment to be transported earlier in the spring when load weight limits are most restrictive. By the addition of the axle, we can now use the transport and get an earlier start on projects requiring the dozer or a heavy scraper.

Other equipment received during 1988 included:

- A Model 816, Truax native grass drill transferred from Des Lac NWR.
- No-till attachment for the Truax drill.
- Bobcat Model 975 skid steer loader transferred from Lake Andes NWR
- 300 gal. Wajax-Pacific slide-in fire pumper unit
- 20' Trail King, 12,000 lb. payload, flat bed trailer
- Suzuki 4x4 all terrain cycle
- New Dodge D150, 4x2 pickup
- Three Canon T50 cameras plus extra lenses
- Panasonic video camera and recorder

5. Communications Systems

During the year, three Motorola Handi-Talkie portable radios and three mobile 8-channel units were received. The new mobile radios allow communication on the S.D. State Radio Network and provide additional service and safety, especially during law enforcement activities.

Lightning struck the radio system antenna, located on the refuge observation tower, during a summer thunderstorm. The antenna and several components of the radio system required replacement or repair.

6. Computer System

New software packages received in 1988 included QDOS II and WordPerfect 50.

As time goes by, more and more uses are found for the computer. Finding the time to keep up with the new technology becomes the major problem.

7. Energy Conservation

To cut down on heat loss, the garages on three of the refuge residences were insulated and panelled. The insulation prevents a cold air sump and helps reduce the energy bills.

J. Other Items

1. Cooperative Programs

a. Cooperative Agreements

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

b. Fire Agreements

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

c. 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 23 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 includes 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.

Relative to impacts on the James River and Sand Lake National Wildlife Refuge, there are as many unanswered questions today as there were under the old 1965 GDU authorization. HR 1116 calls for a two year Scope of Study for the James River which will hopefully resolve some of these questions. In 1988, this comprehensive study was extended one year. This Bureau of Reclamation (Bureau) report must now be sent to Congress by September 30, 1989.

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.



Figure 48. At Sand Lake NWR we normally obtain a winterkill on fish populations every 3-4 years. A flow through Garrison Diversion scenario will eliminate this critical natural function thereby reducing our waterfowl production and migration objectives. 88-SY

The project increasingly takes more time away from other refuge and wetland management activities. 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.

Project data gaps continue to limit a complete and thorough evaluation of the present Garrison project options. Project deficiencies include:

1. Nutrient loading and algal growth, trace elements and heavy metal concentrations from project development.
2. Increased disease on the refuge due to water level fluctuations, water quality changes and the effect of open water during winter months.
3. Flow through (flushing) action on pool productivity.
4. Upstream channelization (initial and deferred).

Bureau vegetative and fisheries monitoring studies have been ongoing for several years as part of the Garrison project.

Water quality data collected at various areas in the refuge are contained in **Table 14**.

Table 14. Water Quality Data (TDS) Collected at Sand Lake NWR (1984-1988)¹.

Month / Year	River Channel	Refuge Pool	
		Mud Lake	Sand Lake
July 1984	416*	375	382
August 1984	475	459	407
September 1984	544	525	460
June 1985	591	521	486
July 1985	576	551	451
August 1985	620	623	479
September 1985	633	656	509
June 1986	518	488	495
July 1986	489	446	439
August 1986	551	488	455
September 1986	522	527	479
April 1987	264**	246**	232**
June 1987	429	403	380
July 1987	338	378	415
November 1987	373	362	404
April 1988	350	400	405
May 1988	508	491	470
July 1988	526	464	527
August 1988	567	548	548
October 1988	778***	765***	657***

¹. Source: U. S. Bureau of Reclamation, Bismarck, N.D.

* All TDS reading taken in Mg/L

** Lowest recorded reading for channel, Mud and Sand Lake pools

*** Highest recorded reading for channel, Mud and Sand Lake pools

Since 1986, Omnidata continuous recording data (2 stations) have been used on the refuge by Bureau biologists (Figures 49 and 50). These stations have been recording (1) water and air temperatures, (2) wind speed and direction, (3) three-par light readings, (4) turbidity and (5) water depth. In the winter dissolved oxygen readings have also been monitored at the sites (parameter initiated for 1988-1989 season). The winter dissolved oxygen readings have correlated quite closely with Service data.

Numerous equipment failures prior to 1988, lead the Bureau to contract out its operation to the U. S. Geological Survey (USGS). Since the 1988 field season the equipment has been working reasonably well.



Figure 49. Omnidata Continuous recording stations are placed on the main lake and sheltered bay areas of Sand Lake. The stations were plagued with technical problems before the 1988 field season. USGS operation in 1988, greatly improved the reliability of the stations. 88-JKW



Figure 50. The main lake station sank on June 28. The pontoon welds apparently gave out after a heavy blow. The equipment was repaired and put back in operation in August. 88-JKW

Major planning activities completed by refuge staff are reported in **Table 15**.

Table 15. Planning Activities on the Garrison Diversion Unit, Completed by Refuge Staff at Sand Lake NWR January - December 1988)

<u>Month</u>	<u>Activity</u>
January	Attended an interagency meeting in Jamestown, N.D. on proposed SDSU fisheries study.
February	Attended an interagency fishery meeting in Aberdeen, S.D.
March	<p>Attended the annual refuge interagency refuge monitoring meeting in Jamestown, N.D.</p> <p>Attended interagency meeting and prepared written comments to Bureau and U. S. Geological Survey (USGS) field offices on 1988 proposed omnidata continuous station monitoring.</p> <p>Attended GDU water quality interagency meeting in Bismarck, N.D.</p>
April	<p>Prepared written comments to Bismarck Field Office (FWE) on the Bureau's comprehensive refuge monitoring study report.</p> <p>Met with Bismarck Field Office (FWE) staff and discussed water quality and quantity impacts to Sand Lake NWR.</p> <p>Met with Bureau and SDSU personnel in an effort to coordinate refuge project field activities.</p>
May	<p>Completed coordination activities with the Bureau SDSU, USGS, and Service (FWE) staff personnel on refuge ongoing field study programs.</p> <p>Met with Bureau (Denver Research Center) personnel and discussed various rough fish management/control options available with and without a Garrison Diversion Scenario.</p> <p>Met with Aberdeen American News to complete story on SDSU's rough fish study.</p>
June	<p>Completed coordination activities with the Bureau, SDSU, USGS and Service (FWE) staff personnel on refuge ongoing field study programs.</p> <p>Met with Bureau and EPA personnel to discuss enviropod IR aerial flight and sonar testing experimental studies.</p>

Table 15. (Continued)

Month	Activity
June	<p data-bbox="493 384 1456 510">Collected coot eggs in Sand Lake Refuge for Bismarck FWE trace element study. This collection completes a three year effort to help determine baseline conditions on the refuge.</p> <p data-bbox="493 541 1456 604">Provided water level information to Bismarck FWE Field Office on rough fish issue.</p> <p data-bbox="493 636 1456 699">Prepared written comments to Pierre Field office (FWE) on James River (SD) FWCA Report.</p> <p data-bbox="493 730 1456 856">Conducted an aerial survey with Bureau personnel of the Sand Lake and Dakota Lake NWR's and Hyatt Slough GMA. The flight was in preparation for EPA enviropod IR flight.</p> <p data-bbox="493 888 1456 982">Met with Bismarck FWE Field Office staff to discuss West Oakes irrigation and Refuge GDU impacts issues.</p>
July	<p data-bbox="493 1014 1456 1108">Completed coordination activities with the Bureau, SDSU, USGS and Service (FWE) staff personnel on refuge ongoing field study programs.</p> <p data-bbox="493 1140 1456 1234">Met with Bureau and Service FWE, REW, and Kulm WMD representatives to discuss water rights/GDU issues surrounding Dakota Lake NWR.</p> <p data-bbox="493 1266 1456 1329">Initiated water surface elevation monitoring study at Dakota Lake NWR.</p> <p data-bbox="493 1360 1456 1423">Prepared and provided Sand Lake NWR/GDU briefing to Regional Office Staff.</p>
August	<p data-bbox="493 1455 1456 1549">Completed coordination activities with the Bureau, SDSU, USGS and Service (FWE) staff personnel on refuge ongoing field study programs.</p> <p data-bbox="493 1581 1456 1707">Prepared written comments to Bismarck (FWE) on rough fish/GDU study report. This report was compiled by the Bureau. Refuge staff provides telephone follow-up comments to the Bureau.</p> <p data-bbox="493 1738 1456 1833">Met with Regional and Field office (FWE) personnel and Field Fishery personnel to discuss Garrison Diversion Activities and tour of refuge facilities.</p>

Table 15. (Continued)

<u>Month</u>	<u>Activity</u>
September	Completed coordination activities with the Bureau, SDSU and USGS staff personnel on refuge ongoing field study programs.
October	Attended GDU interagency meetings held in Jamestown and Bismarck, N.D.
November	Attended a GDU interdivision meeting held in Bismarck, N.D. Completed coordination activities with the Bureau, and USGS staff personnel on refuge ongoing field study programs.
December	Prepared written and oral comments to Bismarck (FWE) field office on their Preliminary Draft FWCA Report on James River Refuges. Removed Staff gauge at Dakota Lake NWR and prepared wrap-up report for 1988 findings. Prepared written comments to Pierre (FWE) field office on their FWCA Report (SD Portion) on the James River.

d. WEB Pipeline

After the fall of the Oahe irrigation project, the WEB proposal was initiated. WEB is a pipeline plan that will bring Oahe water (Missouri River) to northeastern South Dakota towns and cities. The refuge coordinated activities with construction crews so that pipeline crossings could be accommodated across the James River (**Figure 51**). The WEB is now nearly 100% complete and serves parts of 10 counties in South Dakota and one county in North Dakota.



Figure 51. Construction on the WEB pipeline crossing on the James River in Brown County, South Dakota. This river reach is adjacent to Sand Lake NWR along County Highway 16. 88-SY

e. Christmas Bird Count

The annual Christmas bird count was conducted on December 21 (**Figure 52**). Seventeen participants observed 33 species of birds.



Figure 52. Participants who braved the cold weather to conduct the Christmas Bird Count. 88-JWK

f. Weather Station

Daily weather data are recorded and sent in monthly to the National Weather Service. Weather recording equipment is furnished and maintained by the National Weather Service.

g. 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.

3. Items of Interest

Steve Young attended the S-390 fire course at Valentine NWR. Steve also completed a correspondence course on supervision.

Five of the staff attended the Law Enforcement refresher course at Marana and the pre-season refresher in Sioux Falls.

The Department of Defense is considering construction of a radar system known as "Backscatter" in the northeastern part of Brown County, about ten miles east of the refuge. Its effect on wildlife is still to be estimated.

4. Credits

Dave Hilley wrote the sections on public use, facilities and equipment and highlighted the report. Bill Schultze told about the climate, the habitat and the wildlife. Steve Young remembered the planning and things that happened at Pocasse. Bob Wright described the administration and other items that occurred. Marcia Haaland processed the results.