

SAND LAKE NATIONAL WILDLIFE REFUGE

NARRATIVE REPORT

MAY 1, 1952 to AUGUST 31, 1952

PERSONNEL

Herbert H. Dill - Refuge Manager in Charge
Harvey K. Nelson - Refuge Manager
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Sand Lake National Wildlife Refuge

May 1, 1952 to August 31, 1952

1. GENERAL

A. Weather Conditions:

A summary of weather data for Sand Lake Refuge and vicinity as recorded at the official weather station maintained at Refuge Headquarters is given in Table No. 1.

TABLE NO. 1

Sand Lake Weather Data, May 1 - August 31, 1951 & 1952								
MONTH	SNOWFALL		PRECIPITATION		MAX TEMP		MIN TEMP	
	'51	'52	'51	'52	'51	'52	'51	'52
May	-	-	1.92	.82	86	90	31	28
June	-	-	3.47	2.76	82	95	38	39
July	-	-	3.07	1.11	93	96	45	42
August	-	-	2.01	.72	94	104	42	40
TOTALS & EXTREMES	-	-	10.47	5.41	94	104	31	28

Rainfall for this period was far below rainfall received the same periods in 1950 and 1951. May and August were the driest months again this period as was true in 1951. Moisture has been far below normal for the period.

Temperatures were near normal for the entire period. A low of 28° was recorded on May 11, while the highest (104°) occurred on August 14 and 101° the following day.

May was much cooler than normal with below average precipitation. June temperatures were normal with a few light showers occurring the latter part of the month. Temperatures during July were normal with only 1.11 inches of precipitation. Far below normal rainfall for July. Hot winds and only .72 inches of rainfall during August combined to make it one of the driest August's on record at this station. Most of the corn in this area is badly burned from the hot winds and many farmers are cutting their corn for ensilage. Local farming operations were carried out on schedule as very little rain fell to interrupt their harvesting. All small grain in the vicinity has been harvested at the close of the period. Yields nearly hit new lows this year with wheat averaging 5 bushels to the acre and barley 12 bushels to the acre.

B. Water Conditions:

High water from the spring run-off and the backing up of the Elm River from the south through the southern part of the Sand Lake Unit brought flood conditions to near the spring of 1950 flood. The emergency spillway on the Weissmantel Grade at one time had 14 inches of water flowing over it. Traffic on this road was closed for over four weeks until it was repaired by the Brown County Highway Commission. Some channeling occurred at the Mud Lake bridge and around the bridge at the Columbia Dam. Bids were let for the resurfacing of both of these dikes at the close of the period.

All stop logs were replaced in the Columbia Dam on June 9 and by mid June the authorized spillway level, 1270.33 was reached. Strong winds and very little rainfall has dried the lake up considerably this summer. The lowest it has been for several years. A marked increase in growth of aquatic vegetation has been noted throughout the refuge because of the low water levels.

C. Fires:

No fires occurred during the period. Burning permits were issued to permittees when it was necessary to rid farm land of debris left by the spring flood.

II WILDLIFE

A. Migratory Birds

1. Population & Behavior

a. Geese:

A few stragglers from the spring migration lingered at Sand Lake until about May 20. This group consisted of about 2,000 Snows, blues and Richardson's geese. An additional 180-200 common Canada geese were scattered throughout the refuge at that time. As spring cultivation progressed, waste grain and corn became scarce, and the bulk of the remaining geese departed. Observations during mid May revealed a breeding population of about 65 common Canada's. At one time Dill & Nelson observed 32 apparently mated pairs of "honkers". Later observations failed to account for as many on the refuge but observations of 2 pair on territory were recorded for the Putney Slough area, 1 pair at nest in the Dakota Lake area and 1 pair nesting in slough area 1 1/2 miles northeast of Ludden, N. Dak.

Subsequent brood counts did not show the number of Canada geese broods anticipated. Throughout the summer 8 individual broods of geese were recorded on brood counts. An aerial survey on July 27 resulted in the observation of 12 broods varying in size from late downy stage to nearly adult size. An additional group of approximately 40 non-breeding

common Canada's were observed and a group of 50-60 molting Richardson's with 8 snows and 2 blues. Further reports from farmers indicate 4 additional goose broods which we undoubtedly failed to see during brood counts and were not recorded later so we can account for 16 broods on Sand Lake and 1 brood on Dakota Lake. Therefore it is believed that total refuge production was about 18 broods. Average brood size was 3.6, indicating that about 65 young were raised in this vicinity. Since all adult geese have completed their molt and the young are flying, the total number observed at this time of the year would be a further index by which to check production. To date approximately 163 common Canada's have been seen and one mixed group of Common Canada's and Richardson's totaling about 60 birds. Some of the Richardson's are undoubtedly those that escaped from our captive flock.

It is not known what the success was of the two pairs in Putney Slough or the one nest by Ludden but no young geese have been reported in those areas to our knowledge.

Many of the crippled snows, blues and Richardson's geese that were kept through the summer in the "duck hospital" molted and left the enclosure. As a result local rumors are that a flight of 150 or more snows and blues has already returned to Sand Lake.

b. Ducks:

The spring migration was nearly complete by May 1 with some change in blue-winged teal and ruddy duck numbers occurring during May. An aerial census on April 30 showed approximately 5,000 ducks of all species remaining on the refuge.

A breeding pair census conducted by plane on May 15 (Table No 2) showed a total of 437 pairs observed and approximately 850 unmated or nonbreeding birds. The composition as shown represents a large increase in breeding pintails. This was largely due to the increased surface water on areas adjoining the refuge as well as throughout the entire James River valley in northern South Dakota. As indicated in Table No. 2) very few blue-winged teal pairs were recorded, largely perhaps because it was a little early for teal to be completely paired off. The same was true for redheads. Undoubtedly some further changes occurred in the blue-winged teal and ruddy duck population.

Normally there should be a close correlation between the total number of breeding pairs observed and subsequent brood production determined by routine brood counts - generally fewer total broods than breeding pairs. If the total number of breeding pairs reported were increased to compensate for lack of blue-winged teal pairs on May 15 then the anticipated correlation would exist here. However, there is usually a movement of broods into refuge waters from neighboring pot-holes and thus it is difficult to compare the number of breeding pairs observed with broods recorded.

TABLE NO. 2

BREEDING PAIR COUNT

<u>SPECIES</u>	<u>PAIRS</u>	<u>%</u>	<u>UNMATED GROUPS</u>
Pintail	231	53.2	20
Mallard	138	31.6	10
Gadwall	11	2.5	30
Baldpate	19	4.4	15
Shoveller	7	1.6	—
B. W. Teal	4	.9	420
Redhead	8	1.8	255
Canvasback	3	.8	20
L. Seaup	1	.2	50
Ruddy Duck	1	.2	—
Unidentified	14	3.2	30
TOTAL	437		850

As reported in Section V production increased from 5.08 broods per mile in 1951 to 6.46. Average brood size increased from 6.3 in 1951 to 6.9 per brood. The overall increase was due to the presence of more pintails.

Groups of molting drake pintails, mallards were first observed on June 15. From that date on there was a continued increase in numbers - chiefly molting birds. An aerial survey on July 27 showed a mid summer population of approximately 18,000 ducks - chiefly pintails, mallards and blue-winged teal drakes. During late August there was a noticeable increase in mallard, bluewinged teal, green-winged teal and shovellers. An aerial census on September 9 revealed that approximately 35,000 ducks were using the refuge. Two wood ducks were observed on the refuge during the summer, but there was no evidence of nesting activity by that species.

At the close of the period ducks are feeding heavily in harvested fields both in the refuge and on adjoining land. Because there was very little rain during the harvest season farmers were able to complete operations before ducks created any depredation problems.

TABLE NO. 3

WATERFOWL POPULATION
May - August, 1952*

	May 1	Breeding population	July 27	Sept. 9
All Ducks	5,350	4,000	18,500	35,000
Geese	—	500	—	2,000
Can. Canada geese	300	140	—	163
Snow & Blue geese	19,000	—	—	—
Richardson's geese	1,100	—	—	—

* Population data based on aerial census on dates given. Sept. 9 data used even though beyond the close of the period.

TABLE NO. 4

SERIES I June 25-July 1

NUMBER OF BROODS PER CLASS

SPECIES	I	II	III	ALL CLASSES
Pintail	--	4	16	20
B.W.Teal	3	1	--	4
Mallard	1	2	--	3
Unidentified	--	1	--	1
All ducks	4	8	16	28
C.C. Geese	1	2	--	3
Coots	1	2	2	5

SAMPLES 21 MILES OF SHORELINE

TABLE NO. 4a
SERIES II July 22-28

Pintail	--	17	4	21
B.W.Teal	3	5	7	15
Gadwall	10	4	--	14
Mallard	--	3	4	7
Shoveller	1	2	--	3
Baldpate	2	1	--	3
Redhead	--	2	1	3
Ruddy	1	--	--	1
Canvasback	--	1	--	1
Unknown	2	2	--	4
All ducks	19	37	16	72
C. C. Geese	1	2	2	5
Coot	--	3	--	3

SAMPLED 20 MILES OF SHORELINE

TABLE NO. 4b

SERIES III August 25-30

SPECIES	I	II	III	ALL CLASSES
Gadwall	2	--	--	2
B.W. Teal	--	1	--	1
Mallard	--	1	--	1
Baldpate	--	1	--	1
Shoveller	--	--	1	1
Ruddy	1	1	--	2
All Ducks	3	4	1	8

SAMPLED 7 MILES OF SHORELINE

TABLE NO.5

BROOD COUNT SUMMARY - SAND LAKE REFUGE

BROOD CLASS

SPECIES	I		II		III		ALL CLASSES	
	NO.	AVE SIZE	NO.	AVE SIZE	NO.	AVE SIZE	NO.	AVE SIZE
Pintail	-	-	21	6.3	20	7.7	41	6.9
B.W.Teal	6	7.3	7	8.8	7	5.8	20	7.3
Gadwall	12	6.8	4	6.2	-	-	16	6.6
Mallard	1	7.0	6	7.8	4	8.0	11	7.8
Shoveller	1	5.0	2	8.5	1	8.0	4	7.5
Baldpate	2	9.0	2	6.0	-	-	4	7.5
Redhead	-	-	2	6.0	1	3.0	3	5.0
Ruddy	2	4.5	1	4.0	-	-	3	4.3
Canvasback	-	-	1	5.0	-	-	1	5.0
Unidentified	2	5.5	3	7.3	-	-	5	6.6
All Ducks	26	6.1	49	6.9	33	7.2	108	6.9
C.C. Geese	2	5.0	4	3.0	2	3.5	8	3.6
Coots	1	13.0	5	4.2	2	10.	8	Ave size not significant

SERIES I - 21 miles shoreline/31 broods = 1.47

SERIES II - 20 miles shoreline/77 broods = 3.85

SERIES III - 7 miles shoreline/8 broods = 1.14

6.46

TABLE NO. 6
BROOD SPECIES COMPOSITION
1952

	<u>NO. BROODS</u>	<u>PERCENT</u>
Pintail	41	35.3
B.W. Teal	20	17.2
Gadwall	16	13.8
Mallard	11	9.5
Shoveller	4	3.5
Baldpate	4	3.5
Redhead	3	2.6
Ruddy	3	2.6
Canvasback	1	.8
Unidentified	5	4.3
Canada Geese	8	6.9
	<u>116</u>	

c. Coots and Rails:

The peak spring population of coot showed a 70% decrease as compared to 1950 and 1951. It also appeared that there were fewer coots nesting on the refuge during the past summer than in 1950 and 1951. Brood count data show $\frac{1}{4}$ coot broods per mile of shoreline sampled. Previous records do not give comparable data for estimated production.

There was a noticeable increase in coots during late July and early August. It is assumed that these birds moved in from surrounding potholes that dried up.

Sora and Virginia rails were present throughout the season in limited numbers.

d. White pelicans are summer residents at Sand Lake. The breeding colony was confined to one island in Mud Lake as in 1950 and 1951. There were about 80 nests which produced approximately 120 young pelicans. On July 23, 83 young birds were banded. At that time most of the young were about $\frac{3}{4}$ grown and just developing their primaries.

There were approximately 200 non breeding birds associated with the nesting colony. As summer progressed there was a general increase in the pelican population as birds moved into the refuge. Approximately 2,200 pelicans were observed during the aerial census on July 27. By August 10 the number had increased to about 5,000 and 6,500 were present on September 9. Birds are feeding heavily on fingerling carp and buffalo as well as bullheads and perch.

e. Double-crested Cormorants were present in usual numbers. About 350 nests were found on the same island with the pelican nests. It was estimated that approximately 800 young were produced. The abundance of rough fish in refuge waters provides ample food. With present low water conditions it is apparent that pelicans and cormorants are able to catch fish much easier and undoubtedly are a big factor in control of rough fish populations.

f. Great blue herons have been present on the refuge since early spring. There is a small nesting colony just south of Columbia on the James River. Black-crowned night herons are more common and also nest in this vicinity.

Snowy Egret: One individual was observed by Podoll on two occasions along the Houghton Grade during the period August 28-30.

American Egrets were more numerous than previously recorded for the refuge. One group of 24 individuals was observed on July 27. A larger flock of 32 was seen in the south end of the refuge on August 20. These birds apparently wander northward from their more southern breeding colonies during late summer.

Western grebes have been common throughout the summer.

Approximately 120 pairs were observed during mid May. First broods were observed June 18.

Herring gulls & ring-billed gulls have been present in limited numbers throughout the period. There has been a large nesting colony of Franklin's gulls on the refuge for a number of years. This year they occupied about a 4 sq. mile area of river bulrush in the Mud Lake Unit. No estimate of total production was made.

g. Shorebirds: Unusually large numbers of shorebirds were present during the spring migration during early May and again when the various species begin to return from the northern breeding grounds. Birds nesting on the refuge included Wilson's phalarope, Avocet, Western willet, Upland plover, spotted sandpiper, killdeer, pipit plover. Marbled godwits and several smaller "peeps" such as Baird's sandpipers and semipalmated sandpipers were seen throughout the summer but it was not determined whether or not any nesting occurred. Other species of shorebirds observed included long-billed dowitchers which begin to return here from the breeding grounds on July 11. Similar observations during 1951 indicated that many of the dowitchers apparently go through a partial molt of some type here during late July. Stilt sandpipers, greater and lesser yellowlegs, black-bellied plovers, red-backed sandpipers and American knots migrated through this area during mid August until the close of the period. On several occasions extremely large flocks of marbled godwits (180) and Avocets (120) were seen. Generally these species are observed in very small flocks of 10 - 20 birds or less.

2. Food and Cover:

Much of the small grain was short this year and combining operations have left a wealth of feed in most fields. Corn crops in general are fair and will provide additional duck and goose feed on the refuge. Due to the lack of precipitation very little waste grain germinated and as a result there is not the abundance of green goose browse available there has been in past years.

Lower water levels during the past two years have contributed to the development of sago pondweed beds. These areas are now being used by coot and some puddlers and should again aid in providing more suitable food for divers as they move in.

As in 1951 exposed mud flats and a considerable amount of shoreline was seeded with a mixture of Japanese and wild millet Echinochloa crusgalli. Seeding operations were conducted on June 12-13 with the service aircraft piloted by Ray Glahn. Frequent rains during the remainder of June caused a rise in water levels that flooded exposed flats and washed away much seed. After the water receded very little millet germinated and cattail, Typha latifolia emerged to take over such areas. As a result the only millet that germinated early enough to permit ripening before frost was that on the upper margins of the shoreline that did not become covered with water following seeding. Actually wave action

carried seed to much of the entire shoreline in the south 1/2 of the refuge and as a result these will be considerable food benefits derived from such growth. In general, the millet seeding operations was not as successful as in 1951.

There was some sign of alkali bulrush Scirpus paludosus growing on areas seeded during June 1951 near the Weismantel sub-headquarters.

3. Disease:

A combination of low water levels and high temperatures during August created an ideal environment for an outbreak of botulism. During a routine check on August 14 a number of dead and incapacitated ducks and shorebirds were found along the Houghton grade. Symptoms were not typical of botulism, but characterized poisoning resulting from ingestion of toxic algae. A field survey was made in cooperation with members of the Minnesota Public Health Service. A complete report is given in Section V.

B. Upland Game

1. Population and Behavior

a. Ring-necked pheasant. The pheasant population appears to be equal to or greater than that of 1951. Below normal rainfall during the nesting season aided brood survival and at the same time discouraged farmers from plowing sub-marginal land thereby leaving more areas of marsh and annual weeds for cover.

First broods were observed May 19. Newly hatched broods were seen as late as August 22. State Game Technicians report that the peak hatch occurred June 20-25. Brood records kept by the writer for this area show an average brood size of 7.5. Most of Brown County, including the refuge is now considered to be within the zone of high population that extends south, southeast through central and eastern South Dakota.

The state pheasant season for this area will be 20 days (October 18-November 6) with a daily limit of 3 cocks, possession of 12.

b. Hungarian partridge are more numerous than in 1950 and 1951. There appears to be a slight increase each year. Seven different broods have been seen on the refuge while driving around. It is not known what the total production is, but undoubtedly the above random observations represent a small percentage of total broods.

c. Pinnated grouse were present in small numbers during the winter and early spring. One individual was seen by the writer during the summer. A farmer reported a "chicken" with a brood in a grazing unit northeast of Houghton, S. Dak. just east of the refuge. This species seems to remain at a very low level in this vicinity in spite of considerable suitable habitat.

2. Food and Cover:

Food in general is plentiful in this vicinity. Upland game

birds feed largely on wild seeds, fruits, insects and cultivated grains. Pheasants are now feeding heavily on waste grain in fields. Considerable feeding has been noted along the marsh margin where some of the Japanese and wild millet is beginning to shell out.

Cover is more plentiful than during previous years as farmers were reluctant to plow up potholes and other sub-marginal land because of the absence of late spring rainfall.

3. Disease: None noted.

C. Big Game Animals

1. Population and Behavior

a. White-tailed deer:

During the winter census 143 animals were seen on the refuge. This represented nearly 100% count. Allowing for some animals missed and further changes we estimate a breeding population of 150 head. The 1952 increment should raise the fall population to approximately 225 animals. This is a larger population than anticipated following the 1951 3 day hunting season during which the refuge was open. The state did not set an open season for eastern South Dakota this year. It is hoped that they will permit a harvest in this area in the fall of 1953 as there will tentatively be more than 350 deer on the refuge by that time, which is more than we can safely carry with regard to damage to shelterbelts and crop depredation.

Field observations during the past spring showed that there is getting to be more alfalfa raised in this locality each year. The does seem to prefer alfalfa as cover in which to hide fawns. As a result the farmers injure and kill a number of fawns while cutting the first crop of alfalfa. We checked on a number of such incidents the past spring. The little fellows apparently will not move out of the way of oncoming equipment.

2. Food and Cover

Deer feed chiefly on shelterbelts, alfalfa, small grain crops and corn during the summer months. They also do some browsing on emergent aquatics along the marsh fringe.

Shelterbelts provide the best upland cover. Some animals frequent the "wildland" areas and marsh edges.

D. Fur Animals, Predators, Rodents and other Mammals

Principal fur species on the refuge are muskrat and mink. It is too early to determine the status of the muskrat population. It is anticipated that a trapping program will be initiated to remove a few muskrats even though they may show no substantial increase as we undoubtedly lose a certain percentage each year that could just as well be harvested.

Other fur bearers such as raccoon and skunk continue to be problem species, especially with regard to nest destruction. Increased fur prices for these two species may induce trappers to make more of an effort to trap them. Badgers are plentiful and apparently specialize in digging up the patrol roads while hunting for ground squirrels. Even though the state pays a \$4.00 bounty on badger, people in this community make no effort to remove any numbers of animals. Red fox are common throughout the area.

E. Predacious Birds

Marsh hawks, Swainson's hawks and Red-tailed hawks are common species in this area. A migration of marsh hawks through this area was noted during the period August 13-20. Red-tailed hawks were also more numerous during that period.

Sharp-shinned hawks and Cooper's hawks have been increasing in numbers in this area since late August.

Great-horned Owls, Short-eared owls were observed nesting in this area. Prairie falcons and American Rough-legged hawks were also observed frequently throughout the summer.

F. Fish

The principal species are carp, bullhead, buffalo, suckers, perch and northern pike. Carp, buffalo and bullheads are the dominant species. Fish eating birds feed heavily on these species. Fishermen utilize fishing privileges on some of the refuge bridges and recreation areas. Catches have been limited to bullheads and a few northeras.

III REFUGE DEVELOPMENT, MAINTENANCE

A. Physical Development

1. Minor repairs were made on 1947 Ford sedan I-18263, Jeep Pickup I-19062 and 1948 International Pickup I-19217.

2. Major repairs were made on Jeep Pickup I-19062. Brake drums were turned, new lining and wheel cylinder kits installed.

3. Several refuge gates were made wider to permit entry of large farm machinery belonging to permittees who farm refuge land.

4. The exterior of the residence at the Weismantel place was given two coats of paint and trim.

5. New automatic gas hot water heaters were installed at the managers residence, replacing the coal burner and at site No. 3.

6. Three buildings, cabin, garage, and boathouse were moved by service truck from Tewaukon easement refuge, N. Dak. to Sand Lake Refuge. The cabin will be added on to the clerks quarters, the garage was moved to the Weismantel place and the boathouse will be set up on the bank near the headquarters building.

7. All wooden refuge signs were painted and letters touched up with white paint.

8. Refuge trails and additional weed patches around building sites were mown during July - August.

9. Weed Control: Spraying operations were started in late May and continued through July as time permitted. Sow thistle was the most prevalent of the noxious weeds again this year as the flood waters deposited seeds over all the flooded area. Many acres were sprayed with the use of our 14 foot power boom sprayer mounted on a Jeep pickup. Approximately 200 acres of shoreline and marsh were sprayed with the Service aircraft.

10. Nine man days were spent dividing crops on Sand Lake and Tewaukon easement refuge.

B. Plantings:

1. Aquatic and Marsh Plants: As mentioned in the section on waterfowl food and cover, 1,525 lbs. of Japanese millet, 2,475 lbs. wild millet and 500 lbs. of smartweed were mixed together and seeded by service aircraft on exposed mud flats on June 13 and 14. Results of the seeding were not good as frequent rains raised the level of the lake and washed away much of the seed. *June*

2. Trees and shrubs: Five hundred multiflora rose seedlings were planted with very poor results due to the dry weather. *Aug*

3. Upland and Herbaceous Plants: None

4. Cultivated Crops: The harvest of small grains was completed at the close of the period. A good harvest of millet is expected if no frost occurs within the next two weeks.

A total of 2,525 acres were under cultivation the past season. The refuge share of all crops totaled 791 acres. Approximately 151 acres barley, 267 acres corn and 164 acres millet were left in the field for wildlife food. Approximately 34 acres barley, 22 acres corn, 37 acres wheat, 18 acres of oats and 98 acres alfalfa were to be harvested and delivered to the refuge elevator. The refuge share harvested represented grain from fields so located that feeding birds would be vulnerable to fence line hunting. *not*

C. Collections

1. Seed and other Propagules: None

D. Receipt of nursery Stock: None

IV ECONOMIC USE OF REFUGE

A. Grazing

Three permits are in effect covering 630 acres. Grazing is permitted on refuge units from July 13 - November 15 at the rate of one head per five acres. The rate per head was increased this year from \$.60 per head to \$1.00 per head to be more in line with local grazing rates.

B. Haying

Haying permits covering approximately 1,000 acres were issued. Some units can not be fully utilized due to water conditions and dense growth of annual weeds.

C. Other Uses

A permit was issued for placing 52 bee hives on the refuge at the rate of \$.15 per hive.

V FIELD INVESTIGATIONS

A. Waterfowl Brood Counts

During the 1952 nesting season further revisions were made in methods by which annual waterfowl brood counts were conducted. In order to permit observatio and recording of early pintail and mallard broods as well as late gadwall and ruddy duck brood, three separate brood counts were made during the season on approximately the same sample areas. These periods were June 25 - July 1, July 22 - 28 and August 25 - 30. Counts were made from shoreline where possible and by paddling a canoe along the shoreline of sample area. Observations were recorded by species, number and age class. The sample areas selected were representative as to type of habitat and proportion of the entire refuge shoreline.

Observations for each brood count series is shown in Table No. 4. A summary of all counts is shown in Table No. . The interval between dates of subsequent brood counts in most cases eliminated the possibility of doubling up on any one brood through change in age class over the period when class III broods were recorded only during the first count. A class I or II bird observed on June 25 should normally be fully feathered and possibly flying by July 25.

Final computations show an average of 6.5 duck broods per mile of shoreline sampled with an average brood size of 6.9 or approximately 45 ducks produced per mile of shoreline. There are about 75 miles of shoreline on the refuge suitable for waterfowl use. By projecting these totals approximately 3,375 ducks were produced on the refuge during 1952.

Comparable data for 1951 show a density of 5.08 broods per mile of shoreline with an average brood size of 6.0. Total production was approximately 2,300. On this basis about 1,000 more ducks were raised on the refuge during 1952. The bulk of this increase is attributed to the larger number of pintails using the area this year. See Table No.

B. Algae Poisoning in Waterfowl, Shore and Marsh Birds

A number of incapacitated and dead ducks and shorebirds were first observed along the Houghton Grade (State Highway #10) on August 15. At first glance it appeared that the birds were suffering from an attack of botulism but closer observation showed that symptoms were quite different. The birds first seemed to lose control of their feet and legs. Birds could swim but couldn't get airborne by themselves. Shorebirds that couldn't get off the ground would fly away when thrown into the air. During later stages there seemed to be a paralysis of wing muscles and birds in the final stages were unable to hold their heads up. At no time did the nictitating membrane cover the eye and very sick birds still responded to visual stimulus. A noticeably weakened voice was noted in the case of blue-winged teal, mallards and lesser yellowlegs. Most ducks affected were puddlers that inhabited shallow areas and the shoreline. Very few diving ducks were affected at Sand Lake.

The numbers of dead birds per unit area of shoreline varied with changing wind direction. The highest number recorded in one day per mile of shoreline up to September 4 was 34 dead ducks, 8 sick ducks, 28 dead shorebirds, 2 dead Franklin's gulls and 34 sick shorebirds; a total of 122 ducks and 64 other birds. It is difficult to determine total mortality as the largest die-off showed up along open shoreline exposed to the prevailing winds. The condition has existed for about 30 days, but will perhaps subside as soon as frost or sufficient precipitation occurs.

A similar die-off occurred during September, 1951. At that time we were informed by the U. S. Public Health Service that algae poisoning could cause such a condition. No complete diagnosis was made at that time and water samples collected froze sufficiently to destroy algae content before they could be shipped.

As soon as the dead birds began to appear this year, the Public Health Service at the University of Minnesota was contacted. A field crew consisting of Messrs. Hollenbeck and Olson investigated the condition at Sand Lake. Sick and dead birds were collected and posted in the refuge laboratory. External symptoms were listed as paralysis of legs and later the wings. Eyes remained clear, nictitating membrane functioned normally. Internal symptoms were listed as follows: Stomach filled with fluid; watery-secretion in body cavity; dilation of intestinal tract; edges of lobes of liver appeared discolored, with a white tinge on extreme edges. Water samples collected were reported to have contained three species of blue-green algae which are known to be toxic. The principal species was aphanizomenon flosaque and forms of microcystis sp. and polycystis sp.

The Public Health Service biologists reported that certain types of algae poisoning are fatal within a few hours, usually depending on the dosage proportionate to body weight. It was their opinion that the algae develops in the deeper portions of the lake. Wind carries it to the shallow areas and shoreline where it gradually dies and decays. In the process a toxin is liberated from the algae cells and this is ingested

by birds and animals. They did not know whether or not fall frosts would actually destroy the toxin, but fall rains undoubtedly dilute the toxic material so that it becomes less potent.

It is the opinion of the writers that many die-offs reported throughout the mid-west as due to botulism, actually may be due to algae poisoning. Usually an outbreak of botulism reaches an alarming stage before it is investigated while smaller outbreaks are overlooked.

It does not appear that there is much that can be done to alleviate an outbreak of algae poisoning. A combination of cool weather and rain would perhaps help more than anything. In some areas it may be possible to regulate water levels so as to minimize mud flat areas and sand bars, at the same time reduce water temperatures.

C. Alfalfa as Nesting Habitat

The Economic Use Plan for the Sand Lake Refuge (revised Feb. 1952) provides for planting alfalfa on 1/5 of refuge uplands under cultivation. This is considered essential for maintenance of fertility levels. Such plantings are now required of all permittees farming on the refuge.

The first alfalfa plantings were made in the spring of 1951 with companion grain crops. In the spring of 1952, approximately 600 acres of alfalfa was growing on the refuge in small fields representing about 1/5 of each permittees holdings; these fields vary in size from 15 acres to 50 acres depending upon the total acreage farmed by each man. All are about the same distance from the marsh area.

Because it was proposed to harvest this alfalfa when it was from 1/10 to 3/5 in bloom - or from June 10 to June 30 - two questions were immediately posed with respect to the possible use of these alfalfa fields by ducks and pheasants.

1. Would ducks and pheasants nest in the alfalfa in preference to some 2,000 acres of other upland habitat deemed suitable and acceptable?
2. If it were found that these alfalfa fields were used extensively for nesting, what management measures could be adopted to avoid killing the adult birds while mowing the hay and how could the nests be saved?

The report of our study and evaluation of alfalfa as nesting habitat for waterfowl and pheasants accompanied by recommendations for managing haying operations is being submitted separately.

Briefly stated, we set up two refuge study areas along with suitable control areas both on and off the refuge. All nests were located prior to harvest; during the hay harvest detailed observations on the fate of adult birds and nests were made.

As is usually the case with wild life investigations of this type, there are so many variables that it is impossible in one season's work to come up with conclusive evidence pointing up a satisfactory solution to the problem. Be that as it may, we feel that our time was well spent, for

we turned up a flushing bar that proved to be 100% successful when used with a tractor for flushing pheasants, and ducks from nests in the alfalfa.

The Ohio Department of Natural Resources furnished the plans for this flushing bar. Not only did we find it a cheap and effective means for saving nesting birds in the alfalfa, but, also it was used with our John Deere tractor for locating nests.

These bars can be built for about \$12.00 each and are easily mounted in front of any tractor mower with the exception of the Ford or Ferguson side-mounted. In this case, a special bracket would have to be used so that the bar was out ahead of the tractor (See photograph).

While no pheasants or ducks were injured or killed on lands mowed by a tractor equipped with a flushing bar of this type, the following reports from local farmers emphasize the need for a practical device of this kind: Robert Vitense, June 9, 1952 mowed 20 acres. Killed four pheasants and crippled another severely. He also cut three legs off their house cat which was hunting in the alfalfa field! Lloyd Dennert, June 11, 1952, mowed 30 acres. Killed five female pheasants and seriously crippled one female pheasant. Phil Knutson, June 6, 1952. Mowed thirteen acres; killed 10 female pheasants and three blue-winged teal. This man said he counted a total of 15 nests (presumably pheasant and duck) which the mower destroyed. Merle Olson, June 8, 1952. Mowed 15 acres; killed 15 female pheasants. He reported a total of 21 pheasants flushed all of which were hit by the mower - six flew away. Edwin Weismantel June 6-12, 1952. Mowed 90 acres of alfalfa and killed approximately 40 pheasants. He estimated the number killed - no tally was kept.

The mortality from mowing was higher in the vicinity of the refuge than in other parts of the county because there are more pheasant there. Alfalfa is becoming much more generally used in the James River Valley as a result of the Soil Conservation program calling for an increased acreage of legume plantings. Consequently, we consider the mowing of alfalfa with modern high speed tractors that operate at five MPH or faster to be a serious threat to the pheasant population.

Fortunately, the alfalfa harvest on the refuge proper did not result in the slaughter reported on the outside. This was because another practical harvesting method was worked out which can be applied to those permittees owning swathers. Alfalfa can be mowed and windrowed with a swather without killing or injuring nesting pheasants or ducks.

Briefly then, by using flushing bars on standard tractor mowers and swathers, alfalfa can be harvested with no mortality to adult pheasants and ducks. While some nest destruction and desertion occurred, there was no significant change in refuge production of waterfowl or pheasants that could be attributed to harvesting alfalfa.

Generally speaking, alfalfa is used as nesting cover because it is the first vegetation to green up in the spring. Hence it would be logical to expect a high rate of nest destruction by predators early in the season. This we found to have taken place. Therefore, regardless of hay harvesting, our data indicate that most of these nests would have been lost regardless.

While some reneesting took place in the alfalfa following harvest, the amount was negligible from the stand point of overall refuge production.

On this basis then, our problem boils down to two major considerations:

1. The age-old question of proper predatory animal control.
2. Just what is good nesting habitat and how much should we have in relation to the demands for other land uses such as agriculture?

VI PUBLIC RELATIONS

A. Recreational Uses

Recreation Area: The Columbia baseball team again used the recreation area for their ball games as the city park was under water until late June. Crowds up to 800 people were common when a game was in progress. Many others used the area for picnics. Swimming was also popular along the sandy shore below the recreation area.

The Northern South Dakota Council of the Boy Scouts of America held their weekend camporee at the refuge recreation area this summer.

Visitors: From 25 to 50 people frequent the refuge headquarters each weekend to observe waterfowl in the vicinity or to climb the tower.

B. Refuge Visitors

NAME	TITLE OR AFFILIATION	DATE
F. C. Gillett	Reg. Refuge Supervisor	5/2/52
Forrest Carpenter	Ass't. Reg. Refuge Supervisor	"
Robert Dougal	Regional Engineer	"
"Chuck" Evans	River Basin Studies	5/6/52
Ken Black	" " "	"
Walter Pfeifer	N. Dak. State Warden	5/13/52
Clair T. Rollings	Ass't. Reg. Refuge Supervisor	5/21/52
Dr. Morley	Washington, D. C.	5/21/52
T. S. Kibbe	Ass't. Regional Director	5/27/52
Henry Baetkey	Reg. Administrative Officer	5/27/52
Merrill Hammond	Biologist, Lower Souris Refuge	6/25/52
C. E. Weishoffle	U. S. Geological Survey	6/26/52
Lt. Herbert Klinger	U.S.A.F. Ground Observer Corps	7/8/52
Sgt. Glen R. Hansen	" " " "	"
Donald V. Gray	Refuge Mgr., Lower Souris Refuge	7/11/52
Dr. Clarence Cottom	Ass't. Director, Fish & Wildlife Service	7/29/52
Forrest Carpenter	Ass't. Reg. Refuge Supervisor	7/29/52
Bob Arrowsmith	Mechanic, Lower Souris Refuge	8/4/52
L. C. Richardson	S. Dak. State Warden	Frequent
Everett Sutton	G.M.A. Aberdeen, S. Dak.	"
Jerry Stoudt	Flyway Biologist, Aberdeen, S. Dak.	"
Erling Pedoll	State Game Technician	"

C. Refuge Participation

The following meetings were attended by refuge personnel during the period:

Aberdeen Rotary Club	: Talk by Dill, slides by Nelson
Ellendale Sportsmen Club	: Talk and slides by Dill
Lakeview School	: A talk was given by Mgr. Dill
Columbia American Legion	: The film King Chinook was shown by Dill and Nelson

Refuge Managers Dill and Nelson attended the annual North Dakota Wildlife Federation meeting at Minot, North Dakota June 21.

Refuge Manager Nelson attended the North Dakota Game Conference at Bismarck on August 8.

Manager Dill participated in the Brown County Annual weed meeting on May 17 and the County weed clinic at Aberdeen held June 10.

All refuge personnel are participating in the Air Force Ground observer Corps at the local stations in Columbia and Houghton.

VII OTHER ITEMS

A. Items of Interest

Mr. Albert W. Kregge reported for duty as maintenance man-General on June 16 to replace Einar Kaastad who was transferred and promoted during March, 1952.

Easement Refuges:

Dakota Lake refuge was visited several times throughout the period. The flood last year was known to have completely covered the dam and spillway at the south end of the refuge. So we were agreeably surprised to find only minor damage as a result of high water.

Wave action eroded the south embankment at the dam and a small amount of channelling occurred. Approximately 150 cu. yds. of earth fill will be required to repair the damage.

With the drowththis summer there were no complaints from Dakota Lake farmers about wet haylands. Likewise, with stop logs in place in July, the City of Oakes seemed to have sufficient water for their use. As usual, waterfowl production on DakotaLake was practically zero, and summer populations were very small.

Maple River was visited once during the period, May 21. Water levels were about normal in spite of no rain for over a month. Sixty three single male pintails were noted on different parts of the area

indicating a good pintail nesting population. That evening a talk was given to the local conservation club in Ellendale.

Tewaukon and Cloud's Lake were visited regularly all summer in the course of moving the buildings from there to Sand Lake and in connection with economic use.

Water levels were approximately normal most of the period. However, the heavy run-off early this spring left a few scars here and there. (see photo).

Waterfowl production was far below that of last year when 8.6 broods per mile were found on 5 miles of shoreline. This year 13 broods were observed on 4 miles of shoreline for an average of 3.2 broods per mile. The following broods were noted August 5, 1952:

Bowl Spillway - 1 mile

1 blue-winged teal	with 7 number 2
1 mallard	with 5 number 3
1 pintail	with 8 number 3
1 mallard	with 6 number 3
1 mallard	with 7 number 2
1 redhead	with 6 number 2
1 gadwall	with 5 number 1
1 gadwall	with 6 number 2

Lake Tewaukon - 1 1/2 mile

1 gadwall	with 10 number 2
-----------	------------------

Skroch Bay - 1 1/2 mile

1 mallard	with 8 number 1
1 mallard	with 6 number 2
1 blue-winged teal	with 4 number 2
1 blue-winged teal	with 5 number 3

A total of 150 coots and between 900 and 1,000 mallards and pintails were observed that date.

Special use permits in force on Tewaukon include 3 share-crop covering 180 acres, 2 haying and 1 grazing. The refuge share of the crop left in

the field included: millet 40 acres, corn 13, oats 11 and barley 10 acres

C. Photographs

All photographs were taken by Dill and Nelson.

Credits: Sections I, III & IV by R. C. Pratt

Section V Dill and Nelson

Section VII Dill

Harvey K. Nelson
Harvey K. Nelson
Harvey K. Nelson,
Refuge Manager.
September 22, 1952

Approved: _____

Herbert H. Dill
Herbert H. Dill,
Refuge Manager (In Charge)
September 22, 1952

Approved: _____

Regional Director

WATERFOWL

Refuge

Sand Lake

Months of May

to August

19 52

(1) Species	(2) First Seen		(3) Peak Concentration		(4) Last Seen		(5) Young Produced		(6) Total
	Number	Date	Number	Date	Number	Date	Broods Seen	Estimated Total	Estimated for period
I. <u>Swans:</u> Whistling swan									
II. <u>Geese:</u> Canada goose			300	5/1	Summer residents		8	18	
Rich. Cackling goose			1100	5/1	80 cripples remaining				
Brant									
White-fronted goose			200	5/1	8	5/20			
Snow goose			7000	5/1	1200	5/20			
Blue goose			12000	5/1	800	5/20			
III. <u>Ducks:</u>									
Mallard			7000	9/9			11	50	
Black duck			200	9/9			-	-	
Cadwall			200	9/9			16	70	
Baldpate			700	9/9			4	17	
Pintail			15000	9/9 *			11	172	
Green-winged teal			1200	9/9			-	-	
Blue-winged teal			3500	9/9			20	100	
Cinnamon teal									
Shoveller			9000	9/9			4	17	
Wood duck			2	7/25			-	-	
Redhead			50	9/9			3	12	
Ring-necked duck			5	5/1			-	-	
Canvas-back			150	5/1			1	4	
Scaup			150	5/1			-	-	
Golden-eye			50	5/1	4	5/20	-	-	
Buffle-head					1	5/20	-	-	
Ruddy duck			300	5/1			3	12	
Unidentified								24	
IV. <u>Coot:</u>							8		

3-1750

(Sept. 1950) Interior - Duplicating Section, Washington, D.C. 82449

(over)

* Based on aerial census, Sept. 9

Species composition determined from ground sample.

Form NR-1

SUMMARIES

Dates waterfowl counts made April 30 - May 1, July 27
Sept. 9.

Percent of waterfowl area covered 90% or better

Dates brood counts made June 25-July 1, July 22-23, August
25-30.

Percent of area covered in brood counts 87%

Total production:

Geese 65

Ducks 3375

Coots not sufficient data

Total waterfowl usage during period _____

Peak waterfowl numbers 35,000 Aerial census, Sept 9.

Areas used by concentrations Shoreline and mud flats in
south 1/2 of refuge. Islands and sheltered bays in Mud
Lake unit.

Principal nesting areas this season Two islands in south
1/2 of refuge had highest density. Highest production in south
1/2 of refuge

Reported by Harvey L. Nelson

INSTRUCTIONS

- (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) First seen: The first refuge record for the species during the season concerned in the reporting period, and the number seen. This column does not apply to resident species.
- (3) Peak concentration: 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 in the reporting period.
- (5) Young produced: 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.
- (6) Total: Estimated total number of the species using the refuge during the period. This figure may or may not be more than that used for peak concentrations, depending upon the nature of the migrational movement.

Note: Only columns applicable to the reporting period should be used. It is desirable that the Summaries receive careful attention since the data are necessarily based on analysis of the rest of the form.

MIGRATORY BIRDS
(other than waterfowl)

Refuge Sand Lake Months of May to August 1952

(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. <u>Water and Marsh Birds:</u>										
Western grebe										
Pied-billed grebe										
White pelican			6500	9/9			1	80	120	
Double-crested cormorant			3000	9/9			1	350	200	
Great blue heron										
Black-crowned night heron										
American egret	24	7/27	32	8/20						
Snowy egret	1	8/28	1	8/28-30						
American bittern										

(1)	(2)	(3)	(4)	(5)	(6)
III. <u>Doves and Pigeons</u> : Mourning dove White-winged dove					
IV. <u>Predaceous Birds</u> : Golden eagle Duck hawk Horned owl Magpie Raven Crow marsh hawk Red-tailed hawk Swainson's hawk Amr. Rough-legged hawk Cooper's hawk Sharp-shinned hawk Prairie falcon	See narrative section				
Reported by.....H. J. Nelson					

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 Gruiformes)
 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.

1613

Months of May to August, 1941

(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	Marsh fringe and adjacent upland 10,000 acres									It is estimated that there were about 3,000 pheasants in this vicinity at the start of the breeding season. There is some question as to how many of these birds move out and nest in the surrounding country.
Hungarian partridge	Upland meadow and fields. 4,000 acres									
Pinnated grouse	Grassland and field boundaries. 1,000 acres									
* Time did not permit detailed population studies to be made. Studies started in cooperation with the South Dakota Game & Fish Commission were not completed due to road and weather conditions.										

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.

REFUGE GRAIN REPORT

Refuge Sand Lake

Months of May thru August 1942

(1) VARIETY	(2) ON HAND BEGINNING OF PERIOD	(3) RECEIVED DURING PERIOD	(4) TOTAL	(5) GRAIN DISPOSED OF				(6) ON HAND END OF PERIOD	(7) PROPOSED USE		
				TRANS- FERRED	SEEDED	FED	TOTAL		SEED	FEED	SURP.
Barley	2140	540	2780					2780		150	2630
Wheat	270	260	530					530		100	430
Ear corn	700		700			100		600		300	300
Oats	- -	540	540					540		50	490

(8) Indicate shipping or collection points Columbia, S. Dak. (CHW RR)

(9) Grain is stored at Refuge elevator

(10) Remarks Figures based on estimated yield at time of crop division. A complete volumetric measurement of refuge grain will be made as soon as total share of refuge crop harvested is received at elevator.

NR-8a

REFUGE GRAIN REPORT

This report should cover all grain on hand, received, or disposed of, during the period covered by this narrative report.

Report all grain in bushels. For the purpose of this report the following approximate weights of grain shall be considered equivalent to a bushel: Corn (shelled)—55 lbs., Corn (ear)—70 lbs., Wheat—60 lbs., Barley—50 lbs., Rye—55 lbs., Oats—30 lbs., Soy Beans—60 lbs., Millet—50 lbs., Cowpeas—60 lbs., and Mixed—50 lbs. In computing volume of granaries, multiply the cubic contents (cu. ft.) by 0.8 bushels.

- (1) List each type of grain separately: Corn, wheat, proso millet, etc. Include only domestic grains; aquatic and other seeds will be listed on NR-9.
- (3) Report all grain received during period from all sources, such as transfer, share-cropping, or harvest from food patches.
- (4) A total of Columns 2 and 3.
- (6) Column 4 less Column 5.
- (7) This is a proposed breakdown by varieties of grain listed in Column 6.
- (8) Nearest railroad station for shipping and receiving.
- (9) Where stored on refuge: "Headquarters grainary", etc.
- (10) Indicate here the source of grain shipped in, destination of grain transferred, data on condition of grain, unusual uses proposed.



SD-SDL-596

The Boy Scouts of America hold a two day "Camporee" on the refuge.



SD-SDL-597

"Play Ball!!" Too wet in Columbia so the town team takes over refuge facilities for their first few games.



SD-SDL-598

Our refuge signs not only bear the ire of the frustrated hunter or whim of the teen-age target seeker (note bullet hole), but must withstand the ravages of wind and water as well. This picture was taken in May just north of the outlet dam at Tewaukon.



SD-SDL-599

The winter kill of fish at Tewaukon was severe. Tons of carp were found along the shore this spring, but very few game fish.



SD-SDL-600

The Tewaukon cabin is prepared for a 63 mile move. Used but little as they stand, the Tewaukon buildings are urgently needed at Sand Lake.



SD-SDL-601

The cabin, boat house and double garage were jacked up and rolled onto the Federal semi-trailer provided by our good neighbors at Lower Souris.



SD-SDL-602

We found that our industrious W.P.A. crew, who built the cabin in 1936, had thoroughly cemented the rock chimney to the building! Virtually every rock stayed in place and the building had to be cut away from the chimney and fireplace!



SD-SDL-603

Bowling down the highway headed for Sand Lake.
The timbers are 24 feet long.



SD-SDL-604

The last of the Tewaukon buildings are moved out. The boat house followed by the "little" house sail across the North Dakota prairie.



SD-SDL-605

Unloading the cabin at Sand Lake. It is to be joined with the house in the background to provide better quarters for our clerk, Dick Pratt.



SD-50L-606

Pumping 2-4D into service aircraft piloted by Ray Glahn for spraying sow thistle and other noxious weeds.



SD-50L-607

Spraying field infested with cottonwoods on west side of Sand Lake.



SD-SOL-608

From left to right visiting firemen Don Gray, Erling "Punch" Podoll state game technician and Dill. This is the 200 foot rope drag pulled with two pickups to locate nests. It is weighted with every conceivable hunk of iron on the place.



SD-SOL-609

Permittee Walter Seiber with Ohio flushing bar mounted on his tractor. Built for \$12.00 or less these bars proved to be 100% effective in flushing nesting ducks and pheasants in alfalfa.



50-504-610

Three hundred and ~~eighty~~ ^{Fifty} cormorant nests and eighty two pelican nests on an island 200 feet long by about 75 feet wide. Food primarily carp and bullheads with a few yellow perch thrown in.



50-504-611

The unhappy expression on the countenance of Pratt and Dill is provoked by the odor which is terrific! Much regurgitated fish in 90 degree weather makes very bad smell!