

BRANCH OF WILDLIFE REFUGES NARRATIVE REPORTS

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DR. ERICKSON _____

MR. STILES _____

MR. KUBICHEK _____

Stenographers

REFUGES MUD LAKE _____

PERIOD MAY - AUGUST 1957 _____



COVER PICTURE.

Photographer Jim Thompson caught this brood of blue-winged teal cruising along a ditch in typical midsummer teal fashion. The blue-winged teal is a common nester at Mud Lake, and, in spite of belittling remarks to the contrary, comprises a part of many hunters' bags come opening day!

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES & WILDLIFE
MUD LAKE NATIONAL WILDLIFE REFUGE
HOLT, MINNESOTA

Narrative Report
May, June, July, August

Personnel

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Robert M. Abney	Assistant Refuge Manager
George H. Gard	(Trainee) Assistant Refuge Manager
Oliver T. Davidson.	Maintenance Foreman
James M. Thompson.	Refuge Clerk
Daniel C. Wehmeyer	Maintenance Man
David L. Erickson.	Student Assistant

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NARRATIVE REPORT

May, June, July, August

1957

I. GENERAL.

A. WEATHER CONDITIONS.

For the second summer in a row there were quite a few days when the old fireplace felt pretty good. The headquarters buildings, located on an area in the center of much water, invariably experiences temperatures two to four degrees below readings at Thief River Falls which is twenty-five miles southwest of us. Unfortunately, this is also true for the refuge crops which had a difficult time this period. After a rather late planting with cool wet weather, much of the crop rotted in the ground. At the end of the period, after a dry spell we were again soaked with heavy rains which ruined the wheat which had been planted in the goose pen on areas previously occupied by corn. The corn drowned out in June!

There were very few days in the low nineties. Temperatures were at or slightly below average all thru the period. On the following page is a summary of the weather which is rather deceptive because of the heavy precipitation beginning September 1st.

B. WATER CONDITIONS.

The trend of water levels in all pools during the period was above the approved elevations. This was due to above normal precipitation in June and again in early September.

This situation disrupted nesting in Headquarters Pool in May on the large nesting island (Boy Scout Island) in that most of the island remained flooded during the month of May when the birds were on territory. This

Precipitation and temperatures readings:

Reading taken from the weather bureau station - Mud Lake Refuge - this period only

	1957	1956	1955	1954	1953	5-Yr. Average
Month	Rain	rain	rain	rain	rain	rain
May	2.12	4.29	2.37	3.10	3.39	3.05
June	4.57	3.45	3.83	4.18	3.09	3.82
July	2.56	12.34	2.98	1.41	.99	4.06
August	1.05	6.97	1.42	2.95	1.44	2.77
Total	10.30	27.05	10.60	11.64	8.91	13.70

	Five Year Ext.											
Month	High-Low		High-Low		High-Low		High-Low		High-Low		High-Low	
May	82	26	83	27	89	15	76	23	86	24	89	15
June	78	39	95	35	86	40	89	37	90	27	95	27
July	92	42	82	43	93	42	92	45	87	45	93	42
August	90	39	88	44	95	44	85	41	94	41	95	41
Extremes	92	26	95	27	95	15	92	23	94	24	95	15

Refuge record of extremes since 1946.

Month	High--Date		Low -- Date	
May	91	1948	15	1955
June	95	1956	27	1953
July	96	1949	38	1951
August	96	1946	34	1950

	High			Low	
Month	Rain - Year			Rain - Year	
May	12.93	1949	.70	1952	
June	5.08	1950	1.49	1951	
July	12.34	1956	.99	1953	
August	6.97	1956	.90	1950	

was especially discouraging in the case of a pair of Canadas that tried to establish territory there. While no other direct observations of this type were made, high water levels covered most beach areas which are considered highly desirable at this time in attracting nesting waterfowl. The principal difficulty in maintaining desired pool elevations within this unit is the inadequate size and poor condition of the water control structure.

In Green Stump Pool, an attempt to de-water the unit aborted because of heavy runoff from the east that backed in from South Pool. Nevertheless, lowered water levels within this pool provided ample beach area and resulted in attracting more waterfowl during May than any other unit. Poor drainage was also a contributing factor to our unsuccessful de-watering project.

Our efforts to drop the large Mud Lake pool a foot below spillway in May were partly successful, and by the latter part of the month, a nice beach area was exposed and well utilized by ducks on territory. In spite of heavy rain in June, by keeping both controls wide open, we were able to maintain a level only .60 above approved elevation. This dropped to approved elevation again in August but was again drastically disrupted in early September. Generally speaking, however, water elevations maintained within this pool during the period were considered better than last year's and were conducive to improved plant growth and to use by waterfowl.

While water elevations in the other pools were slightly higher than desired, there were no radical departures from approved elevations and use by waterfowl was considered good. However, it is of interest to note that the generally higher pool elevations experienced these past two seasons have suppressed a great deal of our cattail as evidenced by a fringe of brown culms in most pools.

C. FIRES.

None this period.

II WILDLIFE

A. MIGRATORY BIRDS.

(1) Population and Behavior.

a. Waterfowl.

Production this year of an estimated 19,000 ducks was the best since 1952. Canada goose production has increased each year to an estimated 90 goslings this season. Coots are down about 1/3 from last year, and slightly below the four year average.

The following table (#1) presents comparative data on breeding populations, brood counts, and production estimates for the major waterfowl groups this year, last year, and the 1953-1956 average.

Waterfowl activity during the report period was devoted to production. Therefore, this section of the Narrative is a waterfowl production report.

Our primary objective was to establish a sample census route of known size and representativeness, and a projection factor whereby sample counts may be expanded to reliable estimates for the entire refuge.

This is a combined report of the Breeding Population Survey and Brood Production Survey. A different method was applied in estimating the breeding population than was used to estimate brood production. This was done so that resulting ratios between the sample census and the total refuge estimate obtained (or used) in each survey could be further evaluated in order to select a reliable factor for projecting refuge estimates.

The two methods, combined results, comparisons, and relationships are presented in this section of the report.

This year's breeding duck population was estimated to be 8270 birds, slightly more than double last year's estimate.

This estimate is the result of an aerial strip count of the entire refuge which was multiplied by 3.3, the ratio of ducks counted from aircraft to ducks actually present on the sample ground route. This ratio was determined by making an aerial count over the sample route on the same day the ground census was made by automobile.

Table #1

Group	Estimated Breeding Population (total birds)			Non-duplicated Broods Counted on Sample Route**			Estimated Production		
	1957	1956	4 yr. Av. 53-56	1957	1956	4 yr. Av. 53-56	1957	1956	4 yr. Av. 53-56
Canada Geese (large)	60	125*	incomplete	12	7	4.75	90	7	45
Dabblers	5888	3050	"	192	83	136	12815	3010	7683
Divers	2382	950	"	100	67	63.25	6148	2325	2162
Totals for Ducks	8270	4000	"	292	150	199.25	18963	5335	9845
Coots	913	2000	"	50	69	inc.	1935	3100	2509
Grand Total	9243	6125	"	354	226	"	20988	8505	12399

* Included Immatures

** See Map #2

The reduction of this method to a mathematical formula may be stated:

$$\begin{array}{lcl} \text{Estimated} & & \text{Aerial strip} \\ \text{breeding} & = & \text{count of the} \quad \times \quad \text{Sample ground count} \\ \text{population} & & \text{entire refuge} \quad \frac{(\text{Adjusted for unaccompanied males})}{\text{Sample aerial count}} \end{array}$$

The following page explains the method of survey. Table #2 is a summary of the data; explanatory maps #1 and #2 are also included.

Additional information on collection and use of breeding population data is enumerated in the following paragraphs; paragraph numbers refer to column headings in table II.

1. This is a tabulation of the actual ground count of ducks and coots on the established census routes as shown on map #2. The count was made by Dill and Abney on June 6th, by automobile. The count was kept separate for paired birds and un-accompanied males, and then totaled. The column is thus divided A, B, and C.
2. The total number of birds counted on the established sample route was then adjusted to include nesting hens not seen, but believed to be present, by adding the number of un-accompanied males to the total birds seen. Column 1-B added to 1-C gives column 2.
3. The percent of each species composing the total population was obtained by dividing the number of birds of each species in column 2 by the total ducks in column 2
4. This is a list of the ducks and coots counted from the aircraft over the established sample census (ground) route. A total of 400 ducks and coots were counted, 10% of which were determined from column 2 data to be coots. This count was made June 6th by Abney and commercial pilot Rantanen; both pilot and observer counted.
5. This is the total number of ducks and coots counted on the entire refuge from the aircraft, see Map #1. A total of 2776 birds were counted; the number of each species was calculated by applying percentages in column 3. This complete aerial strip

Table #2

BREEDING POPULATION SURVEY

	(1) Ground Count (by car) of sample Established Routes			(2) Ground Census of Established Sample Routes, (Adjusted By Add- ing Females for Unaccompanied Males)	(3) Species Composition (Sp. % of Total)	(4) Aerial Count of Establish- ed Sample Census Route	(5) 100% Aerial Count of Refuge	(6) Est. Breed- ing Popula- tion
	(A) paired birds	(B) Un-accomp- anied Males	(C) Total Birds					
Mallard	70	187	257	444	37%		925	3059
B. W. Teal	84	87	171	258	21.5%		537	1778
Gadwall	32	10	42	52	4.4%		110	364
Widgeon	6	22	28	50	4.2%		106	348
Pintail	6	8	14	22	1.8%		45	149
Black	2	7	9*	9*	1.0%		25	83
G. W. Teal	2	2	4	6	.5%		12	41
Shoveler	4	0	4	4	.4%		10	33
Wood Duck	0	2	2	4	.4%		10	33
Total Dabblers	206	325	531	849	71.2%		1780	5888
Redhead	48	47	95	142	12.0%		300	992
Ringneck	52	29	81	110	9.2%		230	761
Ruddy	12	22	34	56	4.7%		118	389
Scaup	24	3	27	30	2.5%		62	207
Canvasback	0	2	2	4	.4%		10	33
Total Divers	136	103	239	342	28.8%		720	2382
Total Ducks	342	428	770	1191	100.0%	360	2500	8270
Coots			84	126		40	276	913
Total Ducks & Coots			854	1317		400	2776	9183

(*) Un-accompanied birds could not be identified as drakes.



This topographic map shows the Mud Lake area with several pools and lakes. The map is overlaid with a grid and contour lines. Key features include:

- Northwest Pool:** ELEV 1141.5
- Mud Lake Pool:** ELEV 1141.0
- Mud Lake:** Central feature
- Green Stump Pool:** ELEV 1180.0
- Headquarters Pool:** ELEV 1120.0
- South Pool:** ELEV 1122.5
- Elk Lake:** Bottom left
- West Otter Lake:** Top center
- East Otter Lake:** Top center
- Green Bay:** ELEV 1110.0

Color-coded Zones:

- Water:** Blue line
- Mars:** Red line
- Crop:** Orange line
- Upland:** Green line

Handwritten Notes:

- 1/10 Water, 9/10 Upland (near Mud Lake Pool)
- 1/10 Water, 9/10 Upland (near Headquarters Pool)

Legend:

- Blue line: Water
- Red line: Mars
- Orange line: Crop
- Green line: Upland

Scale and Orientation:

- Scale: 1 inch = 1 mile
- North arrow pointing up

Map Title: MUD LAKE GENERAL PLAN

Scale: 1 inch = 1 mile

Legend:

- Blue line: Water
- Red line: Mars
- Orange line: Crop
- Green line: Upland

Scale and Orientation:

- Scale: 1 inch = 1 mile
- North arrow pointing up

Map Title: MUD LAKE GENERAL PLAN

count was made the evening of June 6th. and morning of the 7th by Abney and Rantanen. The spacing of this count over two days is believed to be of little consequence because the birds were on territory and the break occurred near the center of Mud Lake where relatively few birds were found. Both pilot and observer counted.

6. This is the estimated breeding population as derived from the complete aerial count multiplied by the ratio of birds counted from aircraft to birds actually present on the 10% sample ground route. This ratio is 1 to 3.3083.

Mating birds were on territory earlier than last year (refer to last period NR for species listing). There were no set-backs caused by weather or water conditions except two hail storms during the first week of July that hit a corner of the refuge. Had the area struck been larger, this could have been disastrous because the hail stones ranged up to tennis ball size and destroyed many crop fields outside the northwest boundary.

However, the refuge nesting season was generally favorable (calculated 65% to 70% success. The first brood, (Mallard) was seen June 1 and the latest on August 30. This was a Class II Ruddy; no non-fliers have since been seen.

The following figure (#1) graphically illustrates the production trend and comparative yearly success as plotted from the non-duplicated sample brood-data since 1952. Reports by John C. Carlsen during those years provide the basic data with which to compare this year's production. Data for 1954-1956 were taken from Carlsen's "Waterfowl Production Studies, 1953-1956" and the 1953 data from NR Form 1 and page 4a of the 1953 May-August NR.

The only known difference between the method of counting the non-duplicated broods this year and the previous 4 years is: This year only broods counted from the car along the 37-mile sample route were included, whereas in previous years some broods counted from aircraft off the sample route were reported.

This tends to make this year's sample brood count lower in relation to estimated production than in previous years.

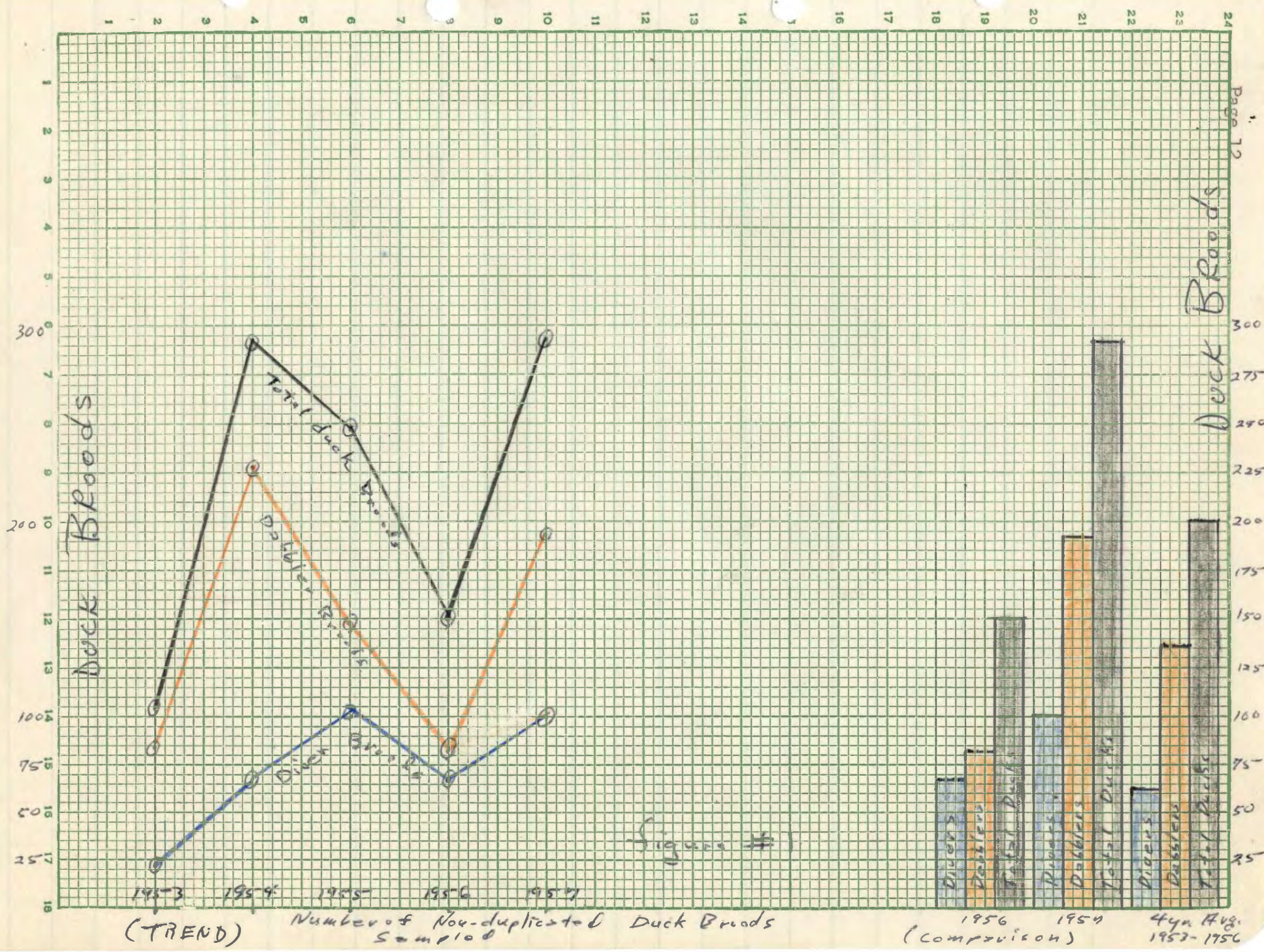


Table #3 is a summary of sample brood counts and estimated production for each species of waterfowl. The top figure on each line is the number of sample broods, bottom figure is the total estimated birds produced.

This year's duck production was estimated on the basis of 292 non-duplicated brood observations totaled from 4 separate counts along a 37 mile sample route (1/8 mile, both sides). All unidentified broods were included, and were placed according to the percent species-composition of the breeding population.

It was determined that the sample represented 1/10 of the total refuge area. Therefore, the sample number of non-duplicated broods was multiplied by 10 to produce the estimated total broods.

Total estimated number of broods was multiplied by the average brood size (all classes) for each species to obtain the estimated birds produced. Average sizes listed in Mr. Richard E. Griffith's "Mean Average Broods 1949-1950 Data" were used in this computation.

The reduction of this method to a mathematical formula for each duck species may be stated:

Estimated birds =	Non duplicated		mean
produced	broods counted	X 10 X	average brood
	on 37 mi. route		size

As previously stated, it was determined that the 37 mile sample route represented 1/10 of the total refuge area. Since this is the basis for projecting the sample to estimated production, the size and representativeness of the sample merit additional evaluation.

The habitat comparison data in Table #4 shows the degree to which habitat within the area covered by the sample route compares to that within the entire refuge.

In connection with the foregoing ratio between sample route and total refuge area, it is significant to note the close approximation to the comparable ratio in the breeding population survey, ^{beavins in finding that the method of projection} was entirely different from the production estimate method:

Table data note: The top figure for each species is the number of non-duplicated broods counted on the 37 mi. sample route. Bottom figures are the total estimated birds produced as projected for the entire refuge.

Table #3

	Sample Brood Counts and Total Estimated Production			Comparison of 1957 Data with:	
	1956	1953-56 4 yr avg	1957	1956	1953-56 4 yr avg
Sample Broods	49		77	+28	
Mallard Est. Production	1800	2825	5020	+3220	+2195
Etc.	-	-	2	+2	
Black Etc.	-	-	157	+157	+157
Gadwall	4		21	+17	
	150	706	1488	+1338	+782
Widgeon	3		5	+2	
	125	306	318	+193	+12
Pintail	1		9	+8	
	50	250	549	+499	+299
G. W. Teal	1		4	+3	
	25	125	242	+217	+117
B. W. Teal	23		69	+46	
	825	3306	4692	+3867	+1386
Shoveler	1		3	+2	
	25	162	189	+164	+27
Wood Duck	1		2	+1	
	10	3	160	+150	+157
Total Dabblers	83	136	192	+109	+56
	3010	7683	12815	+9805	+5132
Red Head	33		28	-5	
	1150	900	1766	+616	+866
Ringneck	12		40	+28	
	400	450	2560	+2160	+2110
Canvasback	4		13	+9	
	125	150	803	+678	+653
Lesser Scaup	-		21	+1	
	-	62	58	+58	-4
Ruddy Duck	18		18	0	
	650	600	961	+311	+361
Total Divers	67	63.25	100	+33	+36.75
	2325	2162	6148	+3823	+3986
Total Ducks	150	199.25	292	+142	+92.75
	5335	9845	18963	+13628	+9118
Coots	69		50	-19	
	3100	2509	1935	-1165	-574
Canada Geese	7	4.75	12	+5	+7.25
	70	45	90	+20	+45
Total Waterfowl	226	incomplete	354	+128	incomplete
	8505	12399	20988	+12483	+8589

Table #4

HABITAT COMPOSITION AND SIZE COMPARISON

Habitat Type	37 mile sample route (1/8 mile on each side)		Entire refuge		Comparison of sample acreages with total refuge area	
	Acres	% of sample	% of refuge	Acres	Projection factor	% of refuge represented by sample
Water	2780	46.95%	36.45%	21930	7.89	12.67%
Marsh	1458	24.63%	24.29%	14610	10.02	9.98%
Cropland	500	8.45%	9.1%	4570	10.94	9.14%
Upland	1182	19.97%	30.16%	18150	15.35	6.51%
Total	5920	100%	100%	60160	10.16	9.84%

Note: See also map #2.

<u>Ducks actually counted on sample route</u>	<u>Estimated Refuge population</u>	<u>Relationship of, sample to refuge</u>
Total Ducks: 770	8270	1/10.74 or 9.31%

This relationship (1/10.74) supports the projection factor of 10 which was used to compute total refuge duck broods. (See Tables #3 and 4)

By applying the estimates finally obtained from the two different methods of survey breeding population and production, nesting success and average brood size figures can be calculated in order to test these estimates:

$$\frac{8270}{2} = 4135 \text{ pairs} \quad \text{and} \quad \frac{2920 \text{ broods}}{4135 \text{ pairs}} = 70\% \text{ nesting success}$$

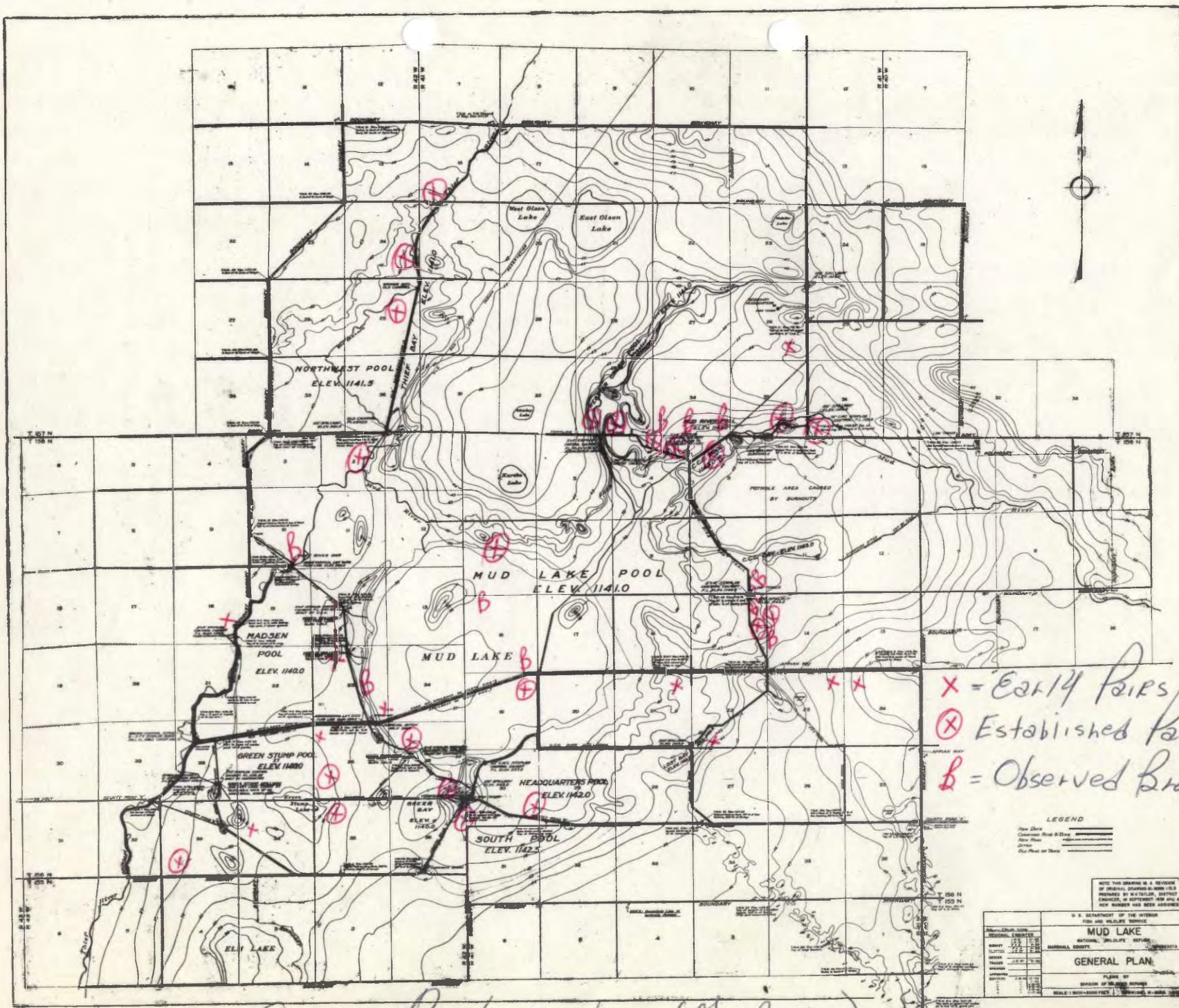
And

$$\frac{18,963 \text{ young}}{2920 \text{ broods}} = 6.494 \text{ overall average brood size.}$$

This calculated nesting success and brood size was within the realm of probability this year. While nesting success data is lacking, the overall sample brood size was slightly above 6.4.

Because the number of broods observed for each species was not considered large enough to be representative, the brood size data referenced in Mr. Griffith's undated memo were used in making the production estimates. Refuge brood size observations requested in Mr. Griffith's memo are included with the NR forms. In spite of the similarity in total observations (291 to 292) these are not to be confused with the non-duplicated brood observations used in making the production estimate. The former are broods for which identification was positive and the number of young definitely established. The similarity in totals is purely coincidence.

Canada Goose production of 90 young was 20 birds better than last year. Goose production has increased by about 20 goslings each season since 1954 when 30 were produced.



Goose Production (MAP #3)

32 pairs were noted this year. However, only 22 pairs were regularly seen throughout the season.

12 broods totaling 47 goslings were counted. The estimate of 90 young is based on the production from 22 pairs. Refer to Map #3 for location of pairs and broods.

One American Merganser brood was seen in Thief River along Madsen Pool.

One Swan was frequently seen throughout the summer, an immature bird that lingered after the spring migration. However, a single swan has been present during most past summers.

In accordance with current instructions, the refuge has been divided into 11 areas for recording observations. these areas were set up and habitat typed this spring. All field observation data have been recorded by areas in order to facilitate preparation of reports required at the close of the year.

b. Water, Marsh and Shore Birds.

Hoebel's and pied-billed grebes were very common nesters and produced well.

The double crested cormorant colony located in the tree snags along the east edge of Mud Lake was active and usual production was attained.

Great blue herons, bitterns and black crowned night herons were common and reproduced successfully.

The franklin gull colony $1\frac{1}{2}$ miles northeast of headquarters was struck by hail storms July 6 and 7. An area 115 yards by 30 yards was searched and the following gull damage noted:

Empty nests	62
Nests with one dead young	42
Nests with two dead young	14
Dead juveniles outside of nests	3
Crippled juveniles outside nests	3
Dead adults	5
Crippled adults	1

Total dead 78

Total cripples 4

Black and common terns were frequently seen in usual numbers throughout the period.

Wilson snipe are very common in wet pasture, meadows and grain fields.

Killdeer, yellowlegs and sandpipers were common summer residents. Phalaropes and golden plover were seen occasionally during the latter part of the period.

(2) Food and Cover.

Habitat conditions were favorable as evidenced by the increased duck production.

An attempt was made to de-water Greenstump Pool, but inadequate drainage coupled with excessive rainfall prevented this accomplishment. However, the pool level was drawn down and the dry areas controlled-burned. As a result, the Greenstump area was the most attractive dabbler habitat.

Mud Lake pool was drawn down about a foot early in the season to provide buffer-reservoir space to prevent flooding of Greenstump by Mud Lake spill. As the season progressed Mud Lake filled to established pool level, but did not spill into Greenstump.

This early drawdown of Mud Lake pool (about 12,000 acres) is the main factor that enabled us to prevent flooded conditions that otherwise would have occurred in most pools. The refuge water control system is such that if Mud Lake level isn't kept in bounds, there is little chance of controlling most of the other pools.

Aquatic plant growth was good in most pools. Best stands were found in Webster, Madsen, CCC, Mud River, Headquarters, South, and peripheral water areas of Mud Lake. However most of the Mud Lake Pool proper was unproductive.

Ranking aquatic plants were Sago, curly leaf pondweeds, coontail, water milfoil, duck weed (*L. trisulca*) and white water buttercup.

Algae growth was extensive but not heavy enough to be detrimental, probably because of ample summer rains.

Insect production was tremendously high throughout the summer.

At the close of the period, about the middle of grain harvest, excessive rainfall prevented further farm work. Consequently, most grain fields in this locality are swathed and wet or partially flooded. It appears that there will be ample waterfowl food available until covered by snow.

It seems that March and April is the only period of critical food shortage for waterfowl in this area. Supplemental feeding on the refuge during this spring period is believed to have been a contributing factor in doubling last year's breeding duck population.

(3) Diseases and Losses.

There were no known diseases during the period. Periodic rainfall during the summer maintained a flow of water in all pools.

B. DOVES.

Mourning doves are not numerous in this area. A few were seen around headquarters and along the census routes. The population compares favorably with last year's general observations.

C. UPLAND GAME BIRDS.

The refuge is just about out of business in the upland game birds. No broods were seen during the period.

Three observations totaling 6 sharptails comprise the total birds seen.

D. PREDACEOUS BIRDS.

One mature american eagle was seen several times during the summer but no evidence of nesting was found.

Sparrow hawks, red-tailed, marsh, coopers, and sharp-shinned hawks were present.

Crows were seen in usual small numbers as were owls. The great horned is the principal owl with predatory inclinations on the refuge, and they are not overly abundant.

E. SMALL MAMMALS.

Muskrat, mink and beaver populations are near a record high and plans are being made for the harvest.

Skunk, fox and raccoon are also numerous and more than routine control measures are indicated.

F. BIG GAME ANIMALS.

The white tail population seems about the same as last year. The fawn crop is good and all deer seen are in excellent condition.

The first fawn seen May 31st. on the ridge between Webster Creek and Mud River.

No known losses occurred on the refuge. Two car kills were reported on the highway just off the refuge.

A 5-day rifle season to coincide with the State season, November 9-13, is being considered for this year.

Moose are still increasing. However, the refuge population seems to have leveled off at slightly more than 100 animals; evidently the increase is spreading into the eastern wilderness. No known losses occurred and reproduction was average.

Bear have been on the rampage this season. There have been at least 3 roaming the bee yards and plum thickets on the refuge. We know of 25 that have been killed in the County near the refuge. One was killed in the city of Thief River Falls.

This noticeable activity is undoubtedly the result of a combination of factors; A local increase in population coupled with a failure of the blueberry crop to the east of us. This crop failure plus torrential rains probably caused the bears to move out of their usual habitat in search of drier and choicer feeding grounds.

III REFUGE DEVELOPMENT AND MAINTENANCE

A. PHYSICAL DEVELOPMENT.

In accordance with preliminary plans, which were formulated last fall, the first of three new goose pens was constructed just east of the headquarters buildings. It is approximately three acres in extent. The location is ideal in that it can be kept under close observation, the activities of people in the vicinity of the buildings minimize potential losses to predators, and visitors can get a good look at the geese from the highway without bothering anyone at the office.

Most of the posts and wire for this new pen were salvaged from the large goose pen near Dahl Grove. The fence around the agricultural field at that point is not considered essential, and the large pen will be closed off accordingly. Corner posts and braces were taken from our refuge stockpile.

The only difficulty with the fine new pen is that no goslings arrived from Seney to occupy it!

Some progress was made on our project to move the three-stall garage from old secondary headquarters. The footings and foundation walls were poured on the new location at headquarters, and gravel hauled for ballast under the floor and ramp. The approach was graveled and a gravel base put in outside of the walls to facilitate drainage. The curtailment of funds in August stopped work on this project. However, it is planned to pour the floor in October and an agreement has been made with a mover to bring the building down shortly after freeze-up this fall.

B. MAINTENANCE.

In addition to the myriad items in this category that are accomplished in routine manner every period, the following are considered worth mentioning: Six man days spent blowing beaver dams that were obstructing ditches near privately owned land contiguous to the refuge. The local Game Warden (Carl Sundstrom) cooperated on this work handling all complaints personally that were phoned in by local farmers; he also removed those dams from the ditches just outside the refuge with our assistance. Most water control structures had to be cleared at least once, and at the Webster Control

the beavers, rather than bring in new material, would merely reach over into the pile of sticks recently removed by refuge personnel, and pull them back down into the structure-opening. We finally resorted to burning such material as soon as it had dried! We failed to see where the trapping program conducted on beaver last spring caused any abatement of the nuisance-factor on the refuge.

At headquarters the attic was insulated and sealed off for sleeping space at Qrts. No. 4; it was also wired and two heating ducts were run in from the furnace. The temporary fence around part of the winter goose pen was salvaged. More scrap was sold and several days work devoted to additional clean-up. Because of delays in supplying materials that were ordered through GSA, the curtailment of funds during the first quarter, and priorities on engineering service from the RO, little progress has been made on re-roofing the buildings or painting them. The painting will be deferred now until next spring, but it is hoped to get at least part of the residences re-roofed this fall. We are still awaiting Central Office Approval for completion of re-modeling at Quarters No. 5.

Two desks were received from the Veteran's Administration and they were transported to Mud Lake from Fargo, N. Dak. Arrangements were made for a commercial hauler to transport a D4 tractor and dozer from Shiawassee to Mud Lake. This tractor was moved without incident and will make a valuable addition to our complement of equipment. A load of corn was received from Squaw Creek, unloaded and stored at the goose pen.

A total of seven telephone poles were replaced and a number of wrap splices removed from the refuge line; Nico-Press Sleeves were substituted. Hay permittees have a way of hauling high loads from the field to the highway with disastrous results to our telephone line! This we are trying to discourage. The hail and windstorm in early July was responsible for blowing over a number of poles.

Two breaks in the dike along Thief River, adjacent to Thief Bay Pool, were repaired using the front-end loader on the Ford tractor. The muskrats caused both of these, but the beavers had plugged one before we got there!

One item of work, long-deferred, that will greatly facilitate water management in the future, was the installation of 18 permanent (and one temporary) water gauges. These gauges are zeroed in at the same base elevation so that they may be read direct by anyone, and the data recorded without

interpolation. The gauge sections were mounted on creosoted boards which, in turn, were anchored to the concrete on the head-walls with lagscrews and expansion shields. Also, a new form was developed for recording and reporting the information obtained. This is now accomplished at the same time the weekly waterfowl census is taken. The waterfowl transect route has been located to include most of the gauges.

C. CULTIVATED CROPS.

A total of approximately 90 acres of corn was planted by refuge personnel in blocks small enough to permit utilization by geese without resorting to knocking it down. Variety planted was Morden's 77.

In spite of about the worst possible growing weather during the period, it now appears that there will be a fair crop of some 60 acres. The balance was plowed under for winter wheat along with an additional 40-50 acres of land. Wheat plantings had barely been completed in late August when torrential rains drowned out over half of these fields. It was not possible to re-seed during September which means we shall be short for wheat for browse this year.

Approximately 60 acres of new ground has been fall-plowed, i.e. in August, and will be used for corn next spring. This plowing is attractive to geese in the fall and will compensate to some degree for the lack of wheat. Geese evidently feed on minute fragments of rhizomes and other sprouts left as a result of plowing, for their disposition toward such fields has been commonly observed in the past.

Our new farming equipment (mounted, for the most part) was of tremendous advantage in getting the crop in and cultivated under adverse conditions. The corn was checked and received one cultivation both ways plus one application of $\frac{1}{2}$ -pound of 2-4D per acre. It will be interesting to see just what the yield will be.

Soil and Moisture work is reported separately. Briefly, it was confined during the period to the improvement of surface drainage and a limited amount of land renovation with the Rome plow and D8 tractor. The dragline was used for cleaning approximately 3,000 lineal feet of ditch involving 6,000 Cu. Yards.

IV ECONOMIC USE

A. GRAZING.

One grazing permit covering 80 acres was in effect this period. Other applicants did not require permits because the wet season provided ample home pasture.

A conversion of land use from haying to grazing would provide more nesting area for the terrestrial nesting ducks.

B. HAYING.

Fifteen hay cutting permits are active this period. The tonnage is not yet known because the measuring and billing operation is still underway. Hay cutting operations were held in abeyance until the latter part of July this year. This may have a bearing on increased dabbling production.

C. VOLUNTEER CLOVER SEED HARVEST.

Seven permits were issued for harvesting volunteer clovers on a 50-50 share basis. Rainy weather has seriously hampered this operation. Most of the harvest is swathed. However, a few permittees are still hopeful of completing some of the harvest.

D. BEE KEEPING.

One permit was issued for 400 stands. Two of the yards have been raided by bears which caused considerable loss to the permittee.

E. CO-OP FARMING.

Farming operations under 16 co-operative agreements was programmed. Crops planted are largely barley, oats, grasses and legumes.

The growing season was fair, but to date only one permittee has completed crop harvest. Crop fields have been wet or flooded since Labor Day weekend. So refuge ducks will collect full share this year!

V FIELD INVESTIGATIONS

Most of this work centered around our student assistant throughout the period. Of prime importance was to evaluate the use by nesting waterfowl of the various types of habitat afforded by the refuge.

The results of these studies were mostly negative, either due to non-use of habitat, such as the small nesting islands developed near the mainland, or owing to the difficulty experienced in finding waterfowl nests. The work was not started until June (after the spring term at the University had finished).

Aside from the assistance rendered in making routine wildlife observations, the best results were achieved by this man in establishing and running out transects in most of the pools to obtain qualitative and quantitative data on submerged aquatics. This was done by air boat (i.e. the Dragonfly motor on the Gruman square-stern canoe). After the transect was established, two men were used to make the run. One man did the navigating by compass and ran the motor, while the other took soundings, obtained plant specimens, and recorded frequency of plant occurrence on a time-interval basis. Special forms were developed for recording data and the transects were plotted individually and collectively on a base map for future reference. All plant specimens were identified, pressed and placed in the refuge herbarium.

Experimental work with certain herbicides was continued including the spraying of three replicated plots of phragmites with amino triazole "Weedazol" using ground equipment. Two strips approximately 45 feet wide and $\frac{1}{4}$ mile in length of cattail (*t. latifolia*) were sprayed with the aircraft to test application methods for amino triazol under limitations imposed by aerial spraying. Benzoic acid was applied to quack grass on a newly-turned piece of ground which was subsequently planted to corn. A fall application of the amine form of benzoic acid (much cheaper) was made on two replicated plots of quackgrass in combination with certain cultural practices calculated to speed root-drying and kill. The chemicals for this work were supplied (without charge) by the American Paint and Chemical Co. Results thus far are promising and will be reported in more detail in

the December 31 NR together with other herbicide data submitted in connection with weed control.

A conference with the State waterfowl technicians resulted in our not doing any waterfowl banding this summer. It developed that the State crews had done sufficient summer banding in the vicinity of the refuge to provide any data we might want. Another consideration was that the volume of data from previous years' bandings at the refuge is considerable, most of which has never been summarized and evaluated. Also, we hesitated to take time that would otherwise be spent on the plant transects and waterfowl production surveys for banding.

BLACKBIRD BANDING.

<u>Species</u>	<u>Total Banded</u>	<u>1956</u>	<u>1957</u>
Yellowheads	240	100	140
Red Wings	112	53	59
Cowbirds	57	31	26
Grackles	9	8	1
Subtotals	418	192	226

Incidental Banding.

Song Sparrows	6	0	6
Mourning Doves	15	10	5
Totals	439	202	237

The above table summarizes a special banding project by Clerk Jim Thompson initiated in 1956. Trapping was done as the opportunity presented during the summer months. Because the traps were in his front yard, there was some interference by dogs, children, and adults.

It is of interest to observe that, while no foreign returns have, as yet, come in, all of the blackbirds (including cowbirds) were common repeaters in the trap from May 1-August 31. The greatest time-interval between repeats was for a male yellowhead trapped May 11, 1957 and re-captured August 20, 1957. Most common interval for blackbird repeaters was 40 days.

Date	Name & Title	Organisation, Firm or Agency	Purpose	Time
5/2	Robert E. Farnes Thief River Falls, Minn.	Area Game Biologist Minn. Cons. Dept.	Beaver Trapping	2 hrs.
5/2	Hans Uhlig Fergus Falls, Minn.	SCS Biologist	Courtesy Call	2 hrs.
5/2	Don Lawrence Thief River Falls, Minn.	Farm Planner, SCS	Courtesy Call	2 hrs.
--	Carl Sundstrom Thief River Falls	State Game Warden	Numerous visits	
5/19	John M. Dahl Rochert, Minnesota	Refuge Manager, Tamarac Refuge	Visit	3 hrs.
5/21	Forrest L. Lee St. Paul 1, Minn.	Waterfowl Biologist Minnesota Cons. Dept.	Courtesy Call	3 hrs.
5/21	Bill Morse St. Paul, Minnesota	Biologist Minn. Cons. Dept.	Courtesy Call	3 hrs.
6/4	Merrill Hammond Unham, N. Dak.	Biologist, Lower Souris Refuge	Brood Census	1 day.
6/8-9	Stan Harris St. Paul, Minnesota	Biologist Minn. Conservation Dept.	Drawdown study	2 days
6/11	Allan J. Downs	Prof. U. of Minnesota Minneapolis, Minn.	Wildlife Photos	1 day
6/18	Robert E. Farnes Thief River Falls, Minn.	Area Game Biologist Minn. Cons. Dept.	Courtesy Call	2 hrs.
6/18	Forrest L. Lee St. Paul 1, Minn.	Waterfowl Biologist Minnesota Conservation Dept.	Courtesy Call	2 hrs.
6/21	Allan J. Downs Minneapolis, Minn.	Prof. U. of Minnesota	Wildlife Photos	2 days

Date	Name & Title	Organization, Firm or Agency	Purpose	Time
6/23 8. 24	John Carlsen & Family Mayville, Wisconsin	Horicon Refuge Asst. Refuge Manager	Courtesy Call	2 days
6/25	William Ellerbrock St. Paul, Minnesota	Game Management Agent	Pick up supplies	1 hour
7/1	Roy Bennett St. Paul, Minnesota	SCS Supervisor	See Refuge	3 hrs.
7/1	Wallace Anderson St. Paul, Minnesota	SCS Supervisor	See Refuge	3 hrs.
7/1	Hans Uhlig Fergus Falls, Minn.	SCS Biologist	Courtesy Call	3 hrs.
7/2	Mrs. Wm. S. Woodson & son 306 Grandview Circle.	Ridgewood, N. J.	See Refuge	4 hrs.
7/3	John McMartin Grygla, Minnesota	SCS Work Unit Conservationist	Farming	1 hr.
7/11	Morris Patterson Rochert, Minnesota	State Conservation Department	Courtesy Call	2 hrs.
7/11	Grady Mann Fergus Falls, Minn.	MRBS, Field Biologist	Drainage problem	1 day
7/17	Erwin Boeker Minneapolis	FWS, Pilot Biologist	Brood Count	1 day
7/22	Sgt. Aud Johnson Bemidji, Minnesota	G. O. C. Representative	Observ. Post	1 hr.
7/22	John Szarkowski St. Paul, Minn.	Photographer Minn. Dept. Cons. Dept.	Wildlife Photos	1 hr.
7/23	James L. Stillings Rochert, Minn.	Maintenance Man Tamarac Refuge	Pick up Equipment	4 hrs.

Date	Name & Title	Organization, Firm or Agency	Purpose	Time
7/23	Richard Nord Rochert, Minnesota	Student Assistant Tamarac Refuge	Pick up Combine	4 hrs.
7/29	Oscar Erickson Warren, Minnesota	Sheriff, Marshall County	Courtesy Call	1 hr.
7/30	Dr. L. W. Melander St. Paul, Minnesota	American Chemical Company	Cattail Control	several calls
8/2	Oscar Erickson Warren, Minnesota	Sheriff, Marshall County	Info. on death	2 hrs.
8/2	Lawrence Hedin St. Paul, Minnesota	State Crime Lab.	Info. on death	2 hrs.
8/3	Richard Nord Rochert, Minnesota	Student Assistant Tamarac Refuge	Courtesy Call	6 hrs.
8/5	Robert E. Farnes Thief River Falls, Minn.	State Area Game Biologist	Trapping Season	3 hrs.
8/9	Erling Wyberg Warren, Minnesota	Marshall County Agent	Courtesy Call	½ hr.
8/11	E. L. Ecklund & Son Bemidji, Minnesota	Scout problem	Scouting	3 hrs.
8/13	Merrill Hammond Upham, N. Dak.	Biologist, Lower Souris Refuge	Brood Census	2 days
8/13	Erwin Boeker Mpls. Minn.	Pilot-Biologist U.S.F.W.S.	Brood Census	2 days
8/24	Forrest L. Lee St. Paul, Minnesota	Waterfowl Biologist Minn. Conserv. Dept.	Courtesy Call	2 hrs.
8/24	Stanley E. Harris St. Paul, Minn.	Biologist Minn. Conserv. Dept.	Courtesy Call	2 hrs.

C. REFUGE PARTICIPATION.

A number of appearances were made before various groups as follows:

Organization	Material Used	Attendance	Presentation Made By
Ringbo 4H Club Middle River, Minnesota	Refuge Slides	20	Dill
Pennington Co. Sportsmans Club Thief River Falls	Refuge Slides	35	Dill
Holt 4H Club Holt, Minn.	Refuge Slides	30	Dill
Moorhead State Teachers College Moorhead, Minn.	Refuge Slides	16	Dill
U. Of Minnesota Ecology Class Itasca, Minn.	Refuge Slides	24	Dill
Celebration Holt, Minnesota	talk	200	Dill
Luthern League Holt, Minnesota	Refuge Slides	50	Dill

D. HUNTING.

None this period.

E? FISHING.

None.

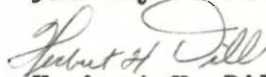
F. VIOLATIONS.

None on the refuge to anyone's knowledge.

Credits:

Section I . . Thompson & Dill
Section II . Abney & Gard
Section III . Dill
Section IV . Abney
Section V . . Dill & Erickson
Section VI . Thompson
Photos . . . Thompson
Editing . . . Dill
Typing . . . Thompson & Thompson & Gard

Respectfully submitted this
3rd day of October, 1956



Herbert H. Dill, Refuge Manager

G Warkins
Regional Office Approval By:

DUCK BROOD OBSERVATIONS REQUESTED BY MR. GRIFFITH'S WATERFOWL

BROOD COUNT MEMO, UNDATED(ABOUT 1951)

Note: These are not the sample brood observations used in the production estimate.

Class I Brood Observations		# of	# of
Species	Number of birds/brood	broods	young
Mallard	5 2 8 5 6 7 8 9 1 18 9 1 4 7 5 5 5 6	18	111
Black	9	1	9
Gadwall	10 9 10 10 9 10 9 10 9 6	10	92
Widgeon	9	1	9
Pintail	9 5	2	14
G. W. Teal	7 11 5	3	23
B. W. Teal	7 11 13 10 10 12 6 6 6 5 2 10 6 4 3 5 12 5 5 10 9 6 4 6 6 10 8 6	28	203
Redhead	9 9 10 7 9 6 5 9 9 6 7 7	12	93
Ringneck	10 1 9 11 7 9 7 5 9 8 4 4 7 5 3 8 7 9 7 11 5 6 3 4 4	25	163
Canvasback	12 3 7 7 7 5 6 8	8	55
Ruddy Duck	4 2 5 5 8 3 5 3 6 5 3 5	12	54
(A) Total # of Broods		120	
(B) Total # of Young			826
Average Brood Size (B÷A)		6.88	

Class II Brood Observations

Species	Number of Birds/Brood	# of Broods	# of Young
Mallard	12 10 2 9 8 7 9 8 9 5 4 4 5 7 7	15	106
Gadwall	3 14 7 6 4 9 8 3	8	54
Widgeon	4 5	2	9
Pintail	2 9	2	11
B. W. Teal	11 8 6 2 13 4 1 4 6 5 10 2 6 3 9 7 6 7 8 4 6 6 2 7	24	143
Shoveler	5	1	5
Redhead	7 8 6 5 7 9 7 9 5 1 8 2	12	74
Ringneck	7 4 10 5 5 7 3 7 6 8 9 5 4 5 4 2 8 3 2	19	104
Canvasback	10 5 3 5	4	23
Ruddy Duck	5 4 7 5 7 6 5	7	39
(A) Total # of Broods		94	
(B) Total # of Young			568
Average Brood Size (B÷A)		6.04	

Class III Brood Observations

Species	Number of Birds/Brood	# of Broods	# of Young
Mallard	6 2 3 9 10 8 10 5 8 8 3 6 6 9 9 6 3 9 6 3 10 2 2 5 9 10 5 5 9 7 9 5 6 8 4 8 6 3	38	242
Gadwall	11 10	2	21
Widgeon	4	1	4
Pintail	11 8 6 4	4	29
B. W. Teal	5 8 5 5 11 3 3 2 2 11 16 7 6 2 6 3 16 8 4 4 8 6 4 4 2 4	26	155
Shoveler	3	1	3
Redhead	4	1	4
Ringneck	1 7 3	3	11
Ruddy Duck	2	1	2

(A) Total # of Broods 77

(B) Total # of Young 471

Average Brood Size (B÷A) 6.12

(C) Total # of Broods
(All Classes) 291(D) Total # of Young
(All Classes) 1865

Average Brood Size (D÷C) 6.41

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

WATERFOWL

REFUGE Mud Lake Refuge

MONTHS OF May TO September, 19

(1) Species	(2) Weeks of reporting period									
	5/1-7 1	5/8-14 2	5/15-21 3	5/22-28 4	5/29-6/6 5	6/7-13 6	6/14-20 7	6/21-27 8	6/28-7/4 9	7/5-11 10
Swans:										
Whistling	1				1					
Trumpeter										
Geese:										
Canada *	140	125	90	70	70	80	90	100	110	120
Cackling										
Brant										
White-fronted										
Snow										
Blue										
Other										
Ducks:										
Mallard	1110	1690	1780	1780	3059	3616	4173	4730	5287	5844
Black		30	20	20	83	100	117	134	151	168
Gadwall	1000	1220	380	180	364	529	694	859	1024	1189
Baldpate	1390	380	400	340	348	383	418	453	488	523
Pintail	150	20	120	120	149	210	271	332	393	454
Green-winged teal	230		40	40	41	67	93	119	145	171
Blue-winged teal	6770	2510	2010	1200	1778	2299	2820	3341	3862	4383
Cinnamon teal										
Shoveler	430	230	220	70	33	54	75	96	117	138
Wood	10			50	33	50	67	84	101	118
Redhead	990	430	760	850	992	1188	1384	1580	1776	1972
Ring-necked	2510	1140	500	760	761	1045	1329	1613	1897	2181
Canvasback	20	20		40	33	122	211	300	389	478
Scaup	2530	440	250	150	207	213	219	225	231	237
Goldeneye			220							
Bufflehead	100									
Ruddy	50		20	20	389	495	601	707	813	919
Other										
Coot:	1110	1260	390	310	913	1128	1343	1558	1773	1988

* Does not include penned birds.

Cont. NR-1
(Rev. March 1953)

WATERFOWL
(Continuation Sheet)

MONTHS OF May TO September, 1957

(1) Species	(2) Weeks of reporting period								(3)	(4)	
	11	12	13	14	15	16	17	18	Estimated waterfowl days use	Production Broods: Estimated seen : total	
Swans:		1	1	1							
Whistling Trumpeter											
Geese:	130	140	150	160	160	170	180	180	15,855	12 90	
Canada											
Cackling											
Brant											
White-fronted											
Snow											
Blue											
Other											
Ducks:	6400	6952	7315	8072	8079	8079	8079	5520	414,797	77 9020	
Mallard	185	202	217	236	240	240	240	200	17,095	2 157	
Black	1354	1519	1624	1819	1852	1852	1852	1800	137,807	21 1488	
Gadwall	998	993	628	663	666	666	666	4050	75,061	5 318	
Baldpate	515	576	637	692	698	698	698	310	47,793	9 549	
Pintail	197	123	249	275	213	253	283	160	19,493	4 222	
Green-winged teal	4904	5425	5946	6427	6470	6470	6470	3150	518,575	69 4692	
Blue-winged teal											
Cinnamon teal	199	188	201	222	222	222	222	80	20,397	3 189	
Shoveler	135	152	169	186	193	193	193	70	12,278	2 160	
Wood	2168	2364	2560	2756	2758	2758	2758	1420	213,268	28 1766	
Redhead	2465	2749	3033	3317	3321	3321	3321	1770	250,381	40 2560	
Ring-necked	567	696	745	834	836	836	836	600	49,661	13 803	
Canvasback	243	249	255	261	265	265	265	30	45,595	1 50	
Scaup									1,540		
Goldeneye									700		
Bufflehead	1025	1131	1237	1343	1350	1350	1350	760	92,180	18 961	
Ruddy											
Other											
Total Ducks							27,233		2,115,561	292 18,963	
	2203	2410	2633	2848	2848	2848	2848	2320	217,573	50 1935	
Coot:	*Duck Broods seen: non-duplicated broods counted from car on 19 mile sample route (10% of refuge)										

(over)

	(5)	(6)	(7)	SUMMARY
	Total Days Use	Peak Number	Total Production	
Swans	35	1	no known	Principal feeding areas
Geese	15,855	100	90	
Ducks	2,115,561	27,233	10,063	Principal nesting areas
Coots	217,573	2,340	1,935	Geese: Webster, Mud Lake, Green Stump, and Goose Bay. Ducks: Mud Lake, Hansen, Webster, Green Stump, Headquarters, and South. Coots: Headquarters, Mud Lake, South, Hansen and Webster.
				Reported by
				R. M. Abney

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).

3-1751

Form NR-1A

(Nov. 1945)

MIGRATORY BIRDS
(other than waterfowl)Refuge Mud Lake RefugeMonths of May to August 1945

(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>										
Great Blue Heron			Summer Resident							
Black-crowned Night Heron			"	"						
American Bittern			"	"						
Horned Grebe			"	"						
Pied-billed Grebe			"	"						
Hoebel's Grebe			"	"						
Eared Grebe			"	"						
Double-crested Cormorant			"	"						
Western Grebe			Rare Visitor							
II. <u>Shorebirds, Gulls and Terns:</u>										
Franklins Gull			Summer Resident							
Black Tern			"	"						
Common Tern			"	"						
Killdeer			"	"						
Yellowlegs			"	"						
Sandpipers			"	"						
Plovers			"	"						
Wilson Snipe			"	"						

(over)

(1)	(2)	(3)	(4)	(5)	(6)
III. <u>Doves and Pigeons:</u>					
Mourning dove	Summer Resident				
White-winged dove					
IV. <u>Predaceous Birds:</u>					
Golden eagle					
Duck hawk					
Horned owl	Summer Resident				
Magpie					
Raven					
Crow	Summer Resident				
Marsh Hawk	" "				
Red-tailed Hawk	" "				
Sparrow Hawk	" "				
			Reported by <u>R. M. Abney</u>		

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.

3-1750
Form NR-1B
(December 1956)

UNITED STATES
DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service

WATERFOWL UTILIZATION OF REFUGE HABITAT

Refuge Mud Lake Refuge

For 12-month period ending August 31, 1957

Reported by R. M. Abney

Title Ass't Refuge Manager

(1) Area or Unit Designation	(2) Habitat Type Acreage	(3) Use-days	(4) Breeding Population	(5) Production		
#1 Northwest	Crops	320	Ducks	338,083	1095	975
	Upland		Geese	16,164	6	9
	Marsh	1560	Swans			
	Water	4380	Coots	40,701	65	116
	Total	6260	Total	394,948	1166	1100
.....						
#2 Wiskey Lake	Crops	640	Ducks	42,260		
	Upland	3840	Geese			
	Marsh	1740	Swans			
	Water	300	Coots			
	Total	6520	Total	42,260		
.....						
#3 Webster - Kelley	Crops	160	Ducks	1,521,364	241	3,246
	Upland	1300	Geese	24,246	14	21
	Marsh	600	Swans	416		
	Water	1980	Coots	106,842	98	155
	Total	4040	Total	1,652,868	353	3,422
.....						
#4 Hagen	Crops	2320	Ducks	84,520	97	908
	Upland	7220	Geese	24,250	8	12
	Marsh	2360	Swans			
	Water	700	Coots			
	Total	12,600	Total	108,770	105	920
.....						
#5 Mud Lake	Crops	770	Ducks	380,341	2169	3506
	Upland	100	Geese	40,411	14	21
	Marsh	3200	Swans	3,000		
	Water	9800	Coots	55,965	109	348
	Total	14,470	Total	479,717	2292	3875
.....						
#6 Madsen	Crops		Ducks	422,601	1042	3246
	Upland		Geese	4,849	2	3
	Marsh	490	Swans			
	Water	1540	Coots	122,105	206	232
	Total	2030	Total	549,555	1250	3481
.....						
#7 Green Stump	Crops	100	Ducks	1,056,503	2147	3118
	Upland	100	Geese	32,328	8	12
	Marsh	790	Swans			
	Water	1650	Coots	20,354	98	
	Total	2640	Total	1,109,185	2253	3130

(over)

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

INSTRUCTIONS

- (1) **Area or Unit:** A geographical unit that, because of size, terrain characteristics, habitat type and current or anticipated management practices, may be considered an entity apart from other areas in the refuge census pattern. Estimated acreage of each unit should be indicated.
- (2) **Habitat:** Crops include all cultivated croplands such as cereals and green forage, planted food patches and agricultural row crops; upland consists of all uncultivated terrain lying above the plant communities requiring seasonal submergence or a completely saturated soil condition a part of each year, and includes lands whose temporary flooding facilitates use of non-aquatic type foods; marsh extends from the upland community to, but not including, the water type and consists of the relatively stable marginal or shallow-growing emergent vegetation type including wet meadow and deep marsh; and the water category includes all other water areas inundated most or all of the growing season and extends from the deeper edge of the marsh zone to strictly open-water areas, embracing such habitat as shallow playa lakes, deep lakes and reservoirs, true shrub and tree swamps, open flowing water and maritime bays, sounds and estuaries. Acreage estimates for each type should be kept as accurate as possible through reference to available maps supplemented by periodic field observations and should agree with unit acreage.
- (3) **Use-days:** Use-days is computed by multiplying weekly waterfowl population figures by seven.
- (4) **Breeding Population:** An estimate of the total breeding population of each category of birds for each area or unit.
- (5) **Production:** Estimated total number of young raised to flight age.

3-1750
Form NR-1B
(December 1956)

UNITED STATES
DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service

WATERFOWL UTILIZATION OF REFUGE HABITAT

Refuge Mud Lake Refuge For 12-month period ending August 31, 19 57
Reported by R. M. Abney Title Asst Refuge Manager

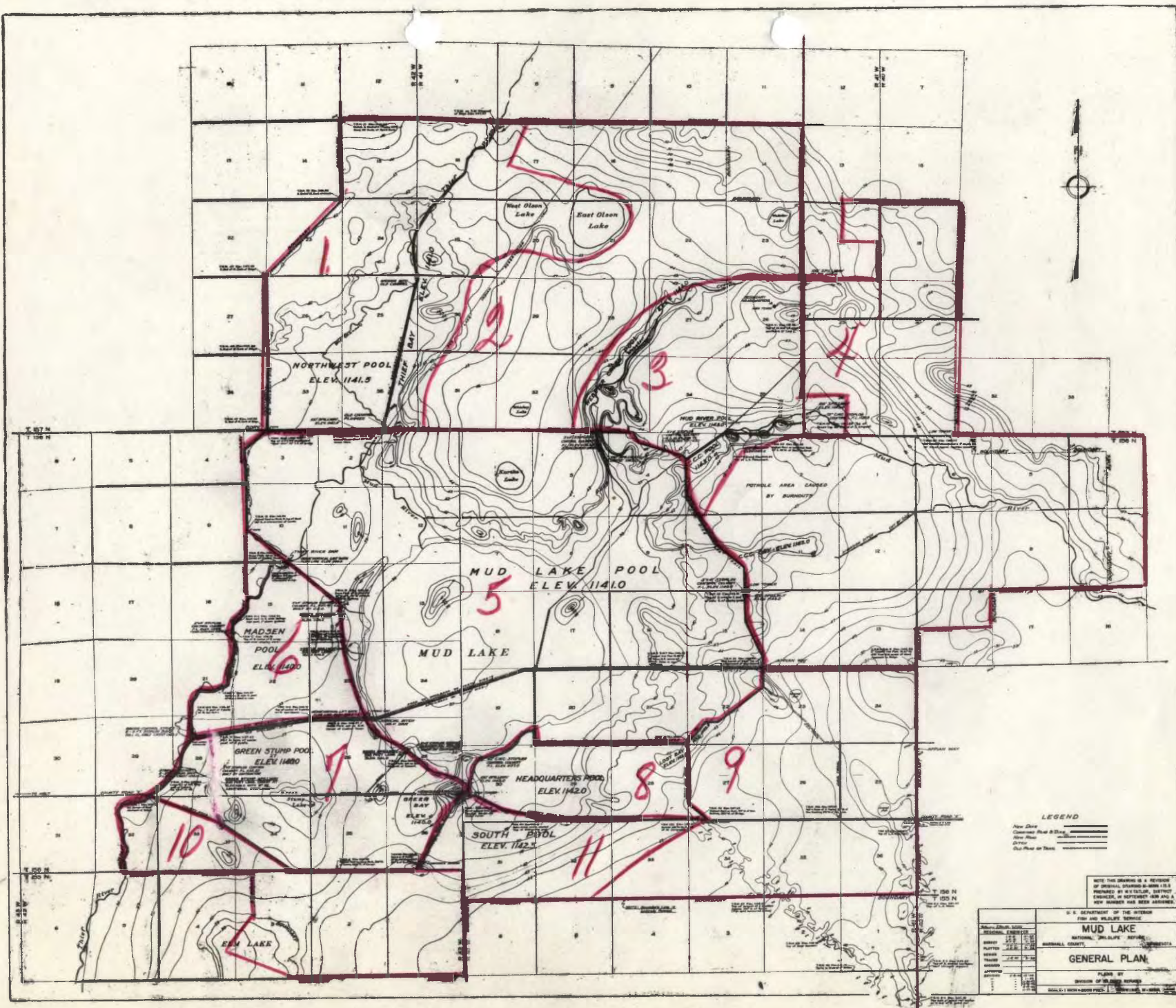
(1) Area or Unit Designation	(2) Habitat Type Acreage	(3) Use-days	(4) Breeding Population	(5) Production
#8 Headquarters	Crops 40	Ducks 126,780	322	2014
	Upland 20	Geese 4,849	2	3
	Marsh 700	Swans		
	Water 1080	Coots 106,842	172	813
	Total 1840	Total 238,471	496	2830
#9 Lost River	Crops 800	Ducks 84,520	65	520
	Upland 1880	Geese 4,849	2	3
	Marsh 1600	Swans		
	Water 200	Coots 3,087	2	
	Total 4480	Total 94,456	69	523
#10 Davidson	Crops 320	Ducks 42,260	11	66
	Upland 3630	Geese 4,849	2	3
	Marsh 170	Swans		
	Water 100	Coots		
	Total 4220	Total 47,109	13	69
#11 South	Crops	Ducks 126,780	581	1364
	Upland 900	Geese 4,849	2	3
	Marsh 800	Swans		
	Water 200	Coots 30,877	163	271
	Total 1900	Total 182,506	746	1638
Total Refuge	Crops 5470	Ducks 4,226,012	8,270	18,963
	Upland 18,990	Geese 161,644	60	90
	Marsh 14,610	Swans 3,416		
	Water 21,930	Coots 508,773	913	1,933
	Total 61,000	Total 4,899,845	9,243	20,986
	Crops	Ducks		
	Upland	Geese		
	Marsh	Swans		
	Water	Coots		
	Total	Total		
	Crops	Ducks		
	Upland	Geese		
	Marsh	Swans		
	Water	Coots		
	Total	Total		

(over)

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DESCRIPTION & EVALUATION OF HABITAT TYPES.

Northwest Area #1.

Includes Northwest, Tamarack and Thief Bay Pools; also East and West Olson Lakes. Thief River flows through the area from north to south. Estimated water area is 4380 acres. Except for Thief River, water areas are shallow, the slope is southward. The shallower water areas contain extensive willow and cattail growths.

Most open water areas are located in the south part of the area. The water area is bordered on the north and east sides by a strip of wet marsh covering approximately 1560 acres.

There are about 320 acres of cropland along the north border of the area. The main agricultural use has been for hay, however, a conversion to pasture would benefit terrestrial nesting waterfowl on this land as well as the joining wet marsh edge.

This area ranks fourth in size; fifth in water fowl use, fourth in nesting, and seventh as a brooding area.

Whiskey Lake Area #2.

The Whiskey Lake area contains 3800 acres of spruce - tamarack. There are three small lakes totaling about 300 acres. There are 640 acres of cropland along the north and northeast side of the area. There is a strip of marsh totaling approximately 1740 acres which lies between the cropland and the conifer section.

The area ranks third in size; eleventh (last) in waterfowl use, last in nesting, and last as a brooding area. Its importance is greatest for moose and deer.

Webster - Kelly Area #3.

This area embraces Webster, Kelly, Mud River, and upper CCC Pools. Also the lower reaches of Webster Creek and Mud River empty into their respective pools. The total water area is about 1980 acres. The bordering marsh strip of 600 acres is choice allaround waterfowl habitat. There are 130 acres of cropland which provides fall feeding areas and 1300 upland acres for terrestrial nesters.

The area ranks seventh in size; first in waterfowl use, fifth in nesting, and third as a brooding area.

Hagen Area #4.

This area embraces most of the refuge upland habitat. Lower CCC Pool is located along the west boundary of the area just north of the summer goose pen. Mud River and Webster Creek flow thru the area from east to west. There are approximately 700 water acres in the entire 12,600 acre area. The 7220 acres of upland is largely grazing land reverted to brush. This is choice deer and moose range. There are approximately 2320 acres of cropland which include hay meadow. Rehabilitation of the pasture land and re-establishment of grazing as a land-use are recommended practices to benefit nesting waterfowl.

There are about 2360 acres of wet marsh meadow to the southwest of the upland habitat. The area ranks second in size, eighth in waterfowl use, eighth in nesting, and eighth as a brooding area.

Mud Lake Area #5.

This area is the largest of the eleven areas and it comprises approximately 14,470 acres. The Mud Lake Pool contains 9,800 water acres (almost half of the total refuge water area) controlled as one pool.

All of the pools, except three, empty into Mud Lake, which so to speak, lies in the center of the refuge.

This water control arrangement is not suited for water fowl management techniques.

There are 3800 acres of marsh, largely closed cattail growth. Most of the 100 acres of upland consists of scattered islands. Improvement of these islands will greatly benefit waterfowl useage.

There are 770 acres of cropland along the east side of the area adjacent to the goose pen in area #4. This land is well located for fall feeding grounds.

This unit ranks first in size, fourth in water fowl use, first in nesting and first as a brooding area.

Madsen Area #6.

This area contains 1540 acres of water and 490 acres of marsh. The interspersion of water and marsh cover is good. Some control of willow brush should be planned for waterfowl habitat improvement.

This area ranks ninth in size, third in waterfowl use, third in nesting, and second as a brooding area.

Green Stump Area #7.

Green Stump Pool was in the process of water draw down this year. Habitat acreages quoted are for normal pool elevation, but the various waterfowl uses were under draw-down conditions. At regular pool level, the area contains 1650 acres of water. The water area is controlled as one pool, but is divided by a natural barrier into east and west portions.

The water area is interspersed with islands totaling 100 acres of upland. There are 100 acres of crop land, largely hay and pasture at the west end of the area. There are 790 acres of marsh, large portions of which are dense cattail.

This area ranks eighth in size, second in water fowl use, second in nesting, and fourth as a brooding area.

Headquarters Area #8.

This area contains about 1080 acres of water in the west end. There are 40 acres of cropland and 20 upland acres along the east edge. The central portion is marsh, totaling about 700 acres. Much of the marsh is dense cattail with some willow brush.

The water control outlet is not large enough to maintain desired water levels.

This area ranks eleventh (last) in size, sixth in waterfowl use, seventh in nesting, and fifth as a brooding area.

Lost River Area #9.

This area includes several small pools; Dahl, East, and Lost Bay, totaling 200 acres. There are approximately 1600 acres of marsh, 1880 acres of upland, and 800 crop acres.

This area ranks fifth in size, ninth in water fowl use, ninth in nesting, and ninth as a brooding area.

Davidson Area #10.

Davidson area is an undeveloped area containing 100 acres of water, 170 acres of marsh, 3630 upland acres, and 320 crop acres. Development plans have been prepared in the 10 Year Development Plan.

The area ranks sixth in size, tenth in nesting and tenth as a brooding area.

South Area #11.

This is a natural impoundment by beaver dams. Some degree of water control is exercised by occasional opening of the beaver dams. The area contains 200 acres of water. There are about 800 acres of marsh, largely cattail; and 900 upland acres.

The area ranks tenth in size, seventh in water fowl use, sixth in nesting, and sixth as a brooding area.

3-1752
Form NR-2
(April 1946)

UPLAND GAME BIRDS

1613

Refuge Mud Lake Refuge

Months of May

to August, 1952

(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.
Ruffed Grouse									Present	Population at extreme low
Sharptail Grouse									Present	Population at extreme low
Pheasant										Possibly present
Hungarian Partridge										Possibly present
Pinnated Grouse										Possibly present

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.

3-1570
NR-8a

REFUGE GRAIN REPORT

Refuge Mud Lake Refuge

Months of May thru August 1957

(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.
Corn, shelled	86	8	94	0	8	71	79	15		15	
Corn, ear		100	100			100	100	none			
Oats	12							12		12	
Wheat, winter	90				49	2	52	38	38		
Rye, winter	92					6	6	86	86		
Barley	354					102	102	252		48	154
Buckwheat	4							4		4	
Flax	15							15			15
Wheat, Sp., treated	16				6		6	10	10		
Red Clover	10							10	10		
Sweet Clover	140			50		1	51	89			89

- (8) Indicate shipping or collection points Holt, Minnesota
- (9) Grain is stored at all at Hdqts. barn, except; 124 bu. barley in steel bin and 14 bu. barley and 4 bu. rye at secondary barn.
- (10) Remarks 50 bu. sweet clover transferred to Squaw Creek Refuge in return for 100 bu. ear corn.

REFUGEE GRAIN REPORT

NR-8a REFUGEE 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.

General view of refuge corn field from newly
turned sod last spring, most of which was quack grass.
Corn in the foreground is growing on a portion of the
field treated with benzoic acid; that in the background
not treated. (Corn: Morden's 77)



Closeups of corn in the field shown on the preceding page. The entire field has been cultivated once; half was treated with four pounds benzoic acid (experimental - see Section V) per acre. A two-foot ruler is in both pictures.



A panoramic view of the cornfield in which virtually a solid stand of quackgrass on half the field was treated with benzoic acid. The portion of the field to the right is untreated.



Wet weather ruined about one-third of the
refuge corn which was plowed under for winter wheat
ground in August. Shortly after the wheat was seeded
torrential rains in early September ruined over half
the wheat! Farming is a frustrating business!



The new 3-acre pen for the geese, east of headquarters buildings, is rushed to completion in June - for Seney goslings that never arrived.

This pastoral scene is part of our resident goose flock moved into the new goose pen, from the large summer pen, to safeguard them from possible predation. Many visitors at headquarters delight in seeing these geese in such attractive surroundings. They produced four broods this year totaling thirteen young - a record for Mud Lake.



Wild rice seedings in Ditch 11 showed appreciable gains this summer - only to be nearly wiped out by highwater early in September.



Part of our "refuge" kids enjoy the swings erected this summer. This recreation area at headquarters was sorely needed. The geese in the back ground often are seen grazing within a few feet of the boisterous youngsters!

So it's "Hi Ho, and off to school we go September 3rd! A new bus, new driver, and the first day of school for Master Wesley "Pokchop" Thompson. The attractive young lady is Sharon Abney.



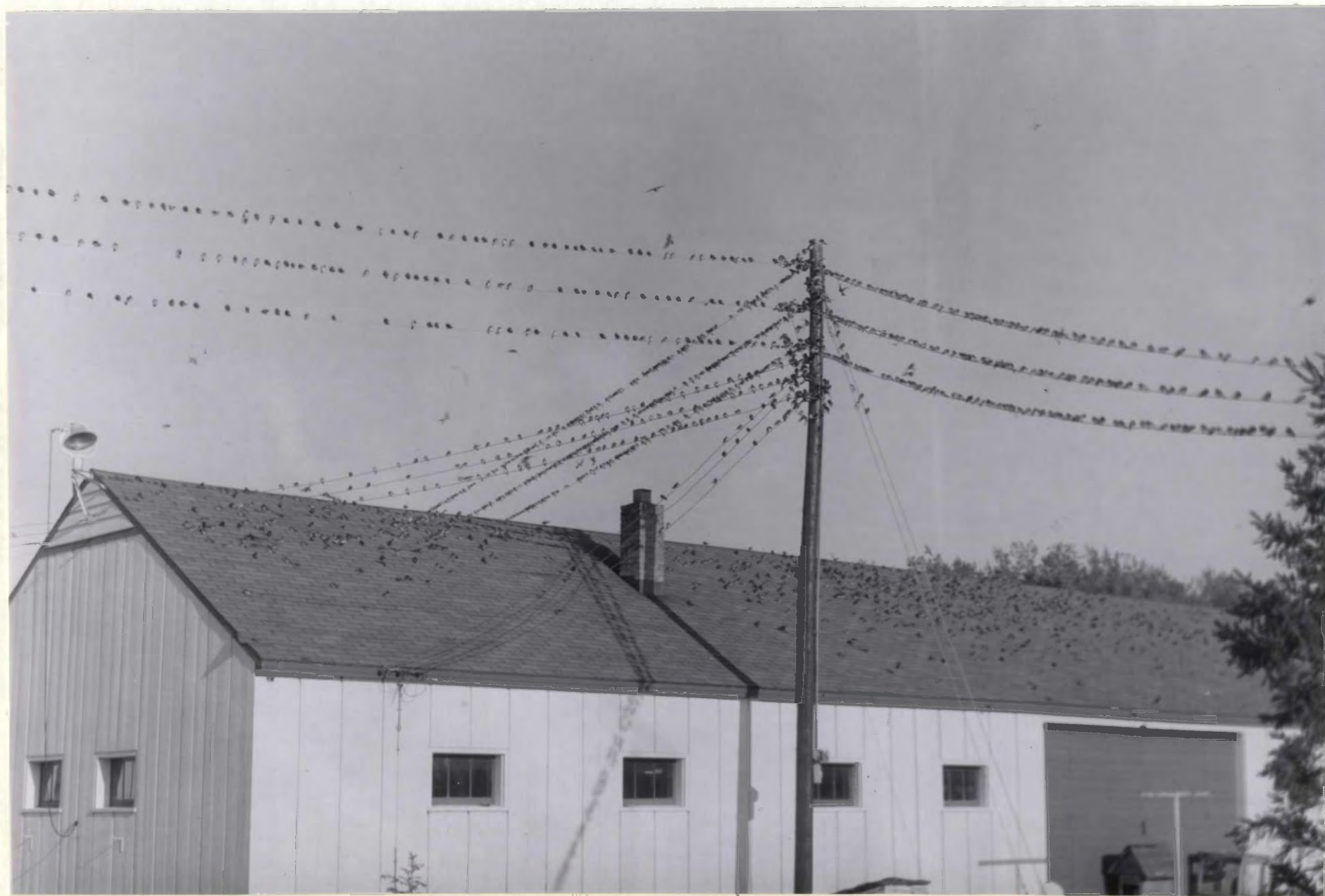
Our new Hanson Brodjet sprayer rig proved to be very useful and efficient for roadside and field spraying. The hand nozzle is good for spot spraying; also, it can be effectively used for fire suppression or cleaning up heavy equipment.



The John Deere "Gyromor" mower-mulcher eliminates the time-consuming raking job incident to cutting the grass and weeds around the headquarters perimeter area. It also fills the bill nicely for mowing trails, fencelines and firebreaks. Much sturdier than a conventional mower, it can be used on most farm tractors. We interchange it between the Ford and Case tractors in a matter of minutes. Maintenance Foreman Davidson states: "The best all-around piece of refuge equipment I have seen for utility mowing."



The decline of summer in northern Minnesota is marked by the swallow's flocking. In the picture they huddle for warmth on the roof of the equipment building on a "cool" August morning!



Ditching dynamite does a fair job of opening a small channel for de-watering part of Green Stump Pool.



Pouring the footings and the finished foundation walls for 3-stall garage - to be moved down from old secondary headquarters after freeze up. Gravel fill is soaked with water to facilitate settling. Pouring the floor was abruptly postponed by the curtailment of funds in August.

