Sand Lake National Wildlife Refuge

Narrative Report

May 1, 1959 to August 31, 1959

Bruce P. Stollberg - - - - - - Refuge Manager in Charge thru July
Lyle J. Schoonover - - - - - - Refuge Manager in Charge Since ~~August~~ July
James B. Monnie - - - - - - - Refuge Manager thru July
Jerry J. Blackard - - - - - - Refuge Manager since ~~August~~ July
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Elmer P. F. Podoll - - - - - - Mechanic
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C O N T E N T S

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I. GENERAL

A. Weather Conditions

A summary of weather data for the period is given in the table below as recorded at the official weather station located at refuge headquarters.

Sand Lake Weather Data

	Precipitation		Temperature	
	This Month	Normal	Min.	Max.
May	3.19	2.24	101	21
June	2.11	4.04	96	44
July	2.88	2.61	105	46
August	1.28	2.16	107	42
Total	9.56	11.05 Ext.	107	21

Precipitation figures do not reflect the true picture as to moisture conditions. The period opened with no subsoil moisture from fall rains or snow. Temperatures were well above normal throughout the period; the highest average for many years. Winds were more prevalent than normal and were very untimely for the growing crops.

Conditions were fairly good throughout May considering the lack of subsoil moisture. Crops were weakened by a hard freeze the night of the 14th. Toward the end of the month we had a 1.58 inch rain that set things growing good again.

Normally June is the month with the most rainfall and the best growing. This year the rain was cut in half and the real deterent was the hot wind. Temperatures above ninety and southerly winds virtually stopped the tender crops'in its tracks'. A few late planted corn fields seemed to partly survive.

One rain of 1.44 on the 8th of July kept some corn hopes alive. That as well as most of the rainfall this season fell from the station north. Those to the south pretty well gave up by the middle of July.

August continued hot and dry. The only rains were little showers that hardly settled the dust. The wind continued to blow and the corn dried up fast.

To the north of the station there is some harvestable corn - very little to the south.

In summary the lack of subsoil, coupled with inadequate rainfall and hot winds have changed the prosperity of the area to one of gloom. Growing conditions will not be at all conducive to waterfowl feeding at Sand Lake this fall.

B. Habitat Conditions

1. Water

Mud Lake It was planned that water levels at Mud Lake would be raised to 1271.8 this spring and held stationary throughout the summer. The desired level was never quite reached because of a poor run-off. A maximum reading of 1271.62 was made in late May; since that time evaporation has slowly lowere d the pool to 1270.9 At various times during the period, small amounts of water spilled over the Dakota Lake spillway, but this was never enough to make an appreciable change in the Mud Lake Pool.

Since our water levels are already well below the approved fall draw-down level, there will be no attempt to lower the pool further.

Sand Lake The period commenced with a reading of 1268.01 in Sand Lake. It was hoped that this level could be raised to 1270.40. Without water, of course this was impossible and week by week the lake slowly diminished. Now the maximum depth of the lake is seven inches and covers an area of seven or eight hundred acres. At the present rate of water loss, we can expect Sand Lake to be entirely dry by the first of October.

One old timer in the area informs us that since 1880, Sand Lake has only been dry twice. During a five or six year period from 1886 to 1892, farmers crossed the lake on wagons and made hay in the bottom each summer. During the severe drought of the mid-thirties, the lake again went dry from 1934 to 1936. It is quite possible that our old friend will see the dust sweep across Sand Lake once more in his life time.

2. Food and Cover

Both the amount and availablility of food looks quite limited this fall.

Sago seed production in Mud Lake was fair this year, but this source of food has already been consumed by resident birds. Seed failed to develop in the shallow water that was left in Sand Lake. Even the green forage will now be lost as the lake continues to dry up.

All of the small grain was unusually short. Some of the barley was not over six inches tall at harvest time. The yields of both wheat and barley were low, probably in the neighborhood of seven or eight bushels per acre. Since the grain matured, an abundance of fireweed, sunflowers and foxtail millet have over-topped the standing grain. These fields will not be attractive to geese. The brightest spot in the small grain picture comes in the form of waste grain. Some private fields both on and off the refuge have not been harvested. Even in

the harvested fields an unusually large amount of grain was lost in the swaths.

The small grain crop was bad and the corn is certainly no better. Due to a feed shortage approximately 1/3 of the corn off the refuge will be cut for silage. On the refuge silage cutting has been permitted, but the average will not exceed 1/6 of the total crop. These fields will be a blank for food and cover for all types of wildlife.

Yields are poor on the remaining corn, with few fields exceeding 20 bushels per acre. Blackbird damage has been severe throughout the north half of the refuge. Most of the field examined, showed between 30% and 70% damage. With fall rains, the remaining corn, on damaged ears, will tend to rot and mold, leaving mighty little for wildlife this fall and winter.

The 30 acres of millet left in the field shows promise of making a fair food crop. The grain is short however, and in some cases the fields are becoming quite weedy.

Early fall plowing in wheat and barley fields will make some attractive browse areas off the refuge. The resident geese are already using these fields so a heavy kill in these fields can be expected when the season opens. Some browse crops planted both by refuge personnel and permittees on the refuge are quite late, but will help to hold geese early in the season.

Natural browse in the pastures is becoming very dry and tough. The degree of utilization in the pastures will depend on weather conditions the remainder of the fall.

With the low water levels in Sand Lake, scattered beds of smartweed and wild millet have developed over an extensive area south of the Houghton Grade. This represents an excellent food source, but it will probably not be flooded this fall and there is a good chance this area could even be dry next spring. Without water we can't hope to get much utilization from the moist soil food crop.

II. WILDLIFE

A. Migratory Birds

1. Waterfowl

a. Geese. A census on May 4 revealed that only 5,000 Snow and Blue Geese and 800 Canada Geese, of all species, were present on the refuge. During the week of May 10th through 16 all remaining migrants left the area and a breeding population of about 100 Common Canadas remained throughtout the summer.

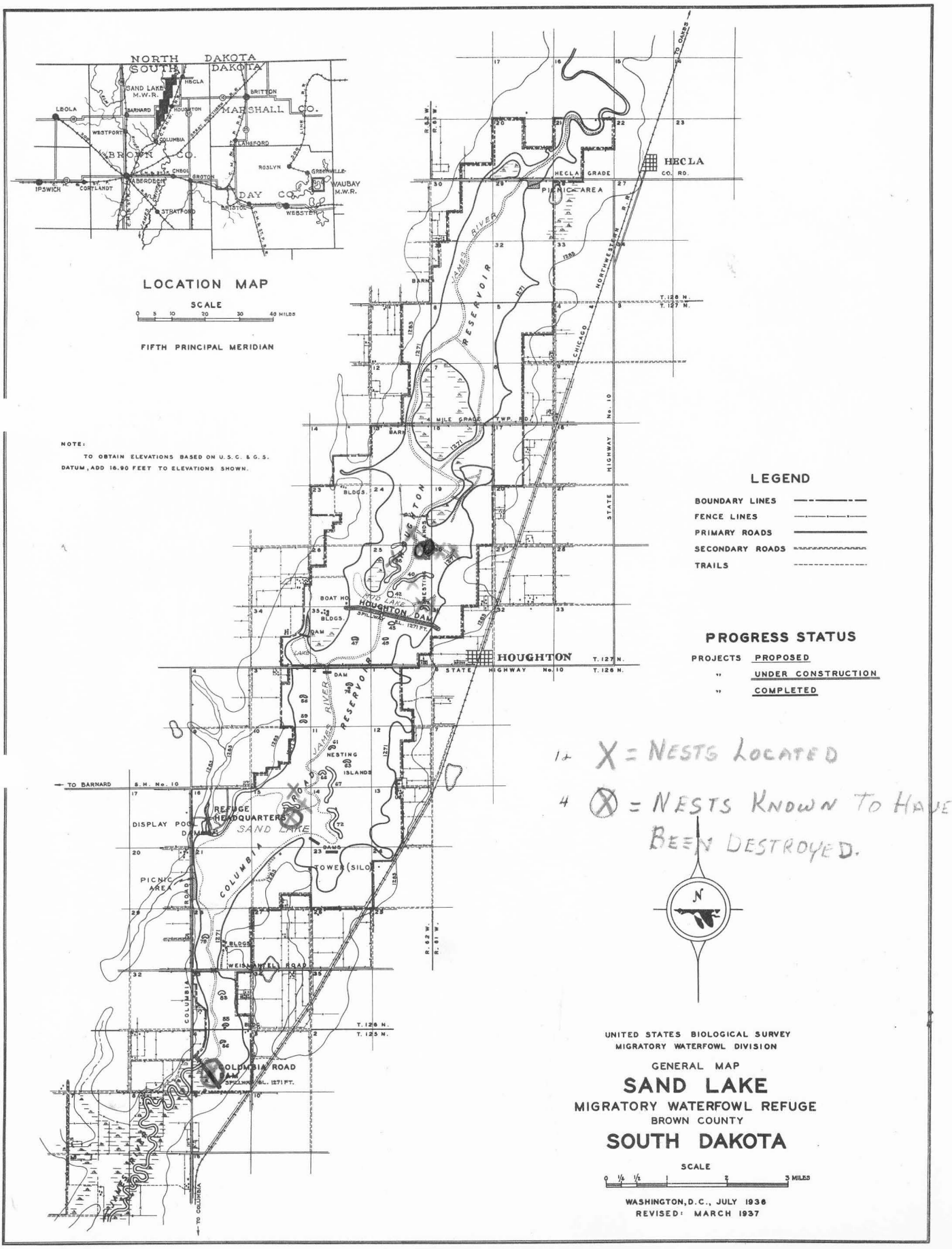
This summer flock produced a known 63 young. The average brood size was not determined because the brood count was made late (June 16) at which time most of the broods were congregated into one small area. Based on the average brood size for the past two years, it is estimated that 12 broods were produced in 1959. The brood concentration area was about one-half wide located northwest of the pelican nesting island in the Mud Lake Unit.

All of the broods located this year were in the Mud Lake Unit. This was somewhat expected because of the extremely dry conditions prevailing in Sand Lake. As reported in the April narrative 12 nests were located. Four of these were in Sand Lake, two of which were definitely destroyed by predators and the fate of the other two was undetermined. It is believed that no broods were produced in Sand Lake this year. In past years Sand Lake has been the main production area with Mud Lake raising only four broods during each of the past two years. From this it might be concluded that the nesting capacity in Mud Lake is actually greater than has been exhibited in past years. In thinking about this it must be remembered that several conditions were not normal this year. No flood peak occurred this year as it does in most years, thus making some of the phragmites islands available as nesting sites without being flooded. Also, the summer population was somewhat forced to nest in Mud Lake. It is gratifying to know that the nesting potential of the refuge is greater than we have actually been experiencing, at least under the conditions prevailing this year.

Now that we know, or at least feel, that a greater nesting potential is available, what can be done about it? The elimination of flood peaks to make these sites available each year would be of great value. This may actually be possible, when and if the proposed irrigation porgram for this area is carried out. A control of predators expecially on the nesting islands, may allow a few more broods to be produced. This, in conjunction with some program to either hold the local Canadas through the hunting season, or maintain an area on the refuge which is so attractive that the hunting loss is minimized, should allow the breeding flock to be enlarged. A banding program should be established, and the experimenting with man-made nesting sites should be continued.

It should be mentioned at this time that we believe that predators on the nesting islands do cause a considerable loss in production. This year, one-third of the twelve nests located (as shown on map on the following page) were destroyed two weeks before the first hatching occurred. No nests were visited after this time. High winds

1959 Goose Nest Locations
& Destruction



after this final check made it impossible to determine the number of remaining nests that hatched. Therefore we know that at least one-third of the located nests were destroyed, and possibly more. No re-nesting figure was determined.

The following table shows the breeding populations and the number of young produced during the past ten years.

Sand Lake Canada Geese
Breeding Population and Production
1950 - 1959

Year	Breeding Population	Young
1959	100	63
1958	100	64
1957	262	95
1956	150	54
1955	100	68
1954	130	46
1953	?	42
1952	105	65
1951	?	56
1950	100	50

As shown in the above table, 1957 was by far the best production year on the refuge. The breeding population that year was also much higher than normal. This seems to indicate that we should afford some additional protection to this flock so as to help increase its number. This would be in the form of protection from predators, human and animal.

b. b. Ducks. The number of dabblers and divers present at the beginning of this period was considerably lower than the number present the previous year at the same period. There were approximately 1700 dabblers and 660 divers. The dabbler population remained near constant until about June 15, then there was a marked increase in Mallards on the refuge. The diver population began to taper off after May 3, with an average population of about 345 remaining. By August 17, the Blue-wing Teal migration had begun and some local movement of nearly all species to Sand Lake had occurred. An aerial count made on August 20, indicated that there were 13,767 dabblers and 320 divers present.

The breeding pair count began on May 19 and continued through May 22. The same method was used this year as was used last year. Approximately fifty percent of the shoreline areas were covered by canoe. A complete aerial count of all refuge shoreline was made to support the canoe count. A separate record was kept for the canoe count and the aerial count. Then a ground-to-air correction factor was determined and the count expanded to arrive at the total number of pairs using the entire shoreline. However, two correction factors were used this year because of the low water and large expanse of mud flats below the Mud Lake Dike; whereas above the Mud Lake Dike water levels were near normal. The correction factors obtained were 2.15 for the area above Mud Lake Dike.

A count of "other areas" was also made, but no correction factor was applied to these areas, as these were censused from the ground. These other areas are listed belwo with the results obtained from each area.

Breeding Pair Count
(Other Areas)
Counted from ground only.

Area	Pairs
1. Display pool	14
2. North end of recreation area	0
3. South of Columbia Dam	5
4. Weismantel Grade to Houghton Grade - East side	0
5. Houghton Grade to Hecla Grade - East side	9
6. Houghton Grade to Hecla Grade - West side	8
7. Dinosaur Potholes	0
8. Level Ditches (2)	1
9. South Potholes	0
10. North of Hecla Grade	1
Total	38

The above counts were made by car and foot. By using this same direct count procedure from year to year a comparison can be made.

The breeding pair population was figured in the following manner. The ground count revealed that there were 114 pairs from Mud Lake Dike to Hecla Grade, but the aerial count showed only 53 pairs in this same area. This gives a correction of 2.15. The ground count from Houghton Grade to Hanson Point revealed that there were 61 pairs while the aerial count showed only 33 pairs in that same area. This gives a correction factor of 1.85. These correction factors are used in the table below.

Number of Pairs Per Unit*

Unit	Aerial Census	Correction Factor	Total
1	40	1.85	74
2 3	130	1.85	241
4	65	1.85	120
5	126	2.15	271
6	97	2.15	209
7	16	2.15	34
		Total, Lake proper	949

* For individual units, see map at end of this report.

Thus, with a total on lake proper of 949 and 'Other Area total of 38, the refuge total would be 987 pairs. The 1958 breeding population was 707 pairs. Thus in spite of the drought, there is a 28.36% increase over the 1958 breeding pair population. At this point it would be interesting to compare the 1958 and 1959 brood counts.

A comparison of the pair count on species composition for the past three years is as follows.

Sand Lake Pairs Composition
1957 - 1959

Species	Percent of Population		
	1957	1958	1959
B.W. Teal	15.5	36.9	24.0
Gadwall	11.0	21.2	20.0
Mallard	16.0	16.3	22.6
Redhead	8.8	4.5	7.6
Pintail	2.2	3.5	2.5
Shoveller	11.0	2.2	13.1
Ruddy	6.1	1.9	2.7
Baldpate	0.0	1.3	2.5
Scaup	18.2	0.6	4.0
Unidentified	10.5	11.5	
G.W. Teal			.8

From the above table it can be seen that there is a marked increase in the divers and shovellers and a moderate decrease in Blue-winged Teal and Gadwall this year. This is exactly opposite of the situation last year. It is assumed that many divers moved into the Mud Lake Unit because it had near normal water conditions. The following table shows the estimated number of breeding pairs for 1959, compares that with pair counts of previous years, and shows estimated broods and an estimation of hatching success based on broods and breeding pairs.

Breeding Pairs and Brood Counts
Sand Lake Refuge

Year	Breeding Pairs	Number of Broods	% of Production
1959	987	75	8
1958	707	305	43
1957	1153	478	41
1956*	-	-	-
1955	369	205	55
1954	564	340	60
1953	658	348	53
	* No pair counts were made.	Five year avg. =	50%

To say that this year's production was a sharp decrease from the previous years would be the under statement of the year. Although the drought has not seemingly affected the number of breeding pairs, it has affected the production of ducks raised to flight age. This year's production of eight percent was eighty-four percent below the five year average.

Two brood counts were made again this year. The first brood count was made from July 6 to July 10, and the second from August 4 to August 11. A canoe was used to make the counts, but paddles were used instead of the ourboard motor. The total area observed on each

each individual count was calculated and then expanded by a direct ratio to the total acreage of similar habitat for the entire refuge. The same areas were censused in both counts.

Production was determined in the same manner as last year; estimating the area covered and expanding this figure to the total area of similar habitat. However, there was less duck habitat to cover this year due to the drought. An estimated 2,468 acres were covered on each count, resulting in 21 broods observed. Expanding this number of broods to the 5,226 acres of similar habitat yields 50.1 broods. Thus, assuming that only two-thirds of the broods were seen, the total production for Sand Lake in 1959 is estimated at 75 broods. By using the average brood sizes from Griffith's data, this total represents 49.2 492 young.

The following table shows the estimated production for each year from 1952 through 1959.

Sand Lake Duck Production
1952 - 1959

Year	Est. Broods	Est. Young
1952	488	3375
1953	347	2360
1954	340	2240
1955	205	1332
1956	276	1784
1957	478	3158
1958	305	2022
1959	75	492
Eight year average	314	2095

From the above table it can be seen that this years production is 75.6 percent below last years production, and 76.5 percent below the eight year average. This decrease in production at Sand Lake is quite comparable to the 67 percent decrease of waterfowl in the entire eastern section of South Dakota as shown by the "1959 Status Report of Waterfowl".

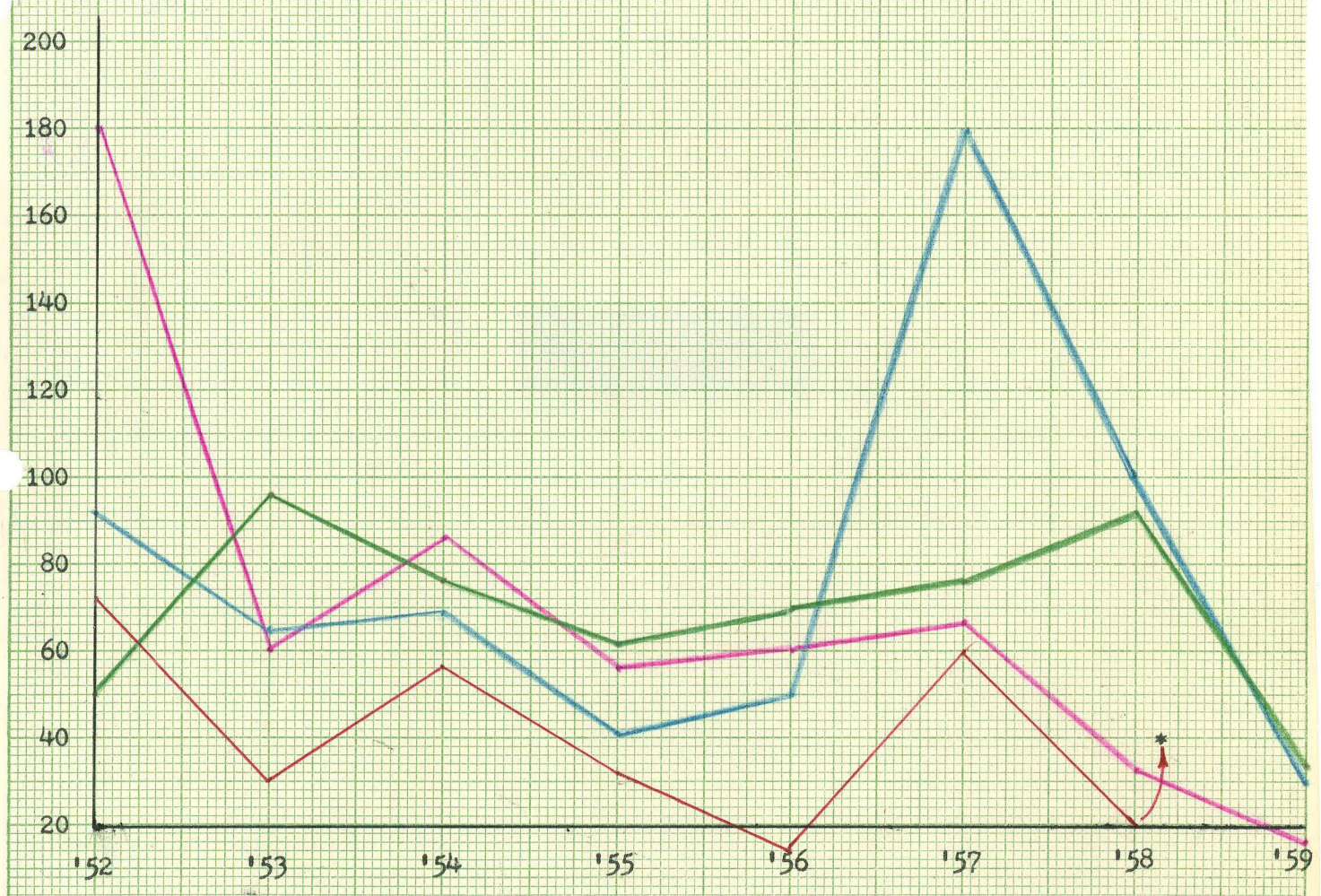
The following graph shows the number of broods per major species for the past eight years.

Mallards constituted the larger percent of the brood species with 45.3 percent. Blue-wing Teal and Pintail followed with 38.6 and 16.0 percent respectively.

Estimated hatching dates show that this years broods were hatched a few weeks later in the summer than last years. The majority of the broods came off from late June to late July, with a peak of six broods from June 21 to 26 and another peak of six broods from July 24 to July 31. There were also four broods hatched from July 1 to July 10.

NUMBER OF BROODS OF MAJOR SPECIES OF DUCKS

SAND LAKE REFUGE 1952-'59



* - No Gadwall broods observed in 1959

2. Other Waterbirds, Shorebirds and Doves

a. Water and Marsh Birds

Coots. The coot population at Sand Lake has shown the same drastic decrease that has occurred throughout the nation. Very few broods were around and the migration has been nil. In 1957 the fall peak was 17,400 birds; in 1958 the population dropped to 2500. This fall the peak was 700.

Grebes. Western, Eared and Pied-billed Grebes have been present throughout the period. Production has been down on all the species of grebes, probably because of the restricted habitat left on the refuge. Very few grebes have used Sand Lake so nearly all of the production and migrating population has been confined to Mud Lake.

Pelicans and Cormorants. Very little change has been noted in the pelican and cormorant population this year. Approximately 5500 pelicans are still present. A high percent of the population is young birds, indicating a successful hatch and brood survival. Despite the low water levels in Sand Lake, pelicans continue to make extensive use of the area.

The cormorant population has increased slightly in recent weeks. The present population is about 1500 birds.

Gulls and Terns. Franklin's Gulls began coming in in large numbers the last half of August. They seem to prefer the mud flats and exposed levees of Sand Lake and Sandell Lake to the deeper water of Mud Lake. Mass flights of gulls leave the refuge shortly after daybreak and return in the evening. Feeding is mainly confined to plowed fields within easy daily flying distance from the refuge.

With the dry weather, grasshoppers are again on the increase through the northeast portion of South Dakota. Undoubtedly the half million gulls on the refuge do a great deal of good in keeping the hoppers under control. Perhaps more emphasis shold be made of the fact in meetings where the refuge is accused of harboring all the foxes, raccoons and blackbirds.

Forester's and Common Terns concentrated in late summer on the sago beds in shallow water. Apparently insect life was most abundant in these warm, decaying masses of vegetation.

Herons and Bitterns. A large area of new feeding grounds has been available to the Great Blues this summer. Since mid-July the herons could wade anywhere in Sand Lake. For the past twenty-three years, some of this territory has been out of bounds for the waders.

b. Shorebirds

With a reduction of water areas in the Dakotas, shorebirds concentrated in spectacular numbers on the mudflats of Sand Lake this fall. Sand Lake has always been noted as a favorite stopping point for shore=

birds, but this fall was exceptional. A number of bird watchers, who have visited the refuge for many years, remarked on the profusion of bird life on the mudflats this year. Large concentrations of Avocets, Dowitchers and Peeps passed through between the twentieth of July and August 15th.

Bird watching clubs seem to be less active in the fall than in the spring, but they are missing a real bet by not trying to identify shorebirds in fall plumage.

c. Doves. Dove banding was dropped this year to give more attention to numerous other biological problems.

Flocking prior to migration was noted the last two weeks of August, at the same time a few young bird s were still seen on the nest.

B. Upland Game Birds

Pheasants. As frequently happens through the northern plains, last summer produced a prolific crop of sweet clover. Local farmers and refuge personnel report that rank stands of sweet clover invaded pastures, soil bank fields and roadsides. With this excellent food and cover combination, plus a mild winter; a near record breading pheasant population was on hand this spring.

For some reason, the early hatch was very poor. Second or third nesting attempts were more successful, but the broods are small and many of the young are scarcely feathered yet. The 59 day pheasant season with a daily limit of five cocks promises to be good, but the harvest will have a high proportion of old birds.

With large areas of the Sand Lake bottom covered with weeds this year, we can expect unusually large concentrations of wintering pheasants on the refuge. A relatively new plant to this area, known as goosefoot (Chenopodium rubrum) dominates hundreds of acres of the lake bed. This species makes rank growths, four or five feet in height. The cover will be excellent, but the value of the small black seeds to wildlife is unknown.

Gray Partridge. Only two covies of partridge have been seen this fall, one near Hecla and the other near Dakota Lake.

Prairie Chicken. A release of 15 males and two females were made at the refuge in April. Shortly after the release a few observations were made of individual birds near the release site. Since May, no sightings have been brought to our attention. The best chance for observations will probably come this winter after a heavy snowfall. An effort will be made then to determine the survival of this initial release.

C. Big Game Animals

White Tail deer have continued to increase on the refuge since

the last hunting season three years ago. This year the South Dakota Department of Game, Fish and Parks has announced a five day shotgun season for northeastern South Dakota from December 15 to December 19. Deawings will be made for permits in each county. Farmers, actively engaged in farming will be given first priority for 200 permits and other residents of the area will be given chance for 200 in Brown County.

Some damage to corn and small grains has been noticeable this summer. This will be a good time to make a herd reduction again before more serious depredations starts.

D. Fur Animals, Rodents, Predators and Other Animals

Raccoon have been public enemy number one on the refuge for several years. A concerted effort should be made to reduce their number this winter through the trapping program. Perhaps additional measures should also be taken by refuge personnel such as trapping or poisoning on the islands early in the spring. It has been felt that a few animals regularly visit the nesting islands and if eliminated just prior to the nesting season, nesting success, especially for the geese, may be increased.

Muskrats are already scarce and with the loss of water in Sand Lake, a further reduction can be expected. Since it is unlikely that any appreciable amount of denning will occur in the Mud Lake area, it will be advisable to close the season on rats this year.

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

Elmer Podoll, being on the ball with his bird observations, noted that his martins were disappearing this summer. To locate the trouble he sat on his porch late one evening and saw a Great Howned Owl light on the railing near his martin house. The owl proceeded to stick a foot in the entrance holes and pull out young martins. The next day Elmer mounted a number 1 trap on the rail and caught the culprit. The job of controlling predacious birds on the refuge has since been turned over to Elmer.

F. Other Birds

A comparison of arrival dates of some of the late migrants has been made form Elmer Podoll's notes.

See next page.

Comparative Arrival Dates
Sand Lake

Species	1957	1958	1959
Upland Plover	-	5/3	4/18
Western Kingbird	5/10	5/7	5/11
Eastern Kingbird	-	5/7	5/11
Black Tern	5/10	5/14	5/16
Red-headed Woodpecker	5/23	5/16	-
Yellow Warbler	5/25	5/20	5/19
Tree Swallows	5/25	5/20	4/26
House Wren	-	5/20	5/20
Gray Cheeked Thrush	5/13	5/21	5/9
Ruddy Turnstone	5/19	5/26	5/11
Baltimore Oriole	5/22	5/26	5/13
Orchard Oriole	5/25	5/26	5/13
Marsh Wren	5/22	5/29	

G. Fish

In Sand Lake, all the fish not removed by the State for restocking or those taken by commercial fishermen, died during the winter. A band of fish carcasses line the shoreline of Sand Lake. Evidently the winter kill was 100 percent effective as no dead fish have appeared in the shallow lake area this summer. With the James River dry below the refuge, there is little likelihood of getting many carp from the south for a while. The biggest concentration of carp is now left in Mud Lake.

Per haps if the dry cycle continues long enough, some form of eradication program may be warranted in this pool, to help delay the population increase that can be expected again with high water.

H. Reptiles

Only garter snakes observed.

I. Disease

None noted during the period.

III. REFUGE DEVELOPMENT AND MAINTENANCE

A. Physical Development

1. Nesting Island Construction. With Sand Lake nearly dry, ideal conditions for building nesting islands have been created. Over the past five weeks, 42 islands have been built in the north half of Sand Lake. A number of these islands are quite small with about 200 square feet of area above the normal water level. Other islands are quite large, some covering nearly an acre. An attempt has been made to keep the islands sheltered by existing growths of phragmites. Barrow pits near the islands will form protected open water ponds for loafing birds. Our goal will be to construct from seventy-five to eighty of these islands, concentrating more on larger islands as more equipment becomes available.

2. Phragmites control. It has been hoped that repeated bog disking of phragmites, especially in dry soil would make effective control. After two diskings a definite thinning of the phragmites has occurred, but without heavy grazing or continued disking the beds will soon re-establish. Diskings have been made on two areas. If time permits, it is hoped that openings can be made in an additional seven or eight miles of dry shoreline yet this fall.

3. The cesspool at Site 3 was pumped out.

4. All of the refuge roads were graded early in the period and need attention again as soon as a grader is available.

5. Roadsides were mowed twice.

6. Part of the refuge recognition signs have been repaired and painted. Additional painting is needed.

7. Tree rows were cultivated and hand weeded near headquarters.

8. Nesting islands were planted to a mixture of Reed's canary and rye grass.

9. Installed two new cattle guards and relocated two old cattle guards.

10. Put concrete foundations under hospital pen feeder.

11. Put new screen doors on managers residence.

12. Rebuilt one-half mile of boundary fence south of 4-mile grade.

13. Put new bracing under elevator driveway.

14. Put down new underground gasoline tank.

15. Banded the following; 64 Blue-wing Teal, one Woodduck, one Green-winged Teal, one Pectoral Sandpipe r, five Semi-palmated Sandpiper.

B. Plantings

1. Trees and Shrubs. Several strips totalling two miles in length were disked this fall in preparation for tree planting next spring.

2. Cultivated Crops. This has been one of the poorest crop years since the "thirties." Yields of all the small grains were well below normal.

A few fields north of Houghton show the best promise to make fair yields of corn. Between the drought and the blackbirds most of the corn is a lost cause.

The following is a summary of the crop acreages and division for 1959.

Crop	Total Acres	Gov't Share Standing	Gov't Share Harvested
Alfalfa	342	-	-
Barley	591	202	4
Corn	658	216	29
Millet	73	8	22
Oats	196	8	-
Wheat	220	2	-
Rye	29	29	-
Totals	2317	465	55

C. Collections and Receipts

None.

D. Control of Vegetation

The campaign on weeds continued again this summer. For the most part, weed control by refuge personnel was confined to wild land and grazing units. Two hundred and fifty acres of Canada Thistle were aerial sprayed. In addition, refuge personnel sprayed 1030 acres of sow thistle and 207 acres of Canada Thistle with tractor drawn spray rigs. A second spraying is planned this fall on some of the worst infestations.

Permittees were required to spray a number of agricultural units for the control of annual weeds as well as for thistles.

E. Planned Burning

Several islands of phragmites were burned this fall to aid in island construction. New growth has rapidly developed on the burned areas so permanent control of phragmites by burning does not seem feasible.

It is believed that burning of the dense cover in the phragmites beds prior to bog disking would greatly facilitate working the soil, but due to the drought, burning is now becoming too hazardous.

F. Fires None

IV. RESOURCE MANAGEMENT

A. Grazing

Nineteen permittees checked 747 cattle into 26 grazing units in May and June. Grass conditions were below normal in May, at turn-in time, so a 25% reduction in cattle numbers for each unit was affected. We were never able to increase these numbers due to hot and dry conditions. Refuge pastures have held up remarkably well and emphasize what proper management will do.

Despite the dry season, little overgrazing has occurred on the refuge. In most cases, the uplands have just about the proper amount of cover for good nesting habitat. This is certainly not the case outside of the refuge where overgrazing is very prevalent this fall.

Heavy grazing of the emergent zone seems to be effective in maintaining small openings where the cattle come to water, but the openings are far too small and too few. It is now felt that either spraying or bog disking will be necessary to make larger breaks in the wall of emergents and that continued heavy grazing in the lower units will help to maintain them in a desirable condition.

The Jones unit (G-6) was divided into a north and south unit to see the effect of concentrating cattle when they have upland and lowland available. Additional shoreline openings have been created and the success of the experiment point to more of this in the future where feasible.

Water has been a problem on some units during the late summer. A number of units have been withdrawn after Sand Lake receded beyond the pasture boundary. For one unit, the permittee constructed a dugout on private land to furnish water for cattle in the refuge grazing unit.

If Sand Lake fails to fill next spring, the cross fencing procedure used in the past, will be inoperative because water will not be available in the lower portion of the unit.

B. Haying

Haying has been limited to a small area near headquarters to control weeds and to reduce the fire hazard.

C. Fur Harvest

None

D. Timber Removal None

E. Commercial Fishing None

F. Other Uses

An exact count of bee hives kept on the refuge will be made next period.

V. FIELD INVESTIGATIONS OR APPLIED RESEARCH

A. Blackbird Studies

1. Problem. Long before the Sand Lake Refuge was acquired by the Fish and Wildlife Service in 1935, blackbirds were a problem to the local farmers. Since 1935, crop damage has been from moderately heavy to severe, depending on the migration movements of the birds and crop conditions.

This year the marsh habitat preferred by blackbirds has been reduced throughout the Dakotas as a result of the drought. Also, approximately fifty percent of the local corn acreage has been eliminated because the fields failed to develop corn or because the fields were cut early for silage.

Naturally, these conditions concentrated the blackbirds on the better cornfields. Corn losses in some of the fields examined, ran as high as 90 percent damage near tree rows dropping to about 30 percent damage at the opposite end of the field. A number of fields have suffered an over-all loss of 40 to 50 percent.

Blackbirds show a definite preference for phragmites or cattail near water as a roosting site. It has been estimated that over 90% of the blackbirds within a five mile radius of the refuge, roost in the emergents of the refuge pools.

The Bureau's problem is two fold. (1) approximately one-third of the refuge share of corn intended for waterfowl use is lost before the waterfowl migration starts. (2) Since habitat on the refuge furnishes a roosting area for blackbirds, local farmers look to the Bureau for a solution to their depredation problem.

2. Present Work. Mr. John DeGrazio, biologist assigned to the Denver Research Laboratory, has been demonstrating some of the newer scaring divices and is making studies on repellants and other controls. Mr. Johnson Neff spent several days studying and supervising the control program.

3. Future Plans. In a meeting held September 1, Governor Herseth and the local farmers urged an immediate operational program to alleviate blackbird depredations. A control plan will be initiated by the Regional Office with the State of South Dakota and the Research Laboratory in Denver cooperating.

4. Effects of The Depredation Problem. It is only natural that as long as the depredation problem exists, an accusing finger will be pointed toward the refuge. Any effort that is made toward a solution to the problem should help to appease local feelings.

With increased emphasis being placed on wetlands acquisition in the tri-state area, neither the states nor our Bureau can afford bad publicity on blackbird depredations around marsh habitat.

B. Experimental Herbicide Applications

1. Quackgrass

Six one acre plots of quackgrass were sprayed on June 18, 1958 with Benzac 354 (Polychlorobenzoic acid) and M-569 (liquid aminotriozol) at the rates of 2,4 and 6 pounds per acre in 75 gallons of water. Stem counts were taken at that time and the quadrants were marked. The area was planted to corn two weeks after being sprayed. This late corn planting was due to a delay in receiving the herbicide.

Results this spring could not be properly evaluated because the permittee farming this particular area became careless and knocked out the marking stakes on the fields edge. Visual checks throughout the summer and fall of 1958 showed that the M-569 plots had better control than the Benzac 354 plots. At that time no difference could be seen in the various strengths of application.

2. Canada Thistle

An acre patch of Canada Thistle was sprayed with M-569 (liquid amitrol) on June 18, 1958. Application was at the rate of four pounds active ingredients per acre. Observations throughout the first summer indicated that a good kill was being obtained.

On June 17, 1959 a final inspection of the area was made. A near 100% kill was obtained. The only live Canada plants were located in a two square rod plot which was choked with nettle. It is believed that the taller growth of these nettles prevented an adequate spray application.

Stem counts showed that where 54 thistles per square yard were present in 1958 there were no live plants in 1959. The control plot showed 43 thistles per square yard in 1958. This control was then sprayed with 2,4-D and there were two live plants present this year.

The findings of this study should be of value on this refuge, and in other areas in future years. If Canada Thistle can adquately be controlled with one or two applications of liquid amitrol a large amount of money may be saved. The never ending yearly process of spraying with 2,4-D is becoming very costly.

3. Phragmites

On August 21, 1958, six one-sixth acre plots were sprayed with Weedazol at the two, four and six pound rates and with M-569 at the same rates. The diluent was water at the rate of 18 to 20 gallons per acre sprayed. This application was made on phragmites located on a dry shoreline. Application was with our tractor pulled equipment and a hand nozzle. This method is not practical because it is impossible to get ground equipment through a phragmites jungle.

The following table shows the results of this work.

Phragmites Application of
Weedazol and M-569 (Liquid Amitrol) 1958

Herbicide &Strength	Original Stem count 8/27/58	Final Stem count 6/17/59	% Kill	% of Regrowth Dying
Weedazol 2# active	34/sq.yd.	35/sq.yd. *	60%	35%
Weedazol 4# active	40 "	35 " *	90%	25%
Weedazol 6# active	54 "	15 " *	90%	80%
M-569 2# active	47 "	11 "	85%	80%
M-569 4# active	31 "	0	95%	95%
M-569 6# active	19 "	0	99 - 100%	95%
Control	46 "	72/sq.yd.	-	-

* These quadrants were located near the center of the plot and spray did not give good coverage.

As shown in the above table the four and six pound M-569 applications gave the best results, showing almost 100% kill. A high percent of the regrowth in these two plots was turning white which indicates that it was dying. The two pound rate M-569 plot shows a high enough direct kill and regrowth kill to be practical and with less expense involved.

On August 20, 1959 three one-acre plots and one two acre plot of phragmites were aerial sprayed. These plots are located due east of Harvey Eichler's farm buildings. The two acre plot was sprayed with Radapon at the rate of 25 pounds of Radapon and eight gallons of water per acre. One of the one-acre plots was sprayed with straight Garlon at the rate of six gallons per acre. Another one acre plot was sprayed with half Garlon and half water at the rate of four gallons of each per acre. The third one acre plot was sprayed with M-569 at the rate of two gallons per acre. All of these plots were checked on August 27, 1959. In the two acre plot sprayed with Radapon, the old phragmites were about 90% dead with no green leaves present; however, the stems could not be snapped off easily. The weeds near the sample plot did not seem to be affected much. In the one-acre plot sprayed with straight Garlon the old phragmites were about 95% dead and fairly easy to break off. The tops of the bulrushes were dead in the immediate area; however, the rank weeds were not affected much. In the one acre plot sprayed with half Garlon and half water the old phragmites were about 80% dead with a few green leaves present. No live young plants were observed. In the one acre plot sprayed with M-569 the phragmites were 75-80% dead with some green leaves still on the stem.. There were six young live phragmites standing at this time in the sample square yard quadrat.

All of these areas will be checked next spring and the results will appear in a later report.

C. Aquatic Transects

Beginning this year a new system of aquatic transects were set in Sand Lake and Mud Lake. It is felt that these transects during this year's low water level will be very valuable for comparisons in future years.

The two transects in the Sand Lake Unit were from the headquarters south to Site 2 and from the headquarters east to Hanson's Point. The two transects in the Mud Lake Unit were from the west control structure at the dike east toward Cy Spurr's farm and from a point on the west shoreline, approximately 400 yards north of the dike, east to the southtip of a large island. The stations on each transect were set up by taking two bearings on permanent structures around the refuge. Thus, the stations can be located with considerable accuracy in the future. The water depth, silt depth, vegetation species, vegetation density, approximate seed production and the turbidity were taken at each station. A rough sketch of the vegetation at each station was also made. It is hoped that a good efficient method of determining seed production will be worked out in the future, because, at the present, the system is only a rough estimation.

D. Waterfowl Populations and Shoreline Grazing Use

The spring migration count, in relation to shoreline grazing, was made on April 15, 22 and May 7 of 1959. The breeding season count was made from June 6 through June 23. The fall migration count will also be included in this report, which will be in the September to December narrative.

E. Vegetation Transects In Grazing Units

This study was continued this year in the same manner as the last two summers. This year all wooden posts were replaced with steel posts. Since this study is to continue for five years a full report will be in the September to December narrative of 1961.

F. Artificial Pothole and Level Ditching Study

At the present all the potholes are completely dry and the level ditches, with some water left in them, are completely surrounded by phragmites. About mid-May some of the potholes contained about one-third to one-fourth of normal water level. Counts were made on all potholes and level ditches through July 17. Although the Dinosaur Track Pothole areas had some water in them in early June, Conard Slough and Silo Bay seem to be attracting more ducks, namely a few Blue Wing Teal, Mallards, and Gadwalls. The last date that ducks were noted using the potholes was on June 20. These were Blue-wing Teal and one Mallard.

A mink was seen on pothole 40 on May 16 in the Conard Slough area.

G. Nesting Studies

No nest dragging was conducted during this period.

VI. PUBLIC RELATIONS

A. Recreational Uses

Recreational use has been some fishing at the Hecla Recreation Area and some picnicing at Columbia Recreation Area. Fishing at Hecla has been poor this year until the bullheads started biting again toward the end of this period.

The Hecla area was enhanced considerably this summer. Manager Stollberg told the Hecla citizens that if they didn't take care of the area it would be eliminated. That is all it took; the same day they were out there mowing and trimming trees. They even built a permanent table (mounted in concrete) and a new toilet. They alos had the road smootherd a little and picked up the debris. The area looks more attractive than it has for many years.

B. Refuge Visitors

May - -
7th B. Palas; R.O. Enforeement Branch, general observations.
12 D. Minehart; SCS, inspect grazing units.
14 R. DeKraemar; Bur. Reclamation, discuss water management.
22 A. Brazda; Pilot Biologist, census of pairs etc.
26 C. Odin; WHP Biologist, discuss potholes and drainage.

June - -
7 A. Zajanc, J. DeGrazio; Denver Lab, blackbird control

July - -
28 C. Keeler; State game mgr., discuss public hunting.

August - -
7 H. Nelson, L. Goldman; R.O. & C.O., tour area.
17 A. Brazda; Pilot Biologist, photograph area.
30 J. Walk; Mingo mechanic, tour area

C. Refuge Participation

Mr. Stollberg showed film and gave talk to Cosmopolitan Club in Aberdeen, S. Dak. on May 13.

Regular attendance at Brown County Sportsmens Club in Aberdeen.

D. Hunting. None this period.

E. Violations. None this period.

VII. OTHER ITEMS

A. Items of Interest

1. Easement Refuges

a. Dakota Lake consists of 1048 acres just over the line in North Dakota. At the beginning of the period the water was about spillway level and during the latter part of May the water rose about two inches above the spillway. However, from early June to late summer the water level dropped and on August 7 the water was barely going over the spillway. On this date, August 7, four broods were sighted below the dam. There were two Blue-winged Teal, one Gadwall, and one Mallard brood comprising a total of 22 young.

No breeding pair counts or brood counts were made earlier in the summer. It is estimated that 300 ducks and 400 pelicans are using this area at the time of this report writing.

The uplands on this easement area have been cut for hay.

b. Maple River easement area has been dry all period.

2. Personnel Changes

Mr. Bruce P. Stollberg, after one and one-half years as manager here, was transferred to the public use department of the refuge branch in Washington, D. C. We miss the Stollbergs and hope them success in the big city.

Mr. James B. Monnie was transferred to Refuge Manager of Tewaukon Refuge at Cayuga, N. Dak. in late July. Jim was assistant manager at Sand Lake since March of 1958. The Monnies will also be missed but they are not too far away. We continue to draw on Jim's resourcefulness to get the new personnel going on the right foot.

Since July our new manager has been Lyle Schoonover. Lyle, his wife, two girls and a boy, came here after several years at Mingo Refuge in southern Missouri. They are glad to be back up north as Lyle calls North Dakota home.

For the first time in years we had a new assistant manager before the old one left. The Jerry Blackards and daughter, entered on duty the week the Monnies left. This is Jerrys first assignment since getting his degree in Utah this spring. Home is quite a ways for them as they hail from Arkansas. Jerry has taken a firm hold of the operations already and we look forward to working with him at Sand Lake.

Again this summer we have had the aid of a Student Assistant. Out of State College we had the able assistance of Vernon D. Cunningham. Vernon's principal duties were a continuance of grazing studies and vegetative studies; potholes and level ditch studies. Vernon established

a plant herbarium for Sand Lake this summer containing over 100 plant species. This should prove to be a valuable tool in future years with so many personnel changes here. Plans are already being made for next years Student Assistant.

3. Credits

Blackard - II.A.; V.B., C., D., E., F., G.; VII.A

Schoonover - I.B.; II.A., B., C., D., E., F., G., H., I.; III.A., B., C., D., E., F.; IV.A., B.; V.A.

Wahl - I.A; III.A; IV.A.; VI.A., B., C.; VII.A

Monnie - II.A., V.B

B. Photographs

Photographs for this narrative were taken by Stollberg, Monnie, Blackard, Cunningham, Monnie and Schoonover. Mountings were made by Wahl with heat applied to dry mounting tissue between picture and page.

Submitted by:

_____
(signature)

Date: September 21, 1959 Refuge Manager
(title)

Approved, Regional Office:

Date: _____

_____
(signature)

Chief, Division of Wildlife

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

WATERFOWL

REFUGE Sand Lake MONTHS OF May 1 TO August 31, 1959

Week (1) ending	5/2	5/9	5/16	5/23	5/30	6/6	6/13	6/20	6/27	7/4
Species	1	2	3	4	5	6	7	8	9	10
Swans:										
Whistling	5									
Trumpeter										
Geese:										
Canada	250	175	115	100	100	100	165	165	170	170
~~Cackling~~ Little Canada	1600	400	10	10						
Brant										
White-fronted										
Snow	11000	2000								
Blue	14000	2000								
Other										
Ducks:										
Mallard	700	400	400	475	475	475	800	1200	3000	3300
Black							10	10	10	10
Gadwall	100	100	100	440	440	440	440	500	800	800
Baldpate										
Pintail	300	100	100	70	70	70	70	80	100	100
Green-winged teal	100	75	35	10	10	10	10	10	10	10
Blue-winged teal	300	600	600	550	550	400	350	350	400	400
Cinnamon teal										
Shoveler	200	200	225	400	400	300	200	150	100	50
Wood				5	5	5	5	5	5	10
Redhead	50	30	20	100	100	100	100	100	50	50
Ring-necked										
Canvasback	10									
Scaup lesser	400	250	200	40	40	40	40	100	150	150
Goldeneye										
Bufflehead										
Ruddy	100	60	30	125	125	125	125	100	50	50
Other Am. Widgeon	100	100	100	60	60	60	60	70	150	150
Coot:	1100	1100	900	1800	1800	1500	750	800	750	750

Int. Dup. Sec.,
Wash., D. C. 37944

3 -1750a
Cont. NR-1
(Rev. March 1953)

WATERFOWL
(Continuation Sheet)

REFUGE Sand Lake MONTHS OF May 1 TO August 31, 1959

Week (1) ending / Species	(2) Weeks of reporting period: 7/11 11	7/18 12	7/25 13	8/1 14	8/8 15	8/15 16	8/22 17	8/29 18	(3) Estimated waterfowl days use	(4) Production: Broods seen	Estimated total young
Swans:											
Whistling											
Trumpeter									10		
Geese:											
Canada	170	170	170	170	200	200	200	217	19,799	12	63
~~Cackling~~ Little Canada									6,140		
Brant											
White-fronted											
Snow									36,000		
Blue									42,000		
Other											
Ducks:											
Mallard	4000	6000	6000	6000	6100	6100	11425	11425	545,200	8	222
Black	10	10	10	10	10	10	10	10	840		
Gadwall	800	800	800	800	700	700	510	510	77,640		
Baldpate											
Pintail	150	150	150	150	450	450	525	525	27,080	4	73
Green-winged teal	10	10	10	10	10	10	10	10	1,840		
Blue-winged teal	450	450	450	450	600	600	1235	1235	77,960	9	197
Cinnamon teal											
Shoveler	50	50	50	50	50	50	50	50	17,725		
Wood	10	10	10	10	10	10	2	2	658		
Redhead	50	50	50	50	50	50	4	4	6,806		
Ring-necked											
Canvasback									20		
Scaup lesser	150	150	150	150	100	100	50	50	14,170		
Goldeneye											
Bufflehead											
Ruddy	70	70	70	70	70	70	40	40	10,520		
Other Am. Widgeon	150	150	150	150	100	100	225	225	14,720		
Coot:	750	750	750	750	750	750	650	650	113,850		

(over)

	(5) Total Days Use	(6) Peak Number	(7) Total Production
Swans	10	5	
Geese	103,939	26,850	63
Ducks	795,179	14,086	492
Coots	113,850	1,800	

SUMMARY

Principal feeding areas

Principal nesting areas

Reported by Schoonover and Blackard

INSTRUCTIONS (See Secs. 7531 through 7534, Wildlife Refuges Field Manual)

(1) Species: 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.

(2) Weeks of Reporting Period: Estimated average refuge populations.

(3) Estimated Waterfowl Days Use: Average weekly populations x number of days present for each species.

(4) Production: Estimated number of young produced based on observations and actual counts on representative breeding areas. Brood counts should be made on two or more areas aggregating 10% of the breeding habitat. Estimates having no basis in fact should be omitted.

(5) Total Days Use: A summary of data recorded under (3).

(6) Peak Number: Maximum number of waterfowl present on refuge during any census of reporting period.

(7) Total Production: A summary of data recorded under (4).

Interior Duplicating Section, Washington, D. C. 37944
1953

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 Schoonover For 12-month period ending August 31, 19__

Reported by _____ Title Refuge Manager

(1) Area or Unit Designation	(2) Habitat Type	(2) Habitat Acreage		(3) Use-days	(4) Breeding Population	(5) Production
	Crops		Ducks			
ONE	Upland	339	Geese	598,781	148	0
	Marsh	229	Swans	878,563	0	0
Mud flat	Water	715	Coots	439	0	0
	Total	321	Total	45,911	468	0
		1684		1,523,694	616	0
	Crops		Ducks			
TWO	Upland	899	Geese	1,364,714	240	24
	Marsh	751	Swans	1,065,919	6	16
	Water	327	Coots	1,171	0	0
	Total	879	Total	27,546	378	0
		3138		2,459,350	624	40
	Crops		Ducks			
THREE	Upland	133	Geese	506,248	242	20
	Marsh	390	Swans	183,541	8	21
Mud flat	Water	1551	Coots	988	0	0
	Total	1153	Total	29,383	450	0
		3227		720,160	700	41
	Crops		Ducks			
FOUR	Upland	77	Geese	122,550	240	14
	Marsh	288	Swans	153,723	2	6
	Water	531	Coots	40	0	0
	Total	360	Total	18,364	144	0
		1256		294,677	386	20
	Crops		Ducks			
FIVE	Upland	914	Geese	1,328,405	542	22
	Marsh	1294	Swans	807,822	8	20
	Water	1255	Coots	951	0	0
	Total	2543	Total	34,892	198	0
		6006		2,172,070	748	42
	Crops		Ducks			
SIX	Upland	682	Geese	1,100,400	418	54
	Marsh	2215	Swans	802,698	0	0
	Water	1648	Coots	72	0	0
	Total	657	Total	18,364	126	0
		5202		1,921,534	544	54
	Crops		Ducks			
SEVEN	Upland	0	Geese	22,456	68	0
	Marsh	781	Swans	3,885	0	0
	Water	187	Coots	0	0	0
	Total	50	Total	9,185	36	0
		1081		35,526	104	0

(over)

3-1752
Form NR-2
(April 1946)

UPLAND GAME BIRDS

1613

Refuge Sand Lake Months of May to August 31, 1959

(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.
Ring-necked Pheasant									4000	
Gray Partridge									15	

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

MIGRATORY BIRDS
(other than waterfowl)

Refuge Sand Lake Months of May to August 1959

(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			2000	8/1-20						
White Pelican			5500	8/20-31						
Double Crested Cormorant			1500	8/20/31						
Great Blue Heron			100	8/1-20						
II. Shorebirds, Gulls and Terns:										
Killdeer			500	8/1-20						
Dowitcher			10000	7/20-8/20						
Avocet			500	"						
Franklins Gull			400000	8/15-31						
Common Tern			400	7/20-8/20						
Black Tern			400	"						

(over)

(1)	(2)	(3)		(	(5)			(6)
III. Doves and Pigeons:								
Mourning dove								
White-winged dove								
IV. Predaceous Birds:								
Golden eagle								
Duck hawk								
Horned owl		10	period					
Magpie								
Raven								
Crow		25	period					
Short-eared Owl		50	period					
Marsh Hawk		50	period					
					Reported by	Lyle J. Schoonover		

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.

• SEP • 59

SD-SDL-842

At the time this picture was taken Sand Lake had 1200 acres of water. The pool is now down to 300 acres and will be dry before hunting season

• SEP • 59

South of the Houghton Grade some good stands of pale smartweed are present on the dry lake bed. However it is questionable if the seed can be flooded for waterfowl this year.

SD-SDL-843

Starting a new nesting island in Sand Lake. An attempt was made to keep a good barrier of phragmites around the islands to serve as a windbreak.

SD-SDL-844

The display pool was nearly dry in August. Since that time all of the water has left this pool.

SD-SDL-845

Most of the 217 resident Canada Geese were photographed on a sandbar in Sandell Lake in August.

SD-SDL-846

• SEP • 59

Bog disking of phragmites to open up shore= line areas was started in August. Repeated disking during a dry summer may kill the phragmites and encourage more desirable emergents.

SD-SDL-847

A strip of phragmites directly in front of the stake was mulched with a rotary mower last spring. No change has occurred in the density of the plants but the mowed strip is about one foot shorter.

• SEP • 59

New growth of cattail and phragmites have invaded several thousand acres of the dry lake bed. The photo shows the height and desnity that some of the new phragmites growth has reached the first year.