Sand Lake National Wildlife Refuge

Columbia, South Dakota

Narrative Report

May 1, 1960 to August 31, 1960

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C O N T E N T S

I. GENERAL

A. Weather Conditions.

	Precipitation This Month	Precipitation Normal		Max. Temp.	Min. Temp.
May	2.39	2.24		28	83
June	2.95	4.04		41	84
July	1.23	2.61		42	104
August	4.69	2.16		39	94
Total	11.26	11.05	Extremes	28	104

Precipitation for the period does not reflect the true picture for the summer. The period opened with inadequate topsoil moisture and never caught up until August.

Crops withstood the low rainfall quite well as temperatures remained near normal with only a few exceptions. This station was about in the middle of a transition from wet to dry. From here north they experienced well above normal rains all summer. In fact they had difficulty getting corn planted and cared for. Some fields never did get planted. Frequent rains of two and three inches made potholes and sloughs ideal for wildlife in the area north of headquarters.

To the south of us rainfall was well below normal and the crops suffered badly, especially the corn. Aberdeen was as much as 5.5 inches below normal (for the crop season from April 1) before a nice shower in August.

Crops on the refuge will be average to a little above, with corn doing the best; not considering the blackbird damage of course.

B. Habitat Conditions.

1. Water

Mud Lake. During May and June water levels remained slightly above pool level with all of the stop logs removed. In July a drawdown of one foot was made to facilitate shoreline spraying and road construction. The drawdown was completed on August 3 and since that date the pool has remained about one foot below capacity.

Sand Lake. The peak of the spring runoff occurred in mid-April, but due to flooding below the refuge, we were obligated to restrict our discharge to the safe channel capacity. Even with our efforts to cooperate, some

farmers complained about flooding. Pool level was reached on July 20 and since that time there has been a three inch loss due to evaporation.

2. Food and Cover.

Food conditions on the refuge are quite different from a year ago when we suffered from a drouth. The small grain crop was above average and was harvested with favorable weather. Shortly after harvest some good rains fell which prompted many farmers to disk or fall plow their fields. In the tilled fields, as well as in the stubble, an abundance of volunteer grain will make favorable browse areas for the geese. To supplement the volunteer grain, 150 acres of rye was sown by refuge personnel. An additional 50 acres will be sown by permittees.

Due to frequent late summer rains, little of the shattered grain left from harvest will be available. This feed has either sprouted or has been covered by tillage.

The corn crop is spotty . In general, the refuge corn fared better than that to the west or south because of a few lucky showers and the moderating effect of the lake on the hot dry winds. Unfortunately, the refuge fields were on the front line when the blackbird attack came and sufferd accordingly. All of the fields have had some loss which in some cases runs to as high as 70 percent.

Most of the millet yields will be good with some loss caused by hail and blackbirds. The early plantings tended to be weedy and it was in these fields that blackbird damage was most severe.

Last year, some closely grazed pastures made excellent goose browse areas. This summer, the grass has grown so rapidly that close grazing has not developed and as a consequence few areas in the grazing units will be attractive to geese.

The response of sago pondweed in Sand Lake due to drying and carp removal has been good. The beds are now much larger than they have been for many years. Coot have moved into these sago beds, however, and it is believed that most of the seed will be consumed before migrant waterfowl appear.

The cover picture has changed radically in the past year. In the spring, large beds of dead annual weeds which grew on the mudflats the previous year, completely covered the water surface. Later in the summer, growths of river bulrush, phragmites and cattail, which started last summer, emerged above the water. By early fall, an estimated 1500 acres of new emergents blanketed sections of the marsh which were once open water. The new invasion was particularly great south of the mud lake dike to Harold Dennerts. New growth has also greatly reduced the openings south of the recreation area to the Columbia Dam.

II. WILDLIFE

A. Migratory Birds.

1. Waterfowl.

a. Geese. At the beginning of the period 1,000 snow and blue geese, 800 small Canada geese and 100 large Canada geese were present. By May 15 all the geese except the large Canadas had left the refuge.

With our reduced water area last fall, the geese and hunters were both concentrated on the north part of the refuge. This lead to an usually heavy kill of our resident flock. The managed shooting area alone recorded 47 of the large geese in the bag checks. We estimated that about 60 breeders were present in the flock that returned last spring. High water hit the Sand Lake Unit after nesting started so the initial nesting attempts were lost. Three renests were found in this unit after the water receded, but in each case the clutches were small, averaging about three eggs per nest. Nesting on the Mud Lake Unit occurred after the pool had filled, so these nests were not flooded. Of the seven nests located in this unit, two were destroyed by predators. One nest in Sand Lake was deserted when visited at a later date.

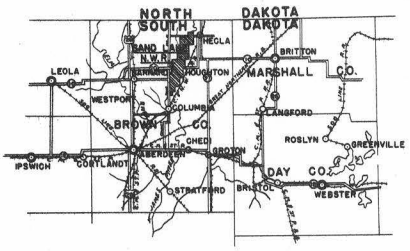
Our spring and summer observations also indicate a decline in our resident goose flock. The fall count is down to 135 birds compared to 217 a year ago.

The following table shows a comparison of broods and young produced for the past eleven years.

Sand Lake Canada Goose Production

Year	Breeding Populations	Number of Broods	Number of Young
1960	60	7	35
1959	100	12	63
1958	100	12	64
1957	262	18	95
1956	150	14	54
1955	100	15	68
1954	130	9	46
1953	?	12	42
1952	105	18	65
1951	?	18	56
1950	100	12	50
Average	130	14	60

1960 Goose Nest Location and Destruction



LOCATION MAP

SCALE

0 5 10 20 30 40 MILES

10 XX - Goose Nests Location

3 ⊗ - Nests Known To Have Been Destroyed.

LEGEND

- BOUNDARY LINES
- PRIMARY ROADS
- SECONDARY ROADS
- TRAILS
- OLD RIVER BED
- EASEMENT ONLY

GENERAL MAP

SAND LAKE

NATIONAL WILDLIFE REFUGE

BROWN COUNTY, SOUTH DAKOTA

SCALE =

0 ½ 1 2 3 MILES

U.S.G.

b. Ducks.

Approximately 1,950 dabblers and 1,075 divers were present on May 1. This represents a slight increase over the number of ducks here at the same time last year. Although the population drppped slightly until the last week in May it began to climb steadily thereafter and an estimated population of 12,000 ducks were present at the end of the period. Approximately 1,000 are divers of this total figure.

The breeding pair count began on May 20 and was continued through May 31. Although an attempt was made to conduct an aerial census and correlate this with the canoe census, as was done in the past two year, the idea was abondoned due to the small number of ducks seen from the plane. Thus, a canoe count was made on the entire refuge. Thiscount was supported by walking areas inaccessable with the canoe. This count revealed that there were 1,603 pairs present as represented by 763 actual pairs and 840 lone drakes seen. The following table shows the pairs and lone drakes by the different units.

Breeding Pairs 1960
Area Distribution

Area	Pairs	Lone Drakes	Total
Mud Lake Unit	150	224	374
Sand Lake Unit	299	294	593
North of Hecla Grade	145	172	317
All Potholes & Ditches	46	47	93
All Other Water Areas	123	103	226
Total	763	840	1603

The greatest increase in breeding pairs was noted on previously dry areas. The Sand Lake Unit had a greater than normal quota of breeders and a good response was found on a newly flooded area north of the Hecla grade. The practice of drying and reflooding marshes definitely has a stimulating effect to both vegetation and waterfowl. An even greater response to wildlife was found on newly flooded areas that had not been previously flooded.

Duck production this year was higher at Sand Lake than it has been for some time. art of this increase can be attributed to the response of low water followed by reflooding. In addition, the high water levels this spring created a number of new impoundments that only have water once or twice in a ten year period.

See next page for tables

Percent Composition of Breeding Pairs 1957-1960

Species	1957	1958	1959	1960
B. W. Teal	15.5	36.9	24.0	21.4
Gadwall	11.0	21.2	20.0	2.9
Mallard	16.0	16.3	22.6	10.1
Redhead	8.8	4.5	7.6	20.4
Pintail	2.2	3.5	2.5	16.7
Shoveller	11.0	2.2	13.1	7.5
Ruddy	6.1	1.9	2.7	10.4
Baldpate	0.0	1.3	2.5	0.6
Scaup	18.2	0.6	4.0	6.8
Canvasback	0.0	0.0	0.0	2.4
G. W. Teal	0.0	0.0	0.8	0.1
Woodduck	0.0	0.0	0.0	0.1
Blackduck	0.0	0.0	0.0	0.6
Unidentified	10.5	11.5	0.0	0.0

Sand Lake Duck Production 1950 - 1960

Year	Breeding Pairs	Calculated Broods	Calculated Young
1960	1603	571	3702
1959	987	75	492
1958	707	305	2022
1957	1153	478	3158
1956	---	276	1784
1955	369	205	1332
1954	564	340	2240
1953	658	347	2360
1952	437	488	3375
1951	---	381	2300
1950	---	520	2760
Average		340	2182

The following table indicates our method of determining production. Since some of the young could not be observed, Griffith's average brood size data was used.

Sand Lake Duck Production - 1960

Species	Obs. Specie Composition	Calculated Broods	Griffith's Avg. Brood Size	Obs. Avg. Brood Size	Production **
Mallard	49.5%	28	6.52	5.70	183
Gadwall	12.60	72	7.09	6.95	510
Pintail	18.45	105	6.10	5.60	640
BW Teal	33.75	193	6.80	5.64	1312
Shoveller	13.05	75	6.33	6.50	475
Redhead	6.75	39	6.31	7.19	246
Canvasback	1.35	8	6.18	4.66	49
Ruddy	6.30	36	5.34	3.78	192
Baldpate	.45	2	6.36	5.00	13
Unidentified	2.25	13	6.33*	4.60	82
Totals		571 Broods			3702

* Average of above species.

** Based on Griffith's average brood size.

In reviewing past narratives, we find that gadwall and ruddy production was well above normal. The most significant decrease from the norm was found in mallards.

A very encouraging increase in the number of redheads stayed late and appeared to be settling down for housekeeping. As sometimes happens many of them never did nest and production of this species was only slightly higher than normal.

The first brood count was made from July 5 to July 14 and the second from August 1 to August 8. A canoe was used with paddles for the first count. Later, a motor was used on the canoe in places to aid the observers in getting through the rank stands of vegetation. The same route in the Mud Lake Unit was run as in the past two years and expanded, according to similar habitat for that area. However, due to limited open water areas in the Sand Lake Unit, the length of the census route was increased. On the other areas a complete census was made where possible with 1/3 added for broods not observed. Possible duplications in the two counts as determined by age classes were subracted from the totals.

See following page.

Area	Broods Actually Seen	Calculated Sub-total
Hecla Gr. to Mud Lake Dike	74	220
Mud Lake Dike to Hanson Pt. (E & W)	21	127
Hanson Pt. to Weismantel Gr. (E & W)	15	22
Weismantel Gr. to H. Dennerts (West side)	21	31
Weismantel Gr. to Columbia Dam (E & W)	21	35
Display Pool	27	40
North Wild Area (Flooded)	7	43
Pond at Tunby & Adjacent Flooded Area	2	3
Pond at Diagonal Trees	3	4
Below Columbia Dam	5	7
Dakota Lake	23	34
Maple River	3	5
Total	222	571

Despite the cool late spring, the peak of the hatching this year was quite early, occurring in the period of June 20 - 25. In past years the peak frequently occurred about July 1.

2. Other Waterbirds, Shorebirds and Doves.

a. Water and Marsh Birds.

Coots. The abundance of dead goosefoot (Chenopodium spp) and new growths of cattail made the Sand Lake Unit expecially attractive to coot. An estimated 600 broods were produced on the refuge, three-fourths of which were found on Sand Lake. These broods probably represent between 2000 and 2500 young. Past records indicate that coot production is normally less than 500 birds.

With the coot population very low on the refuge last year this sudden influx of brood stock must have come from other areas. Apparently the "parent marsh theory" has not been brought to the coots attention.

Western, pied-billed and eared grebes had a successful season. The majority of the nests were found in areas of new emergents.

Pelicans and Cormorants. Both species were again abundant this year. White Pelicans produced about 300 young and the Double-crested Cormorants about 400 young. Most of these were produced on Pelican Island south of the Houghton Grade. The Pelican population was raised considerably by the influx of new birds around the first of August. At the end of the period approximately 3,000 were present. The Cormorant population is about 1500 birds. Gulls and Terns. Mass flights of Franklin's Gulls leave the refuge about daybreak and return shortly before dark in the evening. An estimated 250,000 birds use the refuge. They feed mainly in plowed fields adjacent to the refuge.

Common Terns and Black Terns were abundant in the spring, and through the nesting season. Shortly after the young reach flight the terns disappear.

Great Blue Herons were present in usual numbers. Black-crowned night herons were particularly abundant in the Sand Lake pool. This species showed an increase over last year. American Bitterns were seen frequently throughout the period. Occassionally Sora Rails were sighted.

b. Shorebirds.

Shorebird "enthusiasts" were somewhat disappointed this summer as they came to the refuge. In contrast to last summer there were very few shorebird attraction areas for the "Birders" to visit. However, Dowitchers and Yellowlegs were fairly common in the neighboring sloughs and ponds. Occasionally Marlbed Godwits, Willets, and Avocets could be seen there also. Bairds and Semi-palmated Sandpipers were common in the Mud Lake Unit.

c. Doves.

Mourning Doves were abundant this year and from periodic observations the nesting season was quite successful. Several doves have been killed on the highway adjacent to the refuge boundary. There was no dove banding program on the refuge this summer.

B. Upland Game Birds.

Pheasants. Ring-necked Pheasants were abundant during this period. Most of the broods observed were quite large. It appears that there was a good hatch this year in spite of the prolonged winter with ice and snow. Pheasant season will open October 22, with a daily limit of four cocks, and run to ~~November 20.~~ Dec. 2. 1968

European Gray Partridge. Several pairs were seen adjacent to the refuge this summer. Apparently these birds are holding their own in this area.

C. Big Game Animals.

Approximately 170 deer were taken on the refuge last year with 400 permits allotted to the county. The herd increase this summer has brought the population up to about the size it was a year ago. A hunting season has been set by the South Dakota Department of Game Fish and Parks from December 3 through December 11 for the 400 permit hunters in the county. The major change in the regulations is that rifles will be permitted for the first time. By limiting the number of hunters, we did not object to using rifles on the refuge. A number of adjacent farmers, however, fear that they will loose livestock and are appealing to the state to go back to a shotgun season.

D. Fur Animals, Rodents, Predators and Other Animals.

Raccoon and skunk are still plentiful on the refuge. Nest predation, we feel, is high here because of the physical and biological conditions on the refuge. Predators are attracted to the refuge for crippled birds in the fall and later by the entrails left during the deer season.

The marsh furnishes good winter cover for predators until they were forced out by high water in the spring. The animals then move to a narrow band of pasture or wildland along the pools, which is also used extensively by nesting waterfowl.

The fur prices on long haired fur bearers has continued to rise and the outlook for a more adequate control through trapping is promising.

The high kill of foxes last winter due to ideal snow conver for aerial hunting has made a noticeable dent in the population. It may take a year or two for them to recover.

Despite the large invasion of new emergents, muskrats have shown no increase. Former trappers on the refuge report that this species at one time was the backbone of a thriving fur industry on the refuge. A steady decline was noted during the '40's and now less than a dozen animals are seen during the summer. A return of the rats would mean more money in the pot and could help to control the shoreline emergents.

E. Hawks, Eagles, Owls, Crows, Raven and Magpies.

Marsh Hawks have been the most common hawk. Sparrow Hawks have been seen occasionally. Red-tailed Hawks are common now. Rough-legged Hawks have been noticed occasionally during the period. No eagles have been observed this period.

Burrowing Owls nest in the area and can be seen frequently. Few other owls have been seen.

Crows are occasionally seen, but are not here in large unumbers.

F. Fish.

The Sand Lake Unit was carp free prior to the spring run off. A fair winter kill occurred in Mud Lake, but some fish survived in the deeper channels. Additional carp moved in from both the south and north with high water, so we are now well on our way toward a carp problem again.

III. REFUGE DEVELOPMENT AND MAINTENANCE

A. Physical Development.

Field projects were slowed down considerably this summer by frequent rains and greater emphasis on biological problems. Projects worked on are as follows:

1. Installed three road crossings to grazing unit 23 which was previously inaccessible without a boat. This improvement will allow us to control thistles on a new area and facilitate cattle turn-ins and inspections.
2. Placed three cattle guards in pasture units.
3. Fumigated the granary and cleaned out the elevator shaft.
4. Spot gravelled roads, the south dike and the court yard.
5. Mowed and graded all of the refuge roads twice.
6. Painted the overhead doors on two equipment buildings.
7. Made extensive repairs on the corn crib.
8. Repaired portions of the boundary fence and installed new gates.
9. Stockpiled gravel at the refuge pit for hauling this winter.
10. Repaired and painted window frames at site 4.
11. Installed water gauges.

B. Plantings.

1. Trees and shrubs.

Two miles of trees were planted early in the period. There have been cultivated three times and hoed once. Survival has been very good, about 85 percent in most of the rows.

2. Cultivated Crops.

The refuge share of the crop this year was taken mainly in corn because it was felt that much of the barley would be lost through sprouting or would be topped by weeds. A portion of the harvested corn will be shelled and stored in the granary. Corn has always been preferred over barley for trap bait here as well as by neighboring refuges, so we have tried to avoid stocking up on grains that are only used as a second choice. The following is a summary of the crop acreages and divisions for 1960.

Crop	Total Acres	Gov't Share Standing	Gov't Share Harvested
Alfalfa	316	-	-
Barley	658	112	13
Corn	1010	425	108
Millet	88	50	18
Oats	265	19	2
Wheat	310	-	10
Rye	12	-	12
Rye browse	191	191	-
Total	2850	797	163

D. Control of Vegetation.

A concientious effort was made to do all of the summer thistle spraying in a three week period. Windy days hampered the time schedule, but by working longer hours on calm days, the refuge was covered before any of the thistles went to seed. In addition to the 1100 acres of sow and Canada thistle sprayed by the Hanson brodjet sprayer, 225 acres were aerially sprayed.

Definite improvement can be seen in thistle reduction over a large portion of the refuge. The least headway has been made with Canada thistles and this is especially true of the flood zone, which is frequently supplied with new sources of seed.

E. Planned Burning.

Several small areas were selected for summer burning of phragmites in an effort to control blackbirds and to open up shorelines. The rushes burned well even over shallow water wherever dead growth from the pervious year was present. All of the blackbird nests present were destroyed, but new growth was so rapid that within a month, it was difficult to determine burned areas from unburned on the shoreline.

F. Fires. None.

IV. RESOURCE MANAGEMENT

A. Grazing.

Nineteen permittees turned in 1433 head consisting of 692 cows, 302 yearlings and 439 calves during May and June. Grazing fees were raised from $1.25 an AUM to $1.50 an AUM this year. Also we began charging for calves as 1/4 unit, yearlings as 3/4 and cows as One unit. There seemed to be little resistance among the permittees in regard to either of these changes.

The pastures at turn in time were short and grass growth was slow due to the cool spring and high water. With warm weather in mid June, the pastures made a surprising recovery and kept ahead of the cattle throughout the season. None of the units have suffered from overgrazing, in fact, our grazing has been too light. A number of shortly grazed areas which were important grazing and loafing sites for geese last fall are now knee high in grass. Little bunch effect was created with the light grazing and most of the units are now very similar to the wildland areas. Perhaps it will not be entirely possible to adjust our grazing to fit growing conditions, but more leaway should be brought into our grazing plan in the next revision.

Shoreline openings that have been made in previous years were maintained by the cattle as they continue to water at the same sites year after year. The response to these openings as loafing sites by waterfowl has been very good, but the number of openings are inadequate.

It seems that other measures must be taken in conjunction with grazing to combat the shoreline emergents. One approach tried this fall was to spray the emergents with Amitrol T. When sufficiently dry, these rushes will be burned and it is hoped that the cattle will keep down the new growth in the future. As a second step, we are planting an experimental plot of meadow foxtail on the shoreline. This is a short, water tolerant grass, which we hope will furnish competition for undesirable emergents.

Since our grazing program commenced, it has been the practise to hold the cattle to the bottomland as much as possible in the spring to control the emergents. The thinking in doing this has been that the rushes would be eaten when they are green and tender, thus opening up the shoreline. In practice it seems that cattle prefer the wet meadows and upland in the spring. Some feeding is done in the rushes, but growth is so rapid that the plants seem to make normal development. By August and September, however, the uplands and meadows become dry and the cattle move into the rushes to fight flies and to forage on the tender plants growing near the water. Openings made during this period remain throughtout the fall and the following spring. It certainly appears that more is accomplished toward shoreline improvement later in the season than in May or June.

B. Haying. None.

V. FIELD INVESTIGATIONS OR APPLIED RESEARCH

A. Blackbird Studies.

A field study on blackbirds was started in the fall of 1959 under the technical direction of the Denver Research Station. An expanded program was undertaken this year with Biologist DeGrazio from the Branch of Research serving a s project leader. This study became a major part of the refuge summer work program with four members of the staff working on it part time. The Branch of Predator and Rodent Control contributed personnel for three weeks and the South Dakota Department of Game Fish and Parks had three employees working on the study for six weeks. Technical help was given by several staff members of the South Dakota State College.

Only a brief summary of project segments will be given in this report as Mr. DeGrazio's report of the years work will be included in a later narrative.

1. Crop Damage Appraisal.

The corn fields in a 96 square mile study area were measured and plotted to determine the amount and distribution of crop damage. Eighty random plots were established in which ears on two 35 foot rows were bagged and compared with an equal number of unbagged ears.

2. Population Study.

Transects were run both on the refuge and over the county to determine the nesting population. Roost counts were made in the fall to get a population estimate during the damage period. Thirty-five major roosts were located, one of which harbored over a million birds.

3. Decoy Crops.

Sunflowers, millet and three varieties of milo were planted to test their attractiveness as decoy crops. Each of the crops were poisoned in an attempt to make a reductional control, but none of these crops show much promise for control work.

4. Reductional Control in Roosts.

Dynamiting with crow type bombs was successful in killing about 1000 birds. However, considering the expense and time involved, this method of control is not practical to get the reduction necessary.

5. Bait Stations.

A number of baits were tested in the field. Cracked corn and millet were preferred of the dry grains, but could not compete with milk stage corn and offerred little hope. Once the corn feeding habit developed, very few birds could be attracted to bait stations.

Both strychnine and Tepp were used as poisons at the bait s tations.

During the nesting season, 29 feeding troughs were erected in the marsh. These stations, baited with poisoned grain, show promise of giving some measure of control to the breeding population, but were not effective in the fall.

6. Repellents.

Some of the more promising repellents were field tested. At concentrations which would be practical, none of the repellents gave adequate control. Actually, one repellent seemed to attract birds.

7. Demonstration of Frightening Devices.

All of the recommended frightening devices were demonstrated in the field to 64 farmers in the study area. These devices included firecracker ropes, Zon exploders and shell crackers.

We regretfully report that Sand Lake still has blackbirds and that no solution to the problem is in sight. A lot has been learned about the birds movements, habits, etc. which we hope will lead to a "break through".

B. Experimental Herbicide Applications.

1. Canada Thistle.

Five one acre plots of Canada thistle were sprayed with experimental chemicals on July 11, 1960.

Herbicide and Active Rate	August 25 Results.
2 gal. Amitrol T - 4 lb.	85% kill/thistles - good kill on quack.
1 gal. Amitrol T - 2 lb.	70% kill/thistles - 50% kill on quack.
1 gal. Kenapon - not known.	10% kill/thistles - good kill on grasses.
8 lb. Weedazol - 4 lb.	75% kill/thistles- grass kill = 2 lb. Amitrol T.
1 gal. Garlon - 4 lb.	10% kill/thistles - good kill on grasses.

Amitrol T gave a 100 percent kill even at the two pound rate where the cover was sparce and the thistles received good coverage. Kenapon and Garlon were effective on both phragmites and quackgrass in the study plots, but showed a poor kill on broad leaf plants. The amino triazole chemicals killed both grasses and broad leaf plants.

2. Phragmites.

Three one acre and one two acre plots of phragmites sprayed in August 1959 were checked.

See following page.

Herbicide and Active Rate	August 25, 1960 Results
25 lb. Radapon - 21 lb.	70% kill/phragmites - no secondary kill.
6 gal. Garlon - 24 lb.	95% kill/phragmites - no secondary kill.
2 gal. Garlon - 8 lb.	70% kill/phragmites - no secondary kill.
2 gal. Amitrol T - 4 lb.	90% kill/phragmites - some secondary kill.

The dow products which include Garlon and Radapon showed a rapid kill of phragmites, but by the second season the surviving plants showed no ill effects from the chemical. The Amchem Products - Amitrol T has a slower killing rate the first season with considerable yellowing of regrowth plants the second season.

Canada thistle and river bulrush were little effected by any of these chemicals when sprayed in the fall. They were the first plants to appear this spring and rapidly invaded areas of dead phragmites.

An 8% strength of granular Atrazine was applied at rates of 5, 10, 20 and 40 pounds of active ingredient per acre in stands of cattail submerged in eight inches of water. No kill resulted from this experiment.

C. Aquatic Transects.

Aerial photos were taken by Pilot-Biologist Brazda this summer to determine the extent of the sago beds. These photos have not yet been developed. Spot checks were made by canoe to determine turbidity and seed production. The results of this survey will be reported at a later date when all of the data are available.

D. Waterfowl Populations and Shoreline Grazing Use.

This project was initiated in 1957 to appraise the effects of shoreline grazing on waterfowl production and over-all waterfowl use. The study is to continue for one more year. Tabulated below are the breeding pair counts made this year.

GRAZED				CONTROLS			
Unit	Length of Shoreline	No. of Pair	No. of Pair/Mi	Unit	Length of Shoreline	No. of Pair	No. of Pair/Mi
G-19	1.0 Mi.	14	14	A-48	0.8 Mi	13	16.2
G-18	1.9	36	19	A-40	1.8	21	11.7
G-17	1.3	8	6.1	Conard	1.3	26	20.0
G-16	2.3	26	11.3	G-15	1.9	16	8.4
G-11	1.7	24	14.1	A-27	1.7	10	5.9
G-6	1.2	38	31.6	A-12,13	2.1	11	5.2
G-22	0.8	9	11.2	H-2	1.0	12	12.0

The above counts were made during the period May 20-27. Only pairs and lone drakes were counted; divers and coots were excluded. Although the grazed units showed more pairs per mile in four cases, there were three control which had more pairs per mile. The over all average showed more pairs per mile (15.2) on grazed units over the control units (9.3). However, no conclusive evidence could or should be drawn at this date. A complete five year report will be made in the 1961 fall narrative.

E. Artificial Potholes and Level Ditching Study.

Potholes and Level Ditching Waterfowl Use - 1960

Area	Ducks per pothole or mile of level ditching.						
	4/27	5/6	5/20	5/27	6/15	7/7	Avg.
North Potholes (95)	.04	.12	.26	*	.26	*	.17
South Potholes (45)	.08	.62	*	2.34	.87	.11	1.02
No. level ditch .76 mile	*	10.5	*	2.64	*	*	6.57
So. level ditch .51 mile	*	*	*	3.90	3.90	*	3.90

* Area not checked on these dates.

Both the level ditching and potholes were used mainly by blue-winged teal during the breeding season. The waterfowl use of these areas this summer was a little greater than that of the previous years, but was considerably lower than that found on some of the natural potholes both on and off the refuge.

F. Shoreline Grazing Transects.

Since 1957, thrity-six shoreline grazing transects have been run each year to determine the effects of grazing on shoreline vegetation. The vegetation changes have been so small that only eight of the most representative transects were checked this year. This study will be completed in 1961 and at that time a complete survey will again be necessary to evaluate vegetation changes that have occurred over the five year period.

G. Nesting Studies.

A small acreage was dragged this summer to determine the cover densities preferred by nesting ducks.

The following table shows the results obtained on the 132 acres studied.

Nest Dragging Study

Species	Vegetation	Grazing status	Acres per nest
Mallard & BWT	Brome & Bluegrass	Wildland	8.6
Mallard & BWT	Bluegrass	Light Grazing	12.5
Mallart & BWT	Bluegrass	Heavy Grazing	6.0

The relation of water and loafing sites to nesting cover seemed to be as important to nesting as the density of the cover. Since factors other than cover density were not evaluated, it is difficult to determine a cover density preference, although it was found that Mallards and Blue-winged teal will accept nesting sites in a wide range of cover densities, ranging from knee high vegetation to closely grazed pastures with only occassional clumps of grass. There was no evidence that even our heaviest grazing as practiced on the refuge is adversely effecting waterfowl production.

VI. PUBLIC RELATIONS

A. Recreational Uses.

The Columbia Recreation Area was maintained better this year than it has for many years. A local Extension Club donated a set of swings with a slide and the refuge staff put them up. These two features stimulated use of the area and many favorable comments were received.

Other uses were mainly fishing. Fair fishing was had at the Hecla Rec Area. No success was known for fishing on the Weismantel Grade.

We have had the normal visitor traffic observing the wildlife and climbing the tower.

B. Refuge Visitors.

May 5 - NSTCollege group, Aberdeen, S. Dak.; tour area.
May 10 - Biologists Hammond and Miller, tour area and discuss problems.
June 2 - SCS group; tour area and discuss vegetation control.
June 25 - Harold Titus, Sports Afield; tour area and discuss waterfowl.
July 6 - Herb Dill, Mgr. Mud Lake Refuge; tour area and discuss.
July 27 - Kieth Wallace, SDSCollege Weed Specialist, disscuss problems.
August 8 - Oliver Davidson, Mud Lake Refuge, transfer equipment.
August 19 - Messrs Neff and Besser, Denver Lab; Blackbird research.

Frequent Visitors: GMA Hopkins, State Warden Rishardson, Tewaukon Manager Monnie, State Game Manager DeBates

C. Refuge Participation.

Mr. Schoonover gave talk to Ellendale, N. Dak. Sportsmen Club.
Mr. Schoonover showed slides at First Baptist Church in Aberdeen, S. Dak.
Mr. Blackard gave program to 4-H Camp at Richmond Lake.
Mr. Blackard gave program to Presentation Jr. College Nature Study Class.
Mr. Blackard gave talk and tour to McAlister College of St.Paul, Minn.

VII. OTHER ITEMS

A. Easement Refuges

1. Dakota Lake.

The Oakes area was particularly well blessed with rain this summer. One six inch rain fell in eleven hours. A small flow moved down the James most of the summer, which held the lake near spillway level.

Little waterfowl use of the area was observed. Only 75 ducks were seen on the last aerial count taken in late August.

A number of blackbird flocks were seen moving between Hyatt Slough and Dakota Lake. Several cornfields near the river have received damage. One of the adjacent farmers who depends on sunflowers for a cash crop reported that 50 percent of his crop was lost to birds last year.

2. Maple River.

At the time of our visits to this easement in June and July water was flowing over the spillway at a depth of two inches.

As a result of the low water last year, the entire marsh has grown up to dense stands of cordgrass and soft stme bulrush. The vegetation is too dense for waterfowl use. Only three broods were found on the July 12 brood count.

This easement has a good production potential, but the dam must be raised to hold more water. With deeper water, openings will develop to make this a much more attractive marsh.

B. Items of Interest.

Our student assistant this year was Kenneth H. Larsen. Ken came to us highly recommended rom S. Dak. State College, and proved his worthiness. His assignment was mainly with the blackbird research program but assisted with brood counts, nest dragging and many phases of our operation. His wife and baby were able to stay part of the summer with him at a hunting lodge near the refuge.

SIGNATURE PAGE

Submitted by:

Lyle J. Schoonover
(Signature)

Refuge Manager
(Title)

Date: September 21, 1960

Approved, Regional Office:

Date: _____

_____
(Signature)

Regional Refuge Supervisor

3-1750
Form NR-1
(Rev. March 1953)

WATERFOWL

REFUGE Sand Lake MONTHS OF May 1 TO August 31, 1960

(1) Week Ending	5/17	5/14	5/21	5/28	6/4	6/11	6/18	6/25	7/2	7/9
Species	(2) Weeks of reporting period: 1	2	3	4	5	6	7	8	9	10
Swans:										
Whistling										
Trumpeter										
Geese:										
Canada	100	100	100	100	100	100	100	100	85	85
Cackling										
Brant										
White-fronted										
Snow	500									
Blue	500									
Other Little Canada	800	200								
Ducks:										
Mallard	350	250	200	375	375	825	825	1400	1400	1400
Black						10	10	10	10	10
Gadwall	250	250	150	125	125	175	175	175	175	175
Baldpate	100			35	35	75	75	75	75	75
Pintail	300	250	175	575	575	575	575	575	500	500
Green-winged teal	100	75	10	25	25	25	25	25	10	10
Blue-winged teal	600	500	500	625	625	725	725	725	750	750
Cinnamon teal										
Shoveler	250	200	150	300	300	1200	1200	1200	1200	1200
Wood			5	5	5	5	5	5	5	5
Redhead	175	175	175	700	700	700	700	700	700	700
Ring-necked	25									
Canvasback	25	10	10	80	80	25	25	25	25	25
Scaup Lesser	500	200	150	225	225	125	125	125	100	100
Goldeneye										
Bufflehead										
Ruddy	350	150	150	375	375	375	375	375	300	300
Other										
Coot:	500	400	400	1000	1000	1000	1000	1000	1000	1000

Int. Dup. Sec.,

3-1751
Form NR-1A
(Nov. 1945)

MIGRATORY BIRDS
(other than waterfowl)

Refuge Sand Lake Months of May 1 to August 31 1960

(1) Species	(2) First Seen		(3) Peak Numbers		(4) Last Seen		(5) Production			(6) Total
Common Name	Number	Date	Number	Date	Number	Date	Number Colonies	Total # Nests	Total Young	Estimated Number
I. Water and Marsh Birds:										
Western Grebe			1500	8/1-20						
White Pelican			3000	8/30						
Double-crested Cormorant			1500	8/30						
Great Blue Heron			100	8/20						
II. Shorebirds, Gulls and Terns:										
Killdeer			500	8/1-20						
Dowitcher			2000	8/20						
Franklins Gull			250,000	8/30						
Common Tern			750	7/20						
Black Tern			750	7/20						

(over)

(1)	(2)	(3)		(4)	(5)	(6)
III. Doves and Pigeons:						
Mourning dove		1500	8/1			
White-winged dove						
IV. Predaceous Birds:						
Golden eagle						
Duck hawk						
Horned owl						
Magpie						
Raven						
Crow		25	period			
Marsh hawk		50	period			

Reported by.....

INSTRUCTIONS

(1) Species: Use the correct names as found in the A.O.U. Checklist, 1931 Edition, and list group in A.O.U. order. Avoid general terms as "seagull", "tern", etc. In addition to the birds listed on form, other species occurring on refuge during the reporting period should be added in appropriate spaces. Special attention should be given to those species of local and National significance. Groups: I. Water and Marsh Birds (Gaviiformes to Ciconiiformes and Gruiiformes)
II. Shorebirds, Gulls and Terns (Charadriiformes)
III. Doves and Pigeons (Columbiformes)
IV. Predaceous Birds (Falconiformes, Strigiformes and predaceous Passeriformes)

(2) First Seen: The first refuge record for the species for the season concerned.

(3) Peak Numbers: The greatest number of the species present in a limited interval of time.

(4) Last Seen: The last refuge record for the species during the season concerned.

(5) Production: Estimated number of young produced based on observations and actual counts.

(6) Total: Estimated total number of the species using the refuge during the period concerned.

INT.-DUP. SEC., WASH., D.C.

3-1750b
Form NR-1B
(Rev. Nov. 1957)

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE

WATERFOWL UTILIZATION OF REFUGE HABITAT

Refuge Sand Lake For 12-month period ending August 31, 1960

Reported by L. J. Schoonover Title Refuge Manager

(1) Area or Unit Designation	(2) Habitat Type	(2) Habitat Acreage		(3) Use-days	(4) Breeding Population	(5) Production
One	Crops	339	Ducks	173,231	100	270
	Upland	229	Geese	93,098		
	Marsh	715	Swans			
	Water	321	Coots	13,800		
	Total	1604	Total	380,129		
Two	Crops	899	Ducks	346,463	110	450
	Upland	751	Geese	279,929		
	Marsh	327	Swans	15,000		
	Water	3138	Coots	781,392		
	Total		Total			
Three	Crops	133	Ducks	519,694	410	950
	Upland	390	Geese	270,900		
	Marsh	1551	Swans		30	15
	Water	1153	Coots	40,500		
	Total	3227	Total	831,094		
Four	Crops	77	Ducks	102,000	64	330
	Upland	288	Geese	93,000		
	Marsh	531	Swans			
	Water	360	Coots	30,000		
	Total	1256	Total	225,000		
Five	Crops	914	Ducks	1,104,400	310	850
	Upland	1294	Geese	664,031	30	20
	Marsh	1255	Swans			
	Water	2543	Coots	40,000		
	Total	6006	Total	1,808,431		
Six	Crops	682	Ducks	866,620	292	650
	Upland	2215	Geese	373,239		
	Marsh	1648	Swans			
	Water	657	Coots	10,000		
	Total	5202	Total	1,249,859		
Seven	Crops	0	Ducks	346,000	317	200
	Upland	781	Geese	92,000		
	Marsh	187	Swans			
	Water	50	Coots	10,000		
	Total	1081	Total	448,000		

(over)

INSTRUCTIONS

All tabulated information should be based on the best available techniques for obtaining these data. Estimates having no foundation in fact must be omitted. Refuge grand totals for all categories should be provided in the spaces below the last unit tabulation. Additional forms should be used if the number of units reported upon exceeds the capacity of one page. This report embraces the preceding 12-month period, NOT the fiscal or calendar year, and is submitted annually with the May-August Narrative Report.

(1) **Area or Unit:** A geographical unit which, because of size, terrain characteristics, habitat type and current or anticipated management practices, may be considered an entity apart from other areas in the refuge census pattern. The combined estimated acreages of all units should equal the total refuge area. A detailed map and accompanying verbal description of the habitat types of each unit should be forwarded with the initial report for each refuge, and thereafter need only be submitted to report changes in unit boundaries or their descriptions.

(2) **Habitat:** Crops include all cultivated croplands such as cereals and green forage, planted food patches and agricultural row crops; upland is all uncultivated terrain lying above the plant communities requiring seasonal submergence or a completely saturated soil condition a part of each year, and includes lands whose temporary flooding facilitates use of non-aquatic type foods; marsh extends from the upland community to, but not including, the water type and consists of the relatively stable marginal or shallow-growing emergent vegetation type, including wet meadow and deep marsh; and in the water category are all other water areas inundated most or all of the growing season and extending from the deeper edge of the marsh zone to strictly open-water, embracing such habitat as shallow playa lakes, deep lakes and reservoirs, true shrub and tree swamps, open flowing water and maritime bays, sounds and estuaries. Acreage estimates for all four types should be computed and kept as accurate as possible through reference to available maps supplemented by periodic field observations. The sum of these estimates should equal the area of the entire unit.

(3) **Use-days:** Use-days is computed by multiplying weekly waterfowl population figures by seven, and should agree with information reported on Form NR-1.

(4) **Breeding Population:** An estimate of the total breeding population of each category of birds for each area or unit.

(5) **Production:** Estimated total number of young raised to flight age.

Interior Duplicating Section, Washington, D. C. 27580

3-1752
Form NR-2
(April 1946)

UPLAND GAME BIRDS

1613

Refuge Sand Lake Months of May 1 to August 31, 1960

(1) Species	(2) Density		(3) Young Produced		(4) Sex Ratio	(5) Removals			(6) Total	(7) Remarks
Common Name	Cover types, total acreage of habitat	Acres per Bird	Number broods obs'v'd.	Estimated Total	Percentage	Hunting	For Re-stocking	For Research	Estimated number using Refuge	Pertinent information not specifically requested. List introductions here.
Ringneck Pheasant									4000	
Grey Partridge									15	
Prairie Chicken										None sighted this period.

INSTRUCTIONS

Form NR-2 - UPLAND GAME BIRDS.*

(1) SPECIES: Use correct common name.

(2) DENSITY: Applies particularly to those species considered in removal programs (public hunts, etc.). Detailed data may be omitted for species occurring in limited numbers. Density to be expressed in acres per animal by cover types. This information is to be prefaced by a statement from the refuge manager as to the number of acres in each cover type found on the refuge; once submitted, this information need not be repeated except as significant changes occur in the area of cover types. Cover types should be detailed enough to furnish the desired information but not so much as to obscure the general picture. Examples: spruce swamp, upland hardwoods, reverting agriculture land, bottomland hardwoods, short grass prairie, etc. Standard type symbols listed in Wildlife Management Series No. 7 should be used where possible. Figures submitted should be based on actual observations and counts on representative sample areas. Survey method used and size of sample area or areas should be indicated under Remarks.

(3) YOUNG PRODUCED: Estimated number of young produced, based upon observations and actual counts in representative breeding habitat.

(4) SEX RATIO: This column applies primarily to wild turkey, pheasants, etc. Include data on other species if available.

(5) REMOVALS: Indicate total number in each category removed during the report period.

(6) TOTAL: Estimated total number using the refuge during the report period. This may include resident birds plus those migrating into the refuge during certain seasons.

(7) REMARKS: Indicate method used to determine population and area covered in survey. Also include other pertinent information not specifically requested.

* Only columns applicable to the period covered should be used.

• AUG • 60

Phragmites sprayed by airplane with 2 gal. per acre of Amitrol T one year later. Note the yellowing of regrowth which eventually died.

• SEP • 60

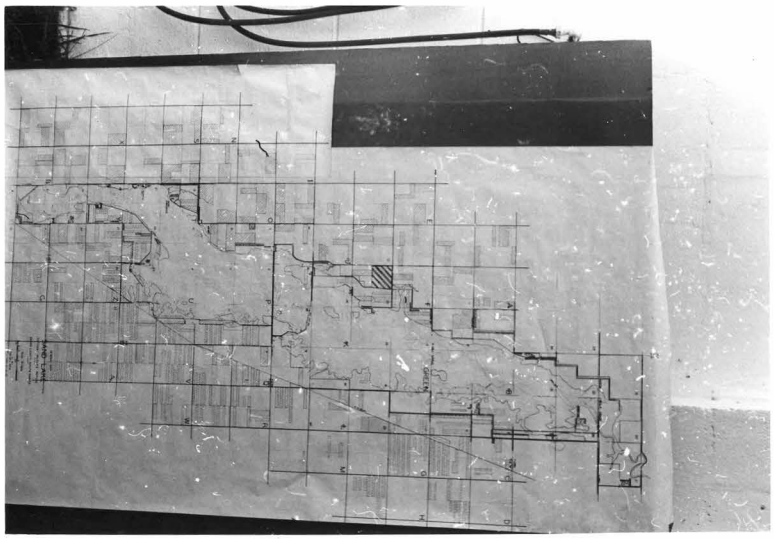
River bulrush rapidly invading areas on which phragmites were killed by spraying.

• SEP • 60

In another area river bulrush and Canada thistles were the first invaders on sprayed areas. One year after spraying phragmites with Amitrol T.

• SEP • 60

Approximately 1500 acres of new cattails and phragmites got a start last year. This scene is typical of the north half of the Sand Lake Pool.



AUG • 60

Shaded areas are cornfields within the 96 square mile study area used for crop damage appraisal in the blackbird project.

SEP • 60

The corn at the right was bagged after silking, but prior to blackbird damage. From this appraisal it is hoped that a more accurate determination can be made of the crop loss in the vicinity of the refuge.

SEP • 60

Part of the blackbirds killed with dynamite bombs. The top row are grackles, second row male redwings with female redwings in the bottom row.

SEP • 60

Scarecrows set out by farmers near farm ponds probably saved some corn in adjacent fields. Ponds such as this one are favored watering sites during the day.

• AUG • 60

Twenty-eight of these poison stations helped to reduce the breeding population of blackbirds with no loss of other species.

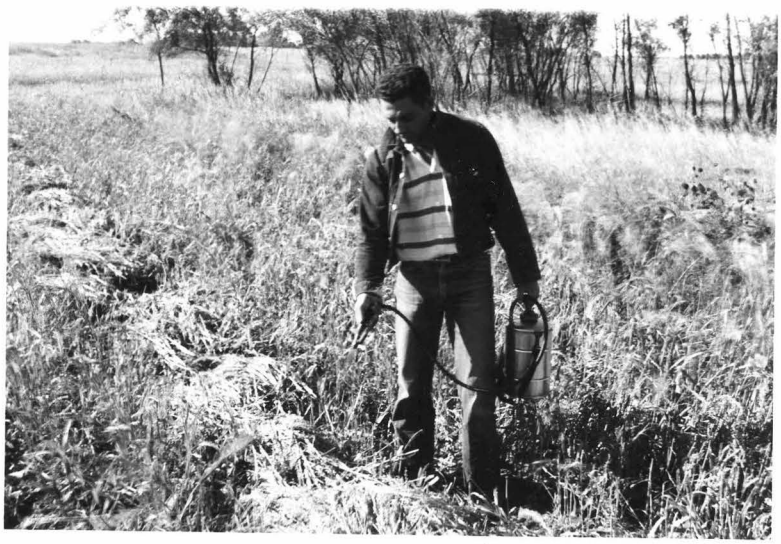
John DeGrazio attempting to poison sunflower heads with a strychnine solution. We haven't decided if the sunflowers are too tall or if John is too short.

• SEP • 60

SEP • 60

The blackbird crew getting lined up for business.

SEP • 60



DeGrazio using Tepp to poison swathed millet.

Scaring devices used in demonstrations to farmers. From left to right they are shotguns for exploding shell crackers, a pipe and stand designed by Mechanic Podoll for using firecracker ropes with cherry bombs and a Zon exploder on stand for use in cornfields.

New refuge sign using three inch pipe for the frame.