SQUAW CREEK NWR
NARRATIVE REPORT - 1967

1967

NARRATIVE REPORT

SQUAW CREEK NATIONAL WILDLIFE REFUGE

PERMANENT PERSONNEL

Refuge Manager GS-11 . . . . . Harold H. Burgess
Biological Technician GS-6 . . . . . Albert J. Yocum
Operator General . . . . . William R. Hamilton
Dragline Operator (Retired 12/27/67) . . . . . Alva W. Bomar
Maintenanceman (Seasonal). . . . . .Walter J. Boyd

See Photo #5.

TEMPORARY PERSONNEL

Clerk-Typist GS-3 (Part-time). . . . . .Mrs. Shirley A. Zeliff
Biological Technician GS-5 . . . . . Stanley S. Cornelius
(1/1-3/11/67)
Biological Technician GS-5 . . . . . Ronald D. Andrews
(EOD 8/28/67)
Laborer (WAE). . . . . John R. Boyd
(6/18-30/67; 7/23/29/67)
Laborer (WAE). . . . . Eric E. Prather
(8/13-26/67)
Laborer (WAE)(Weekend Naturalist). . . . . Calvin D. Huffman
(6/12-17/67; 10/22-12/31/67)

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
SQUAW CREEK NATIONAL WILDLIFE REFUGE
MOUND CITY, MISSOURI

C O N T E N T S

Page

I. General
- A. Weather Conditions 1
- B. Habitat Conditions 2- 7
  - 1. Water 2- 7
  - 2. Food and Cover 2- 7

II. Wildlife
- A. Migratory Birds 8-15
- B. Upland Game Birds 16
- C. Big Game Animals 16
- D. Fur Animals, Predators, Rodents, and Other Mammals 16
- E. Hawks, Eagles, Owls, Crows, Ravens, and Magpies 17
- F. Other Birds 18
- G. Fish 18
- H. Reptiles 18
- I. Disease 19

III. Refuge Development and Maintenance
- A. Physical Development 20
- B. Plantings 23-24
- C. Collections and Receipts 24
- D. Control of Vegetation 24
- E. Planned Burning 24
- F. Fires 24-25

IV. Resource Management
- A. Grazing 26
- B. Haying 26
- C. Fur Harvest 27
- D. Timber Removal .....
- E. Commercial Fishing .....
- F. Other Uses .....

V. Field Investigation or Applied Research
- A. Vegetation Surveys 28
- B. Wood Duck Studies 28
- C. Teal Studies 28
- D. Cooperative Goose Management Studies 29-33
- E. Cooperative Studies With Dr. Myers 34
- F. Cooperative Small White Goose Studies 34
- G. Wildlife Inventory Plan Study 34

VI. Public Relations
- A. Recreational Uses 35
- B. Refuge Visitors 35-37
- C. Refuge Participation 37-40
- D. Hunting 40-41
- E. Violations 41-43
- F. Safety 44

VII. Other Items
- A. Items of Interest 44
- B. Photographs ..... Appendix
- C. Signature 45

1967

Narrative Report

Squaw Creek National Wildlife Refuge

I. GENERAL

A. Weather Conditions

Table 1. 1967 Weather Rosecrans Memorial Airport, St. Joseph, Missouri

	Precipitation				Max.	Min.
	Month	Normal	Snowfall		Temp.	Temp.
January	1.12	1.20	6.7		68	0
February	.17	1.09	1.3		71	1
March	1.13	2.33	.2		86	-5
April	5.48	3.15	1.4		91	27
May	3.93	4.39			98	33
June	10.85	5.93			91	45
July	3.79	3.22			97	49
August	.79	4.21			92	43
September	1.72	3.44			89	30
October	5.99	2.18	T		90	24
November	.42	1.68			69	18
December	2.03	1.36	6.0		60	0
Totals	36.42	34.18	15.6	Extremes	98	-5

Information for the above weather summary was obtained from the U.S. Weather Bureau for their station at Rosecrans Memorial Airport, St. Joseph, Missouri - about twenty-five miles southeast of Squaw Creek National Wildlife Refuge.

Precipitation in 1967 was 2.24" above normal. Heavy snow fell in January and December and one unusually late snowfall of 1.4 inches occurred April 23. February, March, August, September and November were relatively dry but excessive rains fell in April, June and October.

A comparatively mild January and February were experienced with temperatures near the zero mark for only short periods of time. On April 24 a late frost occurred along with the 1.4" of snow. The 1967 summer was cool by Missouri standards. A sharp cold spell occurred in late December and on the last day of the year the temperature registered zero.

B. Habitat Conditions

Waterfowl use days are our primary indices for annual waterfowl refuge management. In 1967 approximately 21,854,000 duck days and 19,513,000 goose days use were obtained compared to 27,375,000 duck days and 13,869,000 goose days use in 1966. (Due to abundant surface water in the vicinity ducks were scattered throughout the valley during the 1967 fall but were concentrated on the refuge during the dry 1966 autumn.)

Perhaps a better concept of current water management can be obtained by comparing this data with the 1953-1963 annual averages of 14,600,000 duck days and 8,215,000 goose days use.

Table 2. Waterfowl day use by habitat unit 1967

Habitat Unit	Habitat Acres	Water Areas	Goose Days 1966	Goose Days 1967	Duck Days 1966	Duck Days 1967	Waterfowl Days Use/A. 1967
1	870	West pools	2,540,197	2,240,420	4,914,877	2,244,382	5,155
2	880	No. Cent. Marsh	2,058,249	2,660,105	685,104	1,102,360	4,275
3	970	Bluff Pool, Paddies SB#3	2,837,392	3,195,346	1,192,940	1,501,346	4,842
4	590	Davis Creek and ponds	384,853	1,590,687	1,452,094	225,827	3,078
5	2218	So. Long Sl. & Main Pool	3,867,129	7,321,517	15,608,949	13,539,736	9,406
6	1321	No. Long Sl. and A-16	2,180,768	2,505,279	3,520,647	3,240,328	4,350
TOTAL	6849		13,868,588	19,513,354	27,374,611	21,853,979	5,184*

*Average

Habitat Unit #1

The Northwest Pool was drawn down during the winter. Light rains brought in 150 acres of surface water during May. Above normal rains flooded the Northwest Pool and its desilting basin (SB#4) in mid-June.

This pool was effectively drawn down for a natural growth of wild millet and smartweeds by July 5. Water spreading ditches were plowed with a single bottom plow on a light tracked-tractor in mid-July and the pool was thereafter irrigated as needed for a maximum growth of wild millet. Seed collection boxes were set out on September 6th at 500 feet intervals along Vegetation Transect #2, but October floods disrupted this study before any data was collected. Mature smartweeds and some mature millet seed were noted on September 6th but it appears that flooding kept much of the millet seed from maturing before a killing frost and this resulted in less fall duck use of this pool than was expected.

Table 3. Impoundment data Northwest Pool 1967

Month	Average Planned	Elevation Obtained	Area Acres	Acre Feet	Remarks
January	853.00	853.00	none	none	Dry
February	853.00	853.00	none	none	Dry
March	854.00	854.00	none	none	Entire Pool Dry
April	856.00	854.12	10	3	In Depression
May	856.00	854.90	100	25	In Depression
June	855.00	855.48	220	70	
July	853.50	853.90	none	none	Started Irrigation
August	853.50	853.98	10	3	
September	854.00	854.08	10	3	
October	855.00	855.64	230	130	
November	856.00	855.96	330	180	
December	855.50	855.38	130	40	
Average	854.54	854.46	130	57	

West and Southwest Pools

The West and Southwest Pools were drawn down to 853.60' during the 1967 winter when some beaver runs were filled in the common levee. A continuing drought prevented a spring buildup but June rains brought the west pools up to flood levels. Evaporation reduced the surface area to fifty acres by September 10, but 180 acres of pool were reclaimed by mid-October with 200 acres available before the winter draw down began on December 15.

It appears that some invertebrate foods were lost during the reduced water supply of August and September. Immature teal and pintail fished this pool hard during that time for their preferred food.

Table 4. Impoundment data West and Southwest Pools 1967

Month	Average Planned	Elevation Obtained	Area Acres	Acre Feet	Remarks
January	853.60	853.64	130	ND	
February	853.60	853.90	150		
March	854.30	854.20	160		
April	855.00	854.36	190		
May	855.50	854.20	160		
June	854.00	854.80	220		
July	853.00	853.40	110		
August	853.00	852.80	100		
September	853.50	Dry at Gauge	50		
October	854.50	854.36	180		
November	856.00	854.60	200		
December	853.00	854.58	200		
Average	854.08	854.08	154		

Habitat Unit #2

The "Northeast Pool" was so silted that it was better classed as "The North Central Marsh and Swamps". It no longer had any connection to its former 3'x5' stoplog control and gauging station but instead was drained by a 100' rock spillway and an underlying 12" corrugated metal pipe.

There was little surface water in this unit until April. Two earlier wild fires burnt excessive vegetative cover in portions of the unit. Rains in June and October flooded the pool to its approximate capacity of 100 acre feet. Intervening draw downs to about a dozen shallow depressions allowed smartweeds to grow and mature on the higher margins which attracted twenty thousand mallards in November 1967.

Habitat Unit #3

Habitat Unit #3 contains Bluff Pool, Settling Basin #3 and the former rice paddies as its water areas. We are not currently interested in making Bluff Pool attractive to waterfowl during the hunting season because it is almost completely surrounded by private Canada goose hunting clubs. We are interested in improving this area for spring and summer waterbird use and for a "show place" when the Missouri Highway Department develope its adjacent I-29 rest areas.

Settling Basin #3 receives overflow waters from Davis Creek and settles out its silt and debris through its cordgrass and associated vegetation before it permits relatively clean water to flow toward the Main Pool.

The basin was practically dry until June 1967 when flood waters poured through the spillways and basin to remain in the lower 100 acres until August evaporation. Inflow again flooded through the basin in October with considerable outflow through the west spillway and leaving about 300 surface acres in the lower basin, the cordgrass hayfields and A-3 wheat browse. Waterbird use was good during the summer and excellent during the waterfowl hunting season.

Canada and lesser snow geese fed intensively on rootlets in the flooded hay and browse areas while mallards and pintails were partial to the smartweeds in the lower basin.

Wet weather prevented some desired culture work in the "old rice paddies" but effective waterfowl use was made of flooded natural vegetation in the lower paddies. The west levee was sloped, graded and seeded to Elbon rye and was heavily used by Canada geese.

Habitat Unit #4

The water areas in H#4 consists of a portion of Davis Creek and its adjacent ponds and the irregularly flooded A-19. This unit was the poorest for waterfowl on both an unit and an acre basis in both 1966 and 1967.

Wood Duck, Bluewing and Munkres' adjacent ponds were dry most of the year and restricted wood duck nesting.

The water levels were low in Davis Creek and the Radial Gate Ditch. Much of A-19 was flooded in June after the main migration had passed. Floods prevented the planting of ten acres of corn and twenty additional acres grew poorly. Domestic millets were planted in ten acres and these were flooded in October along with the roadside barrows. Waterfowl used A-19 heavily a few days during the fall migration but soon exhausted the poor food supply.

Habitat Unit #5

The water areas in H#5 consist of the Main Pool and the south portion of Long Slough. This unit was the most used by waterfowl in 1967. The drought prevented much buildup in the Main Pool until June. However, Squaw Creek was plugged below the SB#1 spillway and a good flow of water was directed toward the West Bay portion of the Main Pool by reversing the outlet flaps of A-16. This resulted in record use of the pool during the spring and summer. High waters prevented a scheduled draw down during the summer and cattails appeared to be taking over the pool. High flooding was attempted to make the upper margins of the Main Pool accessible to waterfowl with good success and snow geese devoured most of the new cattails. The winter draw down was began on November 21, 1967 to remove the attractions and to move the mallards and lesser snow geese south. A December 31, 1967 count of only 100 lesser snow geese; 2,100 Canada geese and 50 mallards is a measure of our success in moving waterfowl off the refuge in frigid weather.

Table 5. Impoundment data Main Pool 1967

Month	Average Planned	Elevation Obtained	Area Acres	Acre Feet	Remarks
January	850.00	849.00*	500	90	*Dry at Gauge
February	851.00	849.00	500	90	Dry at Gauge
March	851.00	849.00	700	100	Dry at Gauge
April	851.00	849.00	700	100	
May	850.50	849.40	700	100	
June	850.50	841.60	1750	2200	
July	850.50	851.70	1800	2500	
August	850.50	850.60	1200	900	
September	850.50	850.24	950	200	
October	851.00	850.86	1300	1000	
November	851.00	850.56	1100	600	
December	850.50	850.56	1100	600	
Average	850.67	850.13	1025	707	

The south portion of Long Slough was important as a supplier of water and of invertebrates until June. A 12" C.M.P. allows Long Slough to be diverted directly into East Bay when this is desirable during low water. The area above this cutoff was an important source of invertebrate food for immature ducks during late summer and of last year's smartweed seed for shovelers during autumn. Geese loafed in this area during November - December.

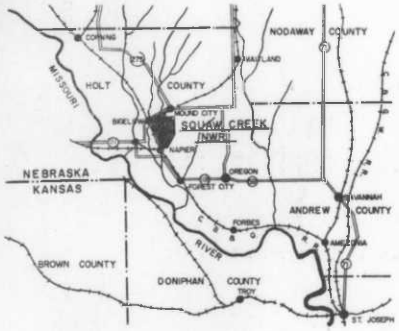
Habitat Unit #6

The only water areas in H#6 are North Long Slough, numerous feeder ditches, Settling Basin #2, several duck ponds and the manageable marshes in A-16.

Diverted Squaw Creek waters kept North Long Slough and A-16 outlets partially open during the winter and attracted some waterfowl. Great waterfowl use were obtained from flooded moist soil plant foods and fallow corn in A-16 during the spring and summer.

Flooded, mowed and grazed cordgrass units in A-16, SB#2 and G-1 and 2 received heavy goose grubbing during October and November. Ducks also used those flooded areas and the feeder ditches intensively during autumn. 50,000 geese and 20,000 pintail were observed feeding in A-15's grazed oats after a heavy rain in October.

1967 Habitat Units

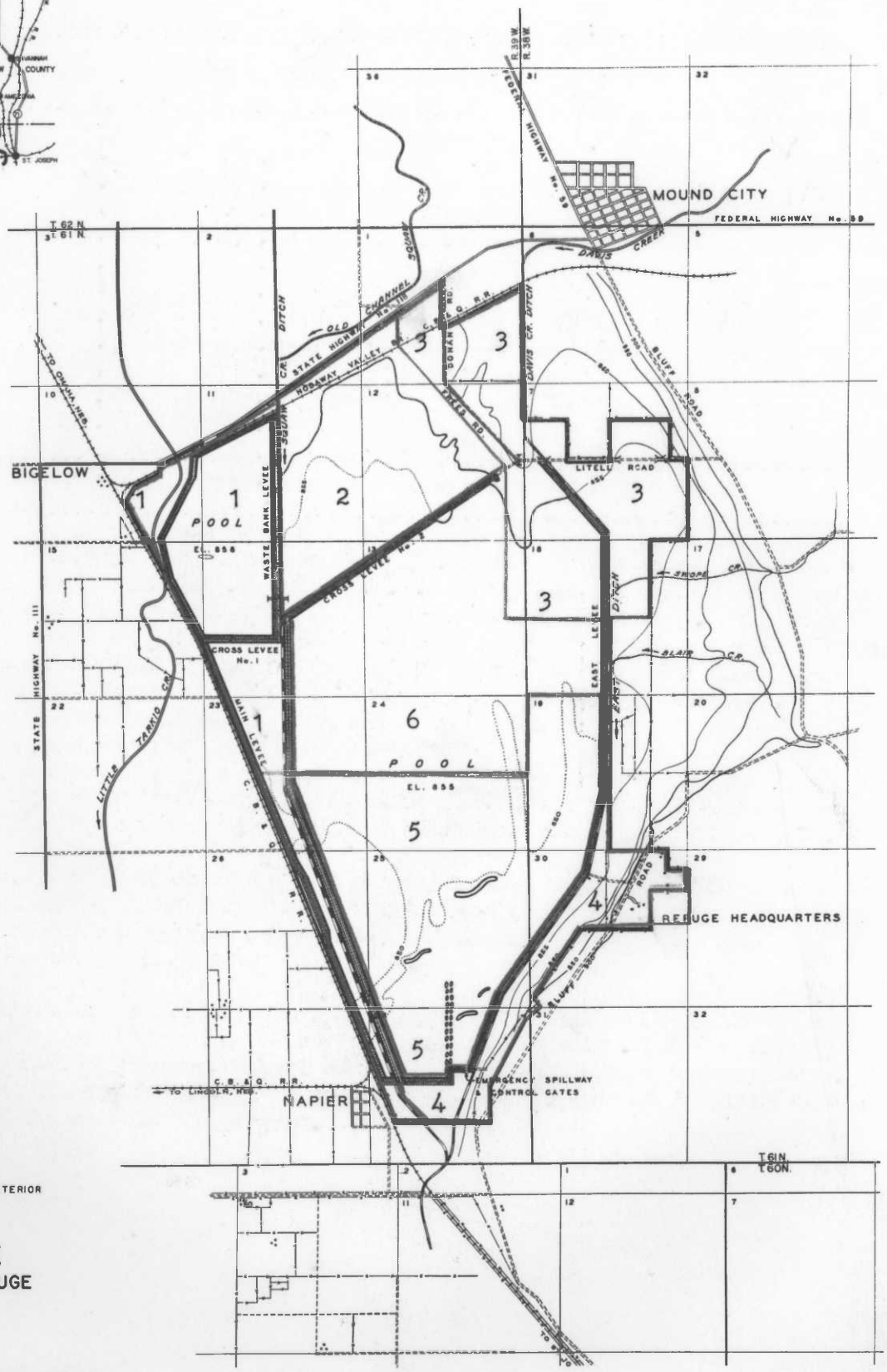


LOCATION MAP

SCALE

0 5 10 20 30

FIFTH PRINCIPAL MERIDIAN



LEGEND

- REFUGE BOUNDARY
- FENCE LINES
- PRIMARY ROADS
- SECONDARY ROADS
- TRAILS
- CANALS & DITCHES

CONTOUR INTERVAL 5 & 20 FEET
DATUM IS MEAN SEA LEVEL

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

GENERAL MAP

SQUAW CREEK
NATIONAL WILDLIFE REFUGE
HOLT COUNTY
MISSOURI

SCALE

0 1/4 1/2 1 2 MILES
0 20 40 80 160 CHAINS

WASHINGTON, D.C., DECEMBER 1936

REV 590210, 630307

II. WILDLIFE

A. Migratory Birds

A near record of 41,367,000 waterfowl use days were set in 1967 as compared to the record 43,712,000 days use in 1965 and 40,337,000 in 1966. A peak record of 19,513,000 goose days use were set in 1967 compared to 16,369,000 in 1965 and 13,869,000 in 1966. Abnormal numbers of shorebirds, waders and rapators were observed during the past year.

Canada geese.

An estimated 6,200 large type Canadas used the refuge during the first week of January but these decreased during the second week of January to 3,000. The Canada geese increased to 4,500 during the last two weeks of January and then slowly decreased through February to 2,000 until they suddenly built up to 11,600 during the week of February 26th. During March the Canada geese decreased to about 500 at the first of April and continued to decrease to ten geese at the end of April.

Small Canada geese did not appear in numbers until the first of March when 240 were observed and these built up to 5,700 in mid-March. The small Canada geese departed during the spring until there were only three left at the end of May.

One large Canada goose stayed on the refuge during the summer.

Twenty-three large type Canada geese first appeared in mid-September and they continued to increase their numbers until 7,450 were on the refuge in mid-November. There were about 4,800 large Canada geese on the refuge at the end of the reporting period.

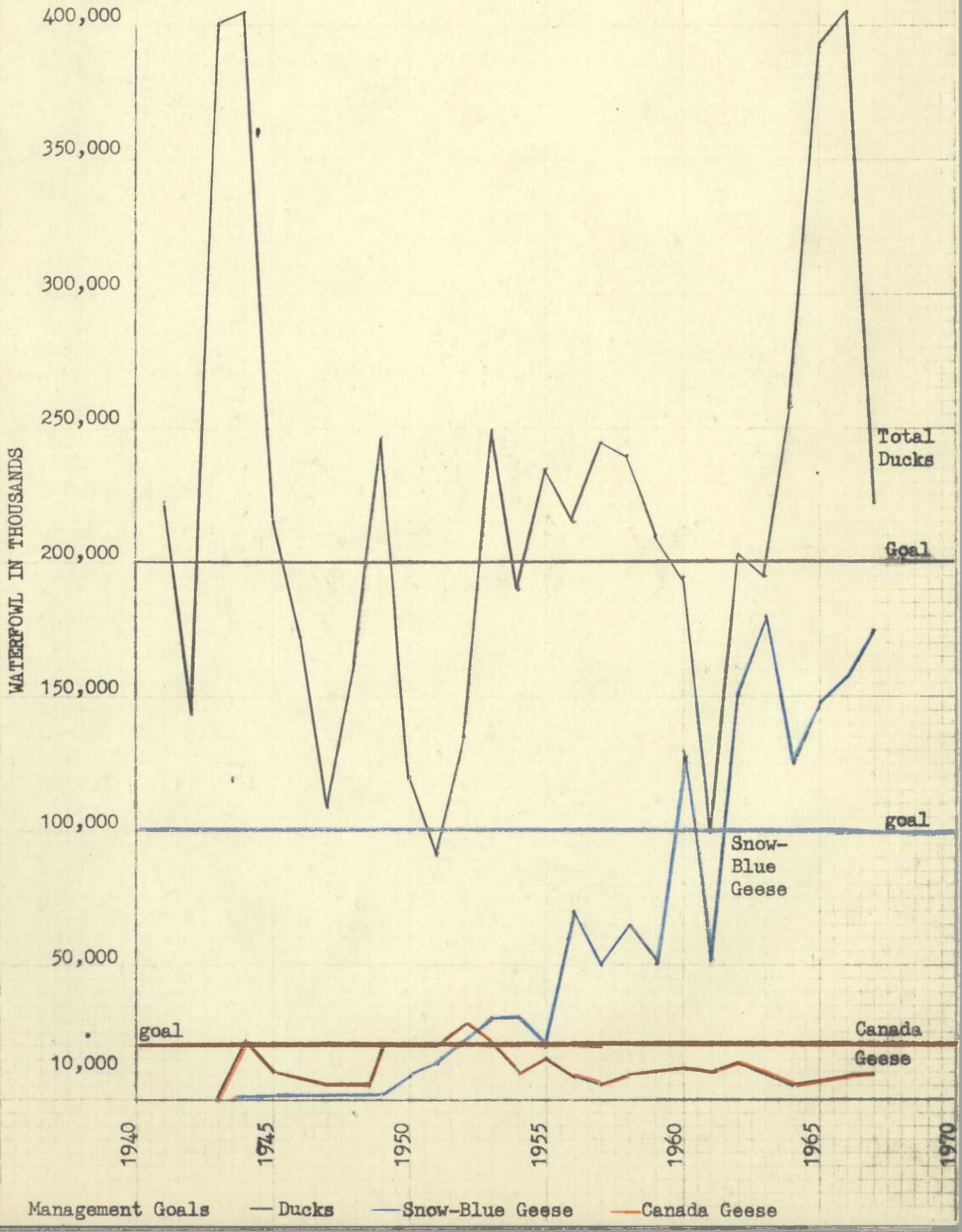
Small type Canada geese first appeared at the end of September and they increased their numbers to 2,000 in the last week of October. They thereafter departed south until the last flock of twenty left in mid-December although one or two stayed with the wintering flock of large Canada geese.

White-fronted geese

Some of the scattered eastern white-fronted goose population regularly use Squaw Creek in migration. Three white-fronted geese were observed in mid-February and fifty arrived in early March. They built up to 1,000 white-fronts by mid-March and peaked at 6,500 in the third week of March. They decreased to the last five in mid-May. Five white-fronted geese reappeared in the third week of September and peaked at 200 from mid-October till the end of that month. Two white-fronted geese were still on the refuge at the end of the year.

PEAK FALL CONCENTRATIONS

SQUAW CREEK NATIONAL WILDLIFE REFUGE



Snow-blue geese

This year started with 16,000 snow and 7,000 blue geese on Squaw Creek National Wildlife Refuge. Cold weather and low refuge water reduced their numbers to 3,350 snow and 2,225 blue by January 28. These were further reduced to fifteen snow and five blue geese during the first two weeks in February. In mid-February a small buildup of 300 snow and 100 blue geese occurred. On February 26 to March 4 about 14,000 snow and 7,000 blue geese returned to Squaw Creek, apparently from the local Missouri River wintering populations. The first important snow-blue goose spring migration occurred the following week when 250,000 snow and 150,000 blue geese used the refuge. During March 12-25 the flock peaked at 308,000 snow and 231,000 blue geese. On April 1 only 31,000 snow and 15,000 blue geese were using the refuge and this was reduced to 120 snow and 60 blue by the end of April. Four snow and four blue were present on July 8 and one snow goose remained through most of the summer.

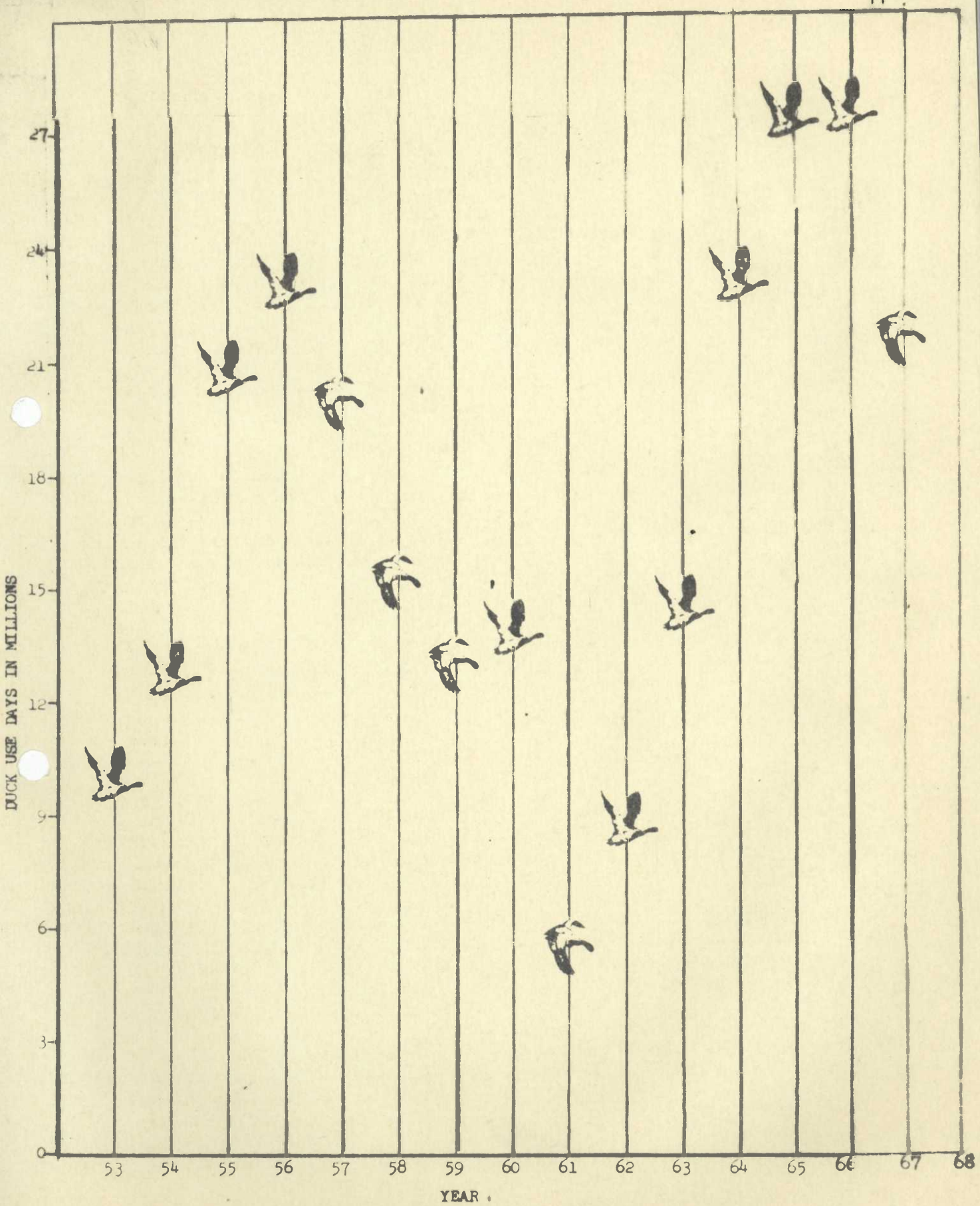
A flight of eight snow geese returned to Squaw Creek September 10 and by October 1 about 6,000 snow and 3,000 blue geese were present. These geese peaked at 98,600 snows and 74,000 blues at the end of October. In mid-December 100,000 snow and blue geese were present on the refuge. Cold weather and winter drawdown encouraged these geese to migrate elsewhere and only 210 snows and 170 blue geese were present at the year's end.

University of Western Ontario, graduate student, Paul Prevett, noticed a few Ross' geese among the lesser snow geese that used the refuge during the fall. He estimated the peak number as five.

Ducks

An estimated 65,070 ducks used the refuge as the 1967 year began. During the second week in January only 500 mallards remained on the refuge. Most of the ducks had moved to the nearby warm water ditches and the Missouri River during the late January freezeup but by the last week of January 18,000 mallards and a few black ducks, pintails, and green-winged teal were present. At the end of February mallards had increased to 265,500 and pintails to 41,500. Black ducks, gadwall, baldpates, shoveler, wood duck, redhead and lesser scaup were observed in mid-March, but ruddy ducks were not sighted until April 1. Green-winged teal peaked at 22,200 and blue-winged teal at 6,800 during the third and fourth weeks of March. About 100 common mergansers appeared the first of March and two hooded mergansers appeared the first week of April.

An estimated 60 mallards, 20 gadwall, 10 baldpate, 40 pintail, 10 green-winged teal, 140 blue-winged teal, 80 shoveler, 22 wood ducks and 6 scaup remained on June 1.



Duck Use Days In Millions At Squaw Creek National Wildlife Refuge

Ducks began their late summer buildup from 80 to 500 in mid-August with increases in numbers of pintail, blue-winged teal, mallards and wood ducks. The invasion continued until the peak fall population of 2,650 blue-wings and 400 wood ducks were reached in mid-September; 10,000 baldpate and 6,000 gadwalls in late September; 70,100 pintails, 400 shovelers, 50 redheads in mid-October; 50,000 green-winged teal, 500 ring-necked, 20 ruddy duck and 10 bufflehead in early November. Fall peaks of 155,500 mallards, 100 scaup and 100 common mergansers were reached the first week of December.

Most pools were drawndown in early December to deliberately reduce open water and thus force ducks south of this winter stress zone. By December 31, 1967 only 1,500 ducks remained.

Other Water and Marsh Birds

One common loon was sighted on June 4. No others were seen in 1967.

Two horned grebes were reported the first week of May and a western grebe was sighted June 11.

Two eared-grebes were present May 4-15. The first two pied-billed grebes were observed March 26. They peaked at six during the spring migration and 106 during the fall migration. About 20 pied-bills spent the summer at the refuge. Twelve nests were found. An estimated 30 pied-billed chicks were produced. This species had not been previously recorded as nesting on the refuge. The last two pied-billed grebes were sighted October 28, 1967.

About 200 white pelicans were present during April. A few were irregularly observed during the summer. The fall peak of 3,200 occurred in late September and the last pelican was observed December 2, 1967.

Five double-crested comorants stopped briefly at the refuge April 2 and 3 and 20 were observed on October 28.

The first great blue herons were sighted March 28th. Great blue herons are summer residents. By mid-September the summer migration of great blues had increased their numbers to a record 360. The last recorded great blue herons were six on October 28. The first green herons were two sighted April 28th. They peaked at 14 during mid-summer and the last one was reported on September 20. One little blue heron was reported on April 28, seven were present July 21-27 and the last four were reported September 12.

Three common egrets were present on April 11. They peaked at six about August 25 and these remained until the end of September. One cattle egret was sighted irregularly from June 8 to mid-October. One snowy egret was observed August 6-12.

Two black-crowned night herons were observed April 15 and five were present throughout most of the summer. The last one was recorded on October 28.

One yellow-crowned night heron was observed on April 2. They peaked at 17 by mid-July and were last reported October 28.

The first least bittern was seen on May 14 while six were recorded during June. The last one was observed on August 12. An American bittern was recorded May 7 through September 28, 1967. Four glossy ibis were seen on April 9 but were not reported after that.

Two king rails were sighted June 22 and a family with three chicks were sighted irregularly through the summer. The last one was reported August 15. A virginia rail was present May 14 and at least two remained until the last recording of August 27. A sora rail was first sighted April 24 and ten were present on the refuge most of the summer. During the early fall their numbers built up to 300 and the last ones were sighted September 30.

A sandhill crane used the refuge through most of November.

American coot first appeared March 12-18, they peaked at 6,100 by the first of April and decreased to 450 on May 1. About ten were present throughout the summer. Their fall build up began in early September. They peaked at 7,560 and all had departed by December 23. Coot spent 150,920 use days on the refuge during 1967.

A critics contention that low pool levels were disasterous to wading birds caused us to search our records in 1966 and to compare our annaul reported peaks of wading birds with reported water levels. We have continued the resulting table in 1967 because it tells an important ecological story. In Table 6 a (-) sign indicates low water and a (+) sign indicates normal or high water in the Main Pool. Population data enclosed within parenthesis were interpreted from written descriptions.

Table 6. Wading bird peak populations 1956-1967

	Year	Gr. blue heron	Green heron	L. blue heron	Com. egret	B-C nite heron	Y-C nite heron	Total
-	1956	100	12	0	6	7	0	125
-	1957	100	12	0	6	6	0	124
- +	1958	(100)	200	700	200	200	100	1500
+	1959	(100)	200	30	200	300	(100)	930
+	1960	50	17	10	33	200	3	313
+	1961	(100)	(100)	0	20	5	5	230
+	1962	65	9	23	52	50	2	201
+ -	1963	202	5	1	16	2	2	228
+	1964	100	6	55	2	27	6	196
+	1965	64	6	7	5	11	4	97
-	1966	103	10	19	15	15	13	175
- +	1967	360	14	7	6	5	17	409
Averages		120	49	71	47	69	21	377

These data indicate that generally the number of wading birds that can be carried by a pool depends more on the pool's ecological conditions rather than the height of the water level.

The 1956-58 droughts produced rank vegetative growth in the pool. This in turn produced excellent crops of invertebrates and other prey species when first flooded in 1958 and 1959. The food supply attracted and carried a large number of wading birds.

But when the water was maintained high (and turbid) 1960-65 the plant and animal food decreased and so did the herons. The 1963 low water was too late for a good growth of acquatic and emergent plants but it did make an abnormal amount of animal food matter available and helped stabilize the heron population. The herons increased their use of Squaw Creek Refuge in 1966 because low waters again concentrated animal food and made it available.

As expected, wading bird use and peaks increased in 1967 because the animal food increased with the flooding of the enriched pool. It appears that excellent wading bird habitat could be maintained by drawing down the Main Pool once in three summers. Such a program would also increase shorebird use, particularly in drawdown years.

Shorebirds

Ten killdeer were first reported on March 11. Their numbers increased to 500 by mid-June. At least five nests were present and 16 young killdeer were hatched. The last killdeer were sighted on November 26.

About 57 semipalmated plover first appeared on the refuge on April 27. All had departed by August 25. Three piping plover used the refuge from April 27-30.

The first American golden plover was recorded on March 26. About 21 were present on April 1. Two were sighted on August 31. Eight black-bellied plovers appeared May 2. The last four were reported on September 23.

Four ruddy turnstones used the refuge the last two weeks of May. Two upland plovers arrived April 15. Three were present in early August and not seen thereafter.

Common snipe appeared in late March and peaked at sixteen on April 1. Ten were present through the summer and they peaked at fifty on their return visit the last two weeks of September.

Sixty willets arrived April 28. They peaked at 107 on May 13. The last one departed September 23. Spotted and solitary sandpipers used the refuge from early May to the end of August. Spotties peaked at eight and solitarys at six.

Ten greater yellowlegs and 100 lesser yellowlegs appeared March 31. The greaters peaked at 50 and the lessers at 10,000 in late April. The last greater yellowlegs were reported on September 28.

Pectoral and Bairds' sandpipers were first sighted in early April but white-rumped sandpipers were not present until May 14. The last Bairds' sandpiper was recorded May 7. The last "white-rumps" were reported June 4. Pectorals peaked at 500 on September 1st and remained a short time thereafter.

Three least sandpiper were seen May 7; they peaked at 21 on July 9 and ten were last recorded September 24.

Thirty long-billed dowitchers arrived April 9. They peaked at 150 by mid-May. The last ten were sighted on September 30. One short-billed dowitcher was reported August 20 and remained until September 9. Dunlins used the refuge May 7-28.

Eight stilt sandpipers were present on May 28. They peaked at 75 in late August and 50 remained on September 23. Semi-palmated sandpipers numbered 1,000 by late April and they peaked at 1,720 in mid-May. Fifty were reported on September 23. Fourteen buff-breasted sandpipers were sighted May 14 and seven remained through mid-summer.

Four marbled-godwit were noted April 21 while only one remained at the end of May. Hudsonian godwits visited at the same time as the marbled godwit but they peaked at 50 in early May with only one present on May 30. One sanderling frequented the refuge from April 27 to May 28 when another one joined it. They were last seen in early June. One avocet used the refuge the last week of July.

A black-necked stilt was spot scoped on the refuge on May 28. This species is listed as an accidental in Birds of Squaw Creek National Wildlife Refuge, RL-155R2, July 1966. It is the first one recorded during the last four years.

Two Wilson's phalaropes first arrived on April 15 and by mid-May nearly 1,000 were present. Only two were present the last day of September. Twenty northern phalaropes arrived a month later than Wilson's phalaropes. The last two northern phalarope were sighted on September 23.

Gulls and Terns

Ten ring-billed gull arrived March 2; they peaked at 100 during April; the last three gulls were seen September 30. Two Franklin's gulls appeared April 9; in late May they peaked at 300. Forty Franklin's were reported on September 30.

On May 28, six Forester's terns arrived at the refuge. The last four were seen August 27. Two least terns used the refuge May 21 and on July 9 twenty-one least terns were present and these remained until September 23.

One Caspian tern was sighted May 7. It remained most of the summer and was joined by six others the first two weeks of September.

Black terns began arriving at Squaw Creek on May 1, by May 20 nearly 2,000 were present. The last black tern departed September 28.

Doves

A few mourning doves spent the winter in this vicinity. Their numbers increased to about 50 breeding pair and a peak of 1,000 during the summer. One dove was sighted during the annual Christmas Count on December 31.

B. Upland Game Birds

About 100 ring-necked pheasants and 100 bobwhites wintered through the 1966-67 winter. Due to heavy rains in April and June first nesting attempts were unsuccessful. However cool weather stimulated these upland birds to renest and this resulted in an estimated 150 young pheasants and 50 bobwhite quail.

C. Big Game Animals

White-tailed deer were commonly observed on Squaw Creek Refuge during 1967. Production was good with about fifty fawns produced. An estimated 200 deer were using the refuge during the Missouri deer hunting seasons. Missouri Department of Conservation estimated 45 bucks were harvested in Holt County. Refuge deer dispersed after shooting had decreased competition and the lack of pursuit made it possible for the deer to move away from their previous refuge.

D. Furbearers, Predators, Rodents and Other Mammals

Form NR-4 for year ending April 30, 1967 indicated 30 opossum, 200 raccoon, 50 mink, 2 badger, 20 striped skunk, 10 red fox, 20 coyote, 10 Franklin ground squirrel, 10 gray squirrel, 400 fox squirrel, 40 plains pocket gophers, 10 beaver, 100 muskrat and 200 cottontail were using the refuge.

Dr. Richard Myers, Central Missouri State College, Warrensburg, Missouri continued that college's mammal studies with senior student, Robert Clement carrying out a special mammal distribution study here during the winter months. The numbers and distribution of small mammals found by Central Missouri State College studies and other observations have not been described as yet. A leaflet is planned. The following small mammals were trapped, observed or reported: opossum, short-tailed shrew, least shrew, eastern mole, red bat, cottontail, woodchuck, Franklin ground squirrel, gray squirrel, fox squirrel, plains pocket gopher, beaver, western harvest mouse, deer mouse, white-footed mouse, muskrat, norway rat, meadow jumping mouse, house mouse, coyote, red fox, raccoon, mink, badger, striped skunk and bobcat.

E. Vultures, Hawks, Eagles, Owls and Crows

Eight turkey vultures used the refuge irregularly from April 9 to September 15. During the Christmas Bird Count on January 2, 1967 a goshawk was sighted. Two sharp-shinned hawks were sighted periodically from February 11 to April 30. It is likely others escaped detection. Cooper's hawk are believed to be permanent residents, two were observed from January through April and two were also reported in late September.

About 20 redtail hawks wintered on the refuge and eight spent the summer here. Seven Harlan hawks were present during January and two remained on April 11. Three reappeared on the refuge in late December. One Swainson's hawk was sighted in April and three were recorded in December. Sixteen rough-legged hawks were present on the refuge through January - February. Four returned October 27 and twenty-one remained at the year's end.

Thirty-eight marsh hawks wintered in 1966-67, compared to ten this winter. A pair spent the summer with us. A peregrine falcon was sighted on the refuge in early May and again in October.

A pigeon hawk was recorded on September 20 joined by another in early October. One remained on December 2. Sparrow hawks are year around residents; three were recorded from February 26 - September 23 and one was reported on December 31.

Four pairs of screech owls were considered permanent residents with the population sometimes increasing to sixteen. One screech owl in the red phase was found in a wood duck house and was banded. Great horned owls are permanent residents. Eight were the most seen. A pair of barred owls continued to nest in a hollow tree near the office. This species peaks at about eight.

Thirty-three short-eared owls used the refuge last winter and six had returned in December. Twenty-five long-eared owls were also present last winter but none had returned at the year's end.

About fifty crows used the refuge from January to March. Ten spent the summer here and eight remained at the year's end. One immature golden eagle was present from January 1 through February 21. Two were present in October. The last one was sighted on December 2.

Ninety-six bald eagles were using the refuge during January and February. The last wintering eagle was seen on March 1. The first fall sighting was on September 20 and the fall peak was seventy which is considerably lower than in recent previous years. Apparently management for moving wintering waterfowl south also moves eagles. Twenty-seven bald eagles were reported December 31, 1967.

F. Other Birds

Birds of Squaw Creek National Wildlife Refuge RL155R-2 was revised in 1966 and now includes 253 visitors and 23 straglers. Of the 23 species mentioned as accidental a western grebe, a cattle egret, a few Ross' geese and a black-necked stilt were sighted this year. A snowy owl was also reported in the near vicinity. This "Christmas Bird Count" was made on December 31. Mr. and Mrs. Fitzhugh Diggs of Hamburg, Iowa and Mr. and Mrs. J.W. Zeliff of Mound City, Missouri participated with the manager as compiler. Near zero weather, six inches of snow and refuge pools ninety-eight percent frozen-over reduced total numbers of birds and species considerably from last year. Forty-five species and nearly 19,000 birds were counted. Red-winged black birds were most numerous with an estimated 10,000 reported. However even this is considerable below last year's estimated one million blackbirds. A complete account of this survey will be published in the April 1968 Audubon Field Notes.

G. Fish

Most fish were eliminated from the refuge pools during the 1966 drouth. Some carp and bullhead fishing were obtained in Squaw Creek in 1967.

H. Reptiles and Amphibians

Snapping turtles were too numerous and too large for good waterfowl refuge management. Turtle attacks were observed on a pintail, a mallard, two coot and a female wood duck. The snapping turtle's attack on the hen wood duck was particularly disasterous to our wood duck habitat and housing program. During the 1967 winter we had placed five experimental houses in the Southwest Pool. In early May we had checked these houses and found that a wood duck was nesting in one of our aluminum houses. Shortly thereafter two birdwatchers reported seeing a turtle take a hen wood duck from the waters immediately below this house. A check of the house found the eggs abandoned and the incubating female wood duck gone. We obtained permission from the Missouri Conservation Department to permit snapping turtles to be removed for sale. In May Mr. Glenn Guyer, Waterville, Minnesota and a licensed non-residence commercial fisherman requested permission to remove the turtles on Squaw Creek. This permission was granted. Mr. Guyer removed about three hundred large snapping turtles in May and an additional twenty large snapping turtles in June from our western pools. He reports that examination of their stomachs indicated numerous black duck feathers and crayfish.

Painted turtles were also commonly observed and leatherbacks were occassionally sighted. A few massasauga rattlesnakes were observed. Their presence kept employees alert and the public on the road.

Garter, milk, blue racer, black, bull and water snakes were commonly observed during the summer.

Professor David A. Easterla of Northwest Missouri State College, Maryville, Missouri reported collecting the following reptiles under Permit No. 24: two common snapping turtles, two western painted turtles, one five-lined skink, two diamond-backed water snakes, one dekay's snake, one red-sided garter snake, one western fox snake and five western massassauga.

Bullfrogs, leopard frogs, tree frogs, spring peepers, Rocky Mountain toads and Great Plains toads were commonly observed.

I. Disease

It is believed that few waterfowl died from lead poisoning after the 1966 hunting season due to owners and managers draining their duck ponds at the close of their hunt and to our efforts toward dispersing the waterfowl south for the winter.

Fowl cholera again appeared among our lesser snow geese in late December 1966 and in January 1967. But it is believed that it was restricted to a few immature snow geese and that no more than twenty died from this disease. A pick up and burn order was issued as soon as fowl cholera was diagnosed. A manuscript by Richard W. Vaught, Dr. H.C. McDougle and H.H. Burgess on the 1963-64 fowl cholera outbreak was published in The Journal of Wildlife Management April 1967. The Missouri Department of Conservation warned us on March 27, 1967 of a die-off of snow geese at Trimble Wildlife Management Area and a possible spread to the Squaw Creek National Wildlife Refuge. The symptoms of the Trimble geese indicated fowl cholera but this could never be confirmed as the cultures all turned out to be negative. U.S. Game Management Agent Hague collected three snow and one blue goose at Sugar Lake, Platt County, Missouri and shipped these to Patuxent Experiment Station. These specimens indicated coccidiosis and this was the only identification of the disease hitting our flocks last spring, when we lost about 200 lesser snow geese. Fortunately ornithosis and a number of virus diseases could be ruled out due to negative findings by Dr. D.O. Trainer, University of Wisconsin and his student's monitoring of Squaw Creek geese blood in January 1966 and November 1966.

Based on processor-derived kill figures an estimated 423 Canada geese, 3,885 lesser snow geese, 5,500 ducks were lost in the Squaw Creek area in 1966 from crippled waterfowl falling into or returning to the refuge or otherwise escaping the hunter. A reduction in this waste would be significant to our future waterfowl brood stocks and to the hunters.

III. REFUGE DEVELOPMENT AND MAINTENANCE

A. Physical Development and Maintenance

In spite of advanced master development planning and programing no development funds were available at Squaw Creek National Wildlife Refuge in 1967.

Old spoils from Little Tarkio Creek were spread into A-18. Spoils from the nearby fishing barrows were also spread to facilitate maintenance.

The island in the Northwest Pool was cleared of plum brush, smoothed and seeded to oats, bromegrass and sweet clover for eventual goose use. The Squaw Creek spillway into the Northwest Pool settling basin (SB#4) was cleaned.

Beaver dens into the Southwest Pool levee were removed and the levee repaired with the old Linkbelt dragline. A parkout was also constructed adjacent to this pool so that bird watchers can park in that vicinity.

The Squaw Creek spillway into the North Central Swamp was deepened and its drain was leveed by agricultural unit A-14 to the marsh above cross levee #2. A-14 field levees and drains were maintained at the same time. The main A-13 drain was cleaned and the spoils spread. Lateral ditches in this unit were also maintained. A new entrance road was constructed from Highway 118 on the Squaw Creek levee into A-10 and over the railroad to A-13.

The high spoils along cross levee #2 drain were leveled and planted to Elbon rye. A spillway was built from C/L#2 ditch into A-16. Part of an excessively large drain in A-16 was filled with adjacent spoils and replaced with a waterway. A 24" corrugated metal pipe was installed in the southeast corner of the A-16 managed marsh to permit the unit to be used as a more effective waterway from Squaw Creek to the Main Pool when needed. Brush was stripped from a portion of SB#2, training ditches were maintained and about sixty percent of the basin planted to winter goose browse. An additional twenty percent with cordgrass was hayed and flooded for waterfowl. Prescribed burning is needed to complete the maintenance of this basin.

A drain and 18" flap gated pipe were installed into Squaw Creek from A-20 (formerly South A-17). Brush and debris were cleared from about seven acres of fallow agricultural land lying between Squaw Creek and the CB&Q RR in the southwest corner of the refuge were planted to winter wheat. This tangle of vegetation had become a poaching hotspot with easy access from Napier. Clearing the area helped reduce this pressure.

Several floods during 1967 backed Davis Creek and deposited debris in the Main Pool outlet drain. This debris had to be cleaned out repeatedly. Davis Creek also broke over its levees into A-8, A-7 and A-6 corn fields and strewed debris throughout the fields. Many man days and the Linkbelt dragline were used to repair this levee. Flood control and protection called for many man hours.

Excess sand from the Davis Creek spillway was hauled to cover the gumbo levee at the south end of Settling Basin #3. This job had not been completed when the dragline operator received a disability retirement on December 27, 1967.

Many man days were used in 1967 maintaining, repairing and overhauling ancient and inadequate equipment. Some units overhauled were: D-8, D-7, TD-18, John Deere, Case and Ferguson tractors, P&H and Linkbelt draglines, backhoe and motor crane. The Studebaker Lark was in the repair shops or waiting for repairs most of the year. Repair costs were excessive. Its replacement, a 1959 Ford Country Sedan, is too low for off patrol road travel, but it hasn't required excessive maintenance. The Willys utility jeep was finally replaced with a four wheeled drive Dodge power wagon. The latter has given excellent service.

The D-8, a loader for the Ferguson tractor and a Bushhog rotary mower were obtained surplus from the Department of Defense, a truckload of shelled corn was traded to Crab Orchard N.W.R. for a load of treated pine posts. An obsolete Austin-Weston grader was transferred to DeSoto N.W.R. for salvage.

A refrigerator was acquired for Residence #1. A gas heater was acquired for Residence #2. An LP gas tank was installed and gas was run to Residence #2 and to a new ceiling furnace in the shop. The living room floor in Residence #1 was sanded, scaled, varnished and waxed. Inlaid linoleum was placed on the kitchen, bath and hall floors. Linoleum was also placed on the upstairs floors of Residence #2.

All of the cordgrass prairie firebreaks and trails were maintained. An old duck pond levee was repaired to impound shallow water and a 100' by 50' wildlife and cattle dugout was constructed in the center of the prairie.

Wildlife surveys were made often and reported weekly. The preliminary wildlife census plan did not produce the quality of data needed for our current management plan. Sufficient funds and trained manpower was not available to do the desired job.

Considerable effort has been spent in trapping and banding waterfowl. This is shown in Table 7. Winter banding was particularly difficult when the waterfowl were encouraged to disperse south in line with our master plan. Due to the early arrivals lesser snow geese were easier to trap before hunting season and their costs per goose was much less at 84¢ each than during other periods.

Table 7. Banding effort-costs Squaw Creek National Wildlife Refuge 1967

Period	Species	Man Hours Us	Man Hours Mo.	Costs Us	Costs Mo.	Total	Cost Per Bird
1/1	98 mallard						
Wintering	2 black duck	100 ducks					
Waterfowl	9 snow geese	10 Geese					
	1 blue geese						
Total	110 birds	264	160	$1184	$323	$1,507	$13.70
8/23-9/16	574 blue-winged teal	587 ducks					
Preseason	13 green-winged teal						
Teal	4 recoveries						
Total	591 birds	110	70	$ 421	$109	$ 530	$ 0.90
10/2-18	520 snow	916					
Preseason	20 recoveries	- 25					
Goose	367 blue	891 Goose					
	5 recoveries						
	3 large Canada						
	1 small Canada						
Total	916 geese	95	70	$ 600	$170	$ 770	$ 0.84
10/20-11/18	283 snow	683					
Canada	12 recoveries	- 16					
Goose	187 blue	607 Geese					
Hunting	1 recovery						
Season	68 large Canada						
	2 recoveries						
	64 small Canada						
	1 recovery						
	5 white-fronted						
Total	623 geese	114		$ 573	$ 95	$ 668	$ 1.07
11/19-12/31	344 snow	1,133					
Post	5 recoveries	- 36					
Canada	155 blue	1,057					
Goose	1 recovery						
Hunting	577 large Canadas						
Season	30 recoveries						
	21 small Canadas						
Total	1,133 geese	264	80	$1719	$279	$1,998	$ 1.79
Total	3,373 birds	847	380	$4497	$976	$5,473	$ 1.62

B. Planting

Insufficient FY 1967 funds caused the refuge to reluctantly turn all corn farming back to cooperative farmers. Again this resulted in insufficient available feed during the critical Canada goose hunting season and in an excessive Canada goose kill.

Cooperative farmers planted 704 acres of corn. Their harvested share on a normal 60:40 basis was about 32,000 bushels while 25,000 bushels were left standing in the field for wildlife consumption. Due to a wet year much of the bottomland corn was planted late and then did not mature in time for harvest prior to the Canada goose hunting season. Waterfowl searched the uplands for feeding areas and were hunted more persistently in the eastern hills than during the past four years. Abundant corn was made available on the refuge by late November harvests. These fields should have been opened earlier for good Canada goose management.

Cooperative farmers grew 171 acres of soybeans and replaced each acre harvested with 1.2 acres of winter wheat goose browse. This was an excellent practice for a wet year. There was no danger of the swollen waste beans causing impaction and the combination of wet soybeans and green wheat was very attractive to all geese and some ducks.

The 35 acres of oats were grown mostly as a green manure crop to prepare some land for wheat and a fenced area for grazing. Cattle were used in the fenced unit to remove excessive vegetation. The resulting volunteering oats were quite attractive to as many as 50,000 lesser snow geese and 20,000 pintail ducks while wet during early October.

Thirty acres of winter wheat was share-harvested on a 75:25 basis after geese had had free browsing privileges. Thirty-seven additional acres were harvested by the refuge.

The refuge's twenty acres of drought-resisting Elbon rye produced much goose browse during the dry winter and spring but did not produce as much seed as expected after a wet June delayed harvesting.

The twenty acres of German millet did little better than the wild millets and foxtail grasses it was meant to replace in A-19 and the old paddies.

The fourteen acres of alfalfa produced thirty tons of hay for the cooperator as part of the A-2 crop rotation plan. Wildlife graze year around on this legume. In addition the cooperator supplies our captive waterfowl with sufficient third cutting alfalfa from this harvest.

The refuge and cooperative farmers planted 415 acres of winter wheat goose browse and nineteen acres of Elbon rye during the autumn. Much of cooperatives effort was in exchange for other crops as per cooperative agreements but a small acreage is on a 75:25 area basis.

C. Collections and Receipts

The refuge harvested 600 bushels of ear corn, 200 bushels of oats, 1,200 bushels of winter wheat, 280 bushels of Elbon rye, 50 bushels of bromegrass and 20 bushels of white sweet clover during 1967. We purchased 400 pounds of German foxtail millet and received 42 pounds of 'Aldous' little bluestem grass seed from the Soil Conservation Service's Plant Material Center, Elsberry, Missouri.

We shipped out 1,500 bushels of shelled corn to Swan Lake and 200 bushels of shelled corn to Crab Orchard National Wildlife Refuge. We shipped about 20 bushels of Elbon rye to the Benson (Minnesota) Wetlands Management Office and hauled 20 bushels of Elbon rye to the Calhoun District, Mark Twain National Wildlife Refuge.

D. Control of Vegetation

About 20 man days were spent clearing and burning weeds from ditch banks, levees and fields. Due to wet weather little spraying was accomplished. About 600 acres of corn were treated with atrazine (see NR-12). About 72 acres of soybeans were treated with amiben and 125 acres of soybeans were treated with treflan. Treflan was used in this case to reduce carryover in a follow up planting of winter wheat.

Managed water was used on about 400 acres to control emergents in pools during May and June.

E. Planned Burning

Inadequate firebreaks and fire protection prevented prescribed burning in early tinder-dry 1967, but wild fires swept through the critical areas in early spring and updated our planned burn areas as well as burning some protected areas. Wet weather prevented prescribed burning during the 1967 autumn.

F. Wild Fires

About nine acres of refuge cordgrass (Spartina) was burned when railroad section men left their adjacent cleanup operations unattended during the evening of February 13, 1967. This was quickly curtained by the refuge crew.

Fire #2 started on February 14, 1967 along Highway 118, was reported at noon by a cooperative farmer. It was attacked by three refuge employees at 12:30 p.m. but due to a strong north wind and dry vegetation it could not be stopped before it crossed into railroad spur into the north central marsh. Four employees then constructed a firebreak at the edge of the north central swamp and backfired to confine the fire within a 200 acre marsh area. Two cooperative farmers and two section men arrived about 3:00 p.m. to contain and mop up the fire.

Fire #3 apparently started about noon February 13, 1967 from sparks of two railroad bridge burn outs. It was discovered at 3:00 p.m. by two members of Fire #2 refuge's crew, who were soon thereafter joined by a railroad crew of six. The fire was mopped up by 5:00 p.m., after burning twenty acres of cordgrass and brushy upland game cover.

Fire #4 "The Napier - Mound City fire" was really the fire of the year. It started apparently from CB&Q RR equipment near Napier at about 10:45 a.m. on February 24, 1967 and with a 45 mph southwest wind stormed across Squaw Creek, levee roads, semi-dry marshes and prairie, rotary mowed and disced cornfields and railroads to Mound City. It was literally beat out by hundreds of men fighting to save their homes at the edge of the city and less than 100 yards from the community gas and petroleum depot. It burned over about 1,800 acres of refuge lands and 200 acres of private lands. It destroyed considerable small mammals, organic material and upland game cover on the refuge and at least two railroad bridges. The refuge damage was partially countered by the fire providing greater waterfowl accessibility to desired habitat and the revision of our burning plan.

IV. RESOURCES MANAGEMENT

A. Grazing

Experimental grazing for goose browse management was continued this year on 120 acres of a cordgrass plant association prairie. The herd was built up to 152 animal units by September when an additional 70 acres of cordgrass and 45 acres of volunteer oats and Elbon rye and stubble were available.

The cattle did well on the grazed and burnt-over cordgrass (Spartina etc.) until the end of August. Both cattle and horses actually preferred the greening Spartina over alsike and Reed Canary grass during the spring. The pasture was supplemented with mixed minerals and insect repellant during the entire grazing season and with baled cordgrass and Canary grass during autumn.

Geese used the grazing area from October to November, building up to 50,000 in the grazed oats and rye area in early October. An average of one dropping per square foot in the over-grazed cordgrass indicated considerable goose use of the entire area. After a heavy October rain 20,000 pintails were observed in the grazed oats.

Under Special Use Permit #G-67-2 Harold Trimmer grazed various numbers of cattle and horses totaling 673.1 animal use months, at $1.00 per a.u.m. $673.10 were remitted through the Regional Office at the end of the year. Due to flooding cattle were entirely removed from the refuge from June 12 to July 3, 1967.

B. Haying

Experimental haying for increasing waterfowl use was also extended in 1967. Ten tons of hay at $2.00 per ton were removed from combined bromegrass covered levees. This permitted geese to feed on the green regrowth during autumn. Seventy-three tons of mixed alsike clover-canary grass at $3.00 per ton were removed from the former landing strip to prepare that area for goose grazing.

Bill Lent removed sixty ton of cordgrass and coarse vegetation at 50¢ per ton from several areas that could be flooded. Flooding during the fall migration brought in thousands of geese and some ducks to feed on the exposed rootlets and other available foods.

The refuge rotary-mowed twelve tons of cordgrass in Settling Basin #3 for Edwin Gibson at $3.00 per ton. This permitted intensive waterfowl use of this area after flooding.

Harold Trimmer removed 210 tons of cordgrass and other coarse vegetation at 50¢ per ton from wild hay units and from field margins. This made those areas available for goose loafing sites.

A shallow old impoundment which was hayed by Trimmer received some runoff and some goose browsing.

Our work indicates that grazing is superior to haying for preparing cordgrass prairie for goose use except on those areas that can be reflooded after mowing.

C. Fur Harvest

Permit trapper John Boyd harvested 11 opossum, 12 raccoon, 2 mink, 2 striped skunk, 1 coyote, 1 beaver, 10 muskrat and 2 cottontails and permit trapper Calvin Huffman took 1 beaver during the 1966-67 trapping season. One nuisance beaver was trapped by the refuge in May and turned over to the Missouri Department of Conservation.

The ten muskrat and two mink were trapped on a fifty percent share basis. Refuge receipts from these were $8.85. Receipts from a refuge-trapped beaver were $13.00. The trappers' share of receipts were $48.35 from all pelts.

V. FIELD INVESTIGATION AND APPLIED RESEARCH

A. Progress Reports

1. Vegetation Surveys

No Progress. High water flooded the Main Pool, retarded annual plants and encouraged a new crop of cattails. September flood waters disrupted seed collection boxes on the Northwest Pools Transect #2 and eliminated an opportunity to measure seed production in that pool.

2. Wood Duck Studies

Various wood duck boxes had been installed on Squaw Creek Refuge since 1940 but no one had ever found signs of wood duck use of a box until 1966.

In 1964 a small pond was planned for wood ducks and impounded adjacent to wooded uplands while cleaning Davis Creek. Wood duck soon began using the pond and in February 1966 an aluminum horizontal house, an aluminum vertical house and a cypress wood duck box were installed on twelve foot metal poles. Wood ducks raised one brood and attempted to rear another in the vertical house in 1966, when a brood of wood duck were also hatched out of the cypress box.

The housing program was expanded during February 1967 when another cypress box and a vertical aluminum house were added at Wood Duck Pond; a cypress box, a duplex and two single aluminum houses were installed in the Southwest Pool; a duplex and a single aluminum house were installed in Bluff Pool; a single aluminum house was added in the north central marsh and a duplex was installed near the manager's residence.

Inspections on April 29, 1967 indicated wood ducks were laying eggs in the horizontal and in a vertical house in Wood Duck Pond and in a single vertical house in the Southwest Pool.

Later inspections, however, indicated that all houses were abandoned. Bird watchers reported seeing a snapping turtle catch a female wood duck below its house in the Southwest Pool - accounting for that desertion. The aluminum houses in these studies were made from surplus World War II machine gun cases.

3. Teal Studies

Blue-winged teal began appearing in our traps on August 23, 1967. Teal trapping was continued until 9/16/67 with the following results:

Table 8. Pre-season teal banding 1967

	Adult		Immature			
Species	Male	Female	Male	Female	Locals	Totals
Blue-winged teal	118	70	169	217	0	574
Green-winged teal	8	3	2	0	0	13
Total	126	73	171	217	0	587

The fact that only 66% of the take were immatures in 1967 compared to 87% in 1966 indicates poor production and a probable cause of less teal use and a smaller trap take in 1967.

4. Cooperative Goose Management Studies

The 1966 Progress Report on Goose Management at Squaw Creek National Wildlife Refuge was extracted for our distribution about August 15, 1967 after it had been incorporated in A study of migration and mortality of geese in Missouri, Federal Aid Project No. 13-R-20-Job 2-Plan 5 (July 1967). We do not find this approach satisfactory, but it apparently is the most practical for our cooperator. Much of the progress report data had previously been included in our 1966 Narrative Report (pp. 28-38). The final report on this four year study should be completed about July 1, 1968 as a separate unity.

Too few conferences between cooperators were held during 1967 to get maximum efficiency from our management efforts. One of the two state waterfowl biologists transferred to the Bureau in mid-summer. This concentrated all state waterfowl studies around our cooperator Richard Vaught and priority was given to his Swan Lake Wildlife Management Area projects. State assistance with our cooperative banding program were also drastically reduced.

Inventories

Mr. Vaught made several aerial waterfowl counts during the winter and made aerial surveys almost every week during the fall migration. Ground surveys were made every week except during the summer by the refuge staff. Goose surveys were on a biweekly basis during the May-August period when only Class C data were needed according to the Squaw Creek Wildlife Inventory Plan.

The aerial counts were always supplemental by ground survey's waterfowl composition data for the immediate refuge area. Independent neckband studies by Paul Prevett, University of Western Ontario showed that the snow-blue geese ratios at Opp's and RSR Ranch Sanctuaries in Atchison County were similar to those at Squaw Creek N.W.R.

Ground observations further confirmed our recommendations to count small Canadas as a separate unity on the ground, since they usually panicked at the approach of a small plane and were not available for the low-altitude large Canada goose aerial counts.

Data listed in Form NR-1 were not always the same as shown in the aerial survey reports because small Canadas and white-fronted geese were not usually recorded by the aerial survey team and because Monday flights did not always reflect the true weekly averages of waterfowl numbers. Wednesday flights would be better for obtaining average weekly population data needed to compute waterfowl use days.

Table 9. Peak fall geese concentrations Squaw Creek N.W.R. 1967

Date	Canadas Large	Canadas Small	Lesser snow geese White	Lesser snow geese Blue	Ross'	White-fronted
10/22-28	6,340	2,000(1)	98.600	74.000	ND	200
11/12-18	7,450(2)	100(3)	80,750	47,050	5	5

(1) Peak small Canada geese numbers mostly eastern arctic type.
(2) Peak large Canada geese numbers.
(3) Typical Richardsons geese.

Banding

Reasonable success was obtained with pre-season lesser snow geese banding. when 887 were trapped. But only four Canada geese were trapped at that time.

Table 10. Lesser snow geese 1967 pre-season banding

Geese	Male	Female	?	Male	Female	Totals	I/A
Snow	204	170	1	75	70	520	.39
Blue	137	113	0	59	58	367	.47
Total	341	283	1	134	128	887	.42

The low ratio of immatures to adults in the pre-season net samples of snow and blue geese are probably influenced by an early migration of non-productive adults and yearlings.

A total of 1,100 geese were trapped during the hunting seasons to obtain representative samples of the various populations using the refuge for future distribution studies. The immature to adult ratios of 617 snow and 342 blue geese banded during the hunting season were 0.76 immatures to one adult snow and 0.86 immatures to one adult blue goose. These are considerably below those indicated for 1966 in Table 11.

Large Canada geese ratio however indicated increased production in 1967. The young:adult ratio of 0.16 per adult for the 65 tiny northeast arctic type Canadas that were netted October 30, 1967 was woefully low (Table 11). This record was improved a little by the mixed group of 21 small Canada geese netted after the 1967 hunting season and included in Table 12.

Table 11. Wild geese trapped during 1967 hunting season

Geese	Adult Male	Adult Female	Immature Male	Immature Female	Total	Imm./Adult 1966	Imm./Adult 1967
Snow	189	162	148	118	617	1.67	.76
Blue	97	87	87	71	342	1.41	.86
Large Canada	21	15	15	20	71	0.65	.97
Small Canada	33	23	2	7	65	1.39	.16
White-fronted	2	1	2	0	5		.67
Total	342	288	254	216	1,100		.75

Table 12. Canada geese trapped post-hunting season 1967

Geese	Adult Male	Adult Female	Immature Male	Immature Female	Total	Imm./Adult 1966	Imm./Adult 1967
Large Canada	171	97	145	164	577	0.65	1.16
Small Canada	4	10	0	7	21	1.39	.50
Total	175	107	145	171	598		1.12

Harvest

The ratio of the number of Canada geese processed by selected commercial pickers to the number harvested in the immediate Squaw Creek Refuge vicinity appeared so constant in 1965 and 1966 that our compulsory Canada goose check stations were terminated. The harvest and total kill were calculated entirely from commercial processor's required records in 1967.

Table 13. 1967 goose kill calculated from processor data

Geese	Processed	Factor	Harvest	Crippling Loss	Total Kill	Percent of Peak
Canadas	602	2.81(1)	1,692	423	2,115	22%
Snows & Blues	1,901	8.18(2)	15,550	3,885	19,435	11¼%

(1) Derived from the average of 2.85 in 1966 and 2.78 in 1965 Canada geese harvested for each Canada processed by five sampled pickers as indicated by compulsory check station data. (2) Derived from total harvested for each processed lesser snow goose as indicated by highway check stations in 1964.

The total Canada goose hunting season kill represented about 22% of the combined hunting season peak concentrations of 7,450 large and 2,000 small Canada geese. If the kill is added to the combined peak concentrations the Canada goose kill then is about 18% of the peak concentrations. Our management objective has been to keep the kill of Canada geese below 20% of the peak Canada goose concentrations until we have obtained our autumn goal of 20,000 Canada geese.

For the past three years we have requested that representative processors save Canada geese heads, tails and wings. From these parts we can obtain an idea of the variety of Canadas involved in the harvest. It is indicated by Table 14 that about 84% of the kill were large Canada geese or that 1,785 large Canadas were killed in the 1967 hunting season. This represented about 24% of the peak large Canada goose concentration but only about 12% of the peak large Canada goose concentration after the kill is added to the November 11-18, 1967 large Canada goose concentration. When the small Canada goose kill of 330 (15.6% of 2,115) is added to the October 22-28, 1967 peak concentration of 2,000 small Canadas, the kill is 14% of their peak concentration.

Table 14. Classification of Canada goose parts 1967

	Large Canadas			Small Canadas		
Age	"Subarctic"	Todd's	Giants	"Hutchins"	E. Arctic	Total
Immature	166	21	27	15	14	243
Adult	115	15	8	18	18	174
Total	281	36	35	33	32	417
Percent	67.4%	8.6%	8.4%	7.9%	7.7%	100%

7. Family Integrity and Productivity Studies

University of Western Ontario graduate student Paul Prevett made some intensive age-color ratio field studies at Squaw Creek N.W.R. during his neckband-family studies of lesser snow geese.

Table 15. Lesser snow geese age-color ratios 1967

	(White)				(Blue)				Percent
Date	Adult	Immature	Total	I/A	Adult	Immature	Total	I/A	White
11/12	389	144	533	.37	301	119	420	.40	56
11/14	354	155	509	.30	199	90	289	.45	64
11/15	408	157	565	.38	266	105	371	.39	60
11/16	386	129	515	.33	242	65	307	.27	63
Total	1537	585	2122	.38	1008	379	1387	.38	60

In conceding improved accuracy of this approach it appears that our net sampling given in Table 11 were bias toward immatures.

Mr. Prevett's findings from his neckbanding studies will be reported later. It is sufficient to state at this time that he has been able to trace his marked geese from McConnell River to Sand Lake N.W.R. and from Sand Lake to Squaw Creek. Numerous relationships have also been found with a number of satellite areas enroute.

Color Phase Study

The ratio of blue to white geese were obtained prior to almost every aerial survey. Less regular studies were made for additional color data.

Table 16. Lesser snow geese color survyes 1967

Date	Location	White	Blue	App.% Snow	Remarks	
10/ 9	Squaw Creek N.W.R.	250	75	77%	Loafing	HHB
10/23	Squaw Creek N.W.R.	261	216	55%	Mixed activity	HHB
11/ 8	RSR Ranch	265	170	61%	Loafing	PP
11/10	Squaw Creek (West Bay)	625	402	61%	"	PP
	Cross Levee #2	101	59	63%	"	PP
	A-7 Cornfield	241	111	67%	"	PP
	SB #3	100	65	60%	"	PP
11/13	Opp's Sanctuary	985	636	61%	"	PP
11/15	RSR Ranch	526	333	61%	"	PP
11/28	Main Pool Squaw Creek	108	91	54%	"	HHB
12/15	East Pool Squaw Creek	104	57	59%	"	HHB
Totals		3,566	2,215	62%		

The close agreement of snow:blue color ratios throughout the Squaw Creek zone indicates that the behavior differences of different arctic populations at Squaw Creek Refuge are not so apparent as we once thought. Indeed Mr. Prevett's neckband studies indicated that we were either dealing with a major portion of the McConnell River population or that the McConnell River lesser snow geese were thoroughly mixed with other populations by the time they reached Squaw Creek.

The only significant differences in color ratios were noted in early October and these may represent earlier and different population migrations. We believe that Mr. Prevett's current doctorate studies will clear up some of the age-old snow goose mysteries that now perplex us.

5. Cooperative Studies With Dr. Myers

Dr. Richard F. Myers has continued his interest in Squaw Creek National Wildlife Refuge by directing Central Missouri State College graduate student Bob Clement's mammal distribution studies during early 1967. After transfer to Missouri University at Kansas City Dr. Myers conducted a summer biology class field day and an autumn zoological excursion here. Plans call for Dr. Myers and the manager to prepare a refuge mammal checklist during 1968.

6. Cooperative Small White Goose Study

We and Paul Prevett have supplied ISU graduate student Dave Trauger with additional data this year for an expected early publication on Ross' and the intermediate white geese.

7. Waterfowl Inventory Plan Study

A revised draft of our inventory plan was submitted in May and again November 28, 1967 and was finally approved by Area Biologist James Monnie on December 11, 1967. We found this a most difficult assignment because the approved procedure continued to change after our original submission in 1966. It was obvious that sufficient qualified manpower and funds were not available at Squaw Creek N.W.R. for the classes of inventory data needed for our current management program.

8. Winter Mallard Banding

This study was abandoned as contrary to our current management plan of encouraging wintering waterfowl to migrate south. Two black duck and ninety-eight mallards were trapped in January-February 1967 at the exorbitant cost of $14.70 per duck.

9. Mourning Dove Banding

No progress due to lack of funds for assistance with this program. Our quota was 100 doves.

VI. PUBLIC RELATIONS

A. Recreation Use

The public used Squaw Creek National Wildlife Refuge about 30,000 times for 3,760 "converted twelve hour visitor days" in 1967. This is an increase over the 12,920 times and about 2,700 days in 1966 but less than the 4,500 days estimated for 1965.

Public use increased due to the local Audubon Society's support of the Land and Water Entrance Fee Program and to more attractive waters. We began collecting fees on April 1, 1967 and therefore contacted numerous visitors here for the spring waterfowl migration. However a large proportion of our visitors were on educational tours or visited during the hunting season non-fee tours and for the second year in a row expenses exceeded receipts.

B. Official Visitors

A list of official and interesting visitors have been extracted from our register. The first trip by regular official visitors is listed and marked with an asterisk (*).

Date	Name and Address	Purpose of Visit
1/2	Mr. and Mrs. Floyd Lawhon*, St. Joseph, Missouri	Christmas Bird Count
	John Hamilton*, Audubon Society	" " "
	Mr. and Mrs. Fitzhugh Diggs*, Hamburg, Iowa	" " "
1/3	USGMA John Hague*, St. Joseph, Missouri	Enforcement
1/4	Mo. Conservation Agents Clifton* and McCloud*	"
1/5	Richard Vaught*, MDC, Columbia, Missouri	Cooperative Study
1/9-13	Jerome Besser*, Denver Wildlife Research Center	Starling Studies
	Albert P. Kelley, Wildlife Services, Lafayette, Ind.	" "
	Fred R. Courtsal, " " " "	" "
	Dr. R.D. Grant, Ralston-Purina Co., St. Louis, Mo.	" "
	Lawrence Knepper, Tarkio, Missouri	" "
1/11	USGMA LaVerne Broyles*, Topeka, Kansas	Salvage Waterfowl
1/11-12	Dr. C.D. MacInnes, U. of Western Ont., London, Canada	Canada Goose Study
	Paul Prevett*, U. of Western Ontario, " "	" " "
1/14	Ron Andrews*, Iowa State University, Ames, Iowa	Goose Study
1/17	Phil Rice*, Jim Ryan*, Ken Armstrong*, Hollis Crawford*	
	Bob Kemp*, Missouri Department of Conservation	Meet
1/20	Bob Clement*, CMSC, Warrensburg, Missouri	Mammal Study
1/30	Rodney Green*, CMSC, Warrensburg, Missouri	Graduate Studies
2/9	Roy Coy*, St. Joseph Museum, St. Joseph, Missouri	Courtesy
2/13	Councilmen Clemens, Collins, Cooper and Fleener, Mound City, Missouri	City Sewage Lagoon
2/20	Rich Nolf*, St. Joseph Museum, St. Joseph, Mo.	Student Tour
	Issam Madi (Jordan), Demoileia (Greece)	" "
	Lamior Hinnauie (Lebanon)	" "
2/23	USGMA Chord*, Sioux City, Iowa	Looking for Geese

Date	Name and Address	Purpose of Visit
2/23	James Shipley, Iowa Conservation Commission	Looking for Geese
	Keith Thompson " " "	" " "
2/26	Prof. David Easterla*, N.W.Mo. State College	Onthology Class
2/28-3/1	James Monnie*, B.S.F.W., Quincy, Illinois	Biological Problem
3/9-13	Richard West, Denver Wildlife Research Center	Banding Blackbirds
3/11	Dr. David Parmalee*, Staff and 15 Students, K.S.T.C.	Field Trip
3/13-15	Hank and Vera Bradshaw, W. Des Moines, Iowa	Photo-story
3/14	Ray Franzen, N.G.F.&P. Comm. Falls City, Nebr.	" "
3/14	Robert McWhorter, K.F.F.&G. Manhattan, Kansas	See Geese
3/16	Dr. Harvey Gunderson*, U. of Nebr. Museum	" "
3/18	Dr. Richard Myers*, family and students C.M.S.C.	Field Trip
3/24	Jack Fennell, M.D.C. Kirksville, Mo.	Courtesy
3/27	Wm. Steinhauser and 27 Albany, Mo. Students	Field Trip
3/28	Leo Emmett* and E.J. Harvey* U.S.G.S., Rolla, Mo.	Water Study
3/31	U.S.G.M.A. Bonde, Lincoln, Nebr.	White-front Study
4/9	Harry Gregory, Ervin High School, Kansas City, Mo.	Observations
4/17	Benny Howerton*, Swan Lake N.W.R.	Pick up Planter
4/21	Bob Dierks and 34 Stanberry, Mo. R-II Students	Tour
5/2	A.H. Pearson and H.L. Foley CB&Q RR, St. Joseph, Mo.	Cooperation
5/4	Louanna Plemel, St. Marys Zavier, Kansas	U.S.N.P.S. Interview
5/14	Mrs. Elizabeth Cole, President and 60 members Nature Conservancy	Tours
5/15	Mound City R-II third and sixth graders (73)	Tours
5/16	Mound City R-II fifth grade (50)	Tours
5/28	Rev. Peters and 20 members Shenandoah, Ia. Lutheran Church	Tour
5/28	Maria Alicia Wernicke, Rosario, Argentina	Touring
5/28	Gregg Frenup, Buenos Aires	Touring
6/21-23	M. Nioma Foster, Izmic, Turkey	Visit Mrs. Burgess
7/19	Jay Gore*, Tenn. G. & F. Comm.	Study Marsh Management
7/20-22	Fritz Krege, Sand Lake N.W.R.	Hauling Supplies
7/24	Drs. Minter* and Mueller* and 36 N.W.M.S.C. Ecology Students	
8/1	Lisle Jeffrey, Pres. State Audubon Soc., Columbia, Mo.	Birding
8/4	Harold Green, B.O.R., Ann Arbor, Michigan	Fee Inspection
8/16-17	Ed Crozier and Joe Kineck, B.S.F.W., Mpls., Minn.	Planning
8/16	Mo. Hiway Dist. Engineer, K.C. Townley and three staff members, St. Joseph, Missouri	Planning
8/28	Mickey Howard, Trimble State Wildlife Area	For Corn
9/5	Ed Nuzman*, White Cloud, Ks. (Colo. State College)	Employment
9/15	Steve Kramer* and James Lloyd* N.D.C. Agents	Teal Season
9/28	Prof. H.W. McGee and 20 Tarkio Ecology Students	Trip
10/14	Jerry Martz, Mich. Dept. Conservation	Wild Goose Workshop
	Bert Blair, Fling Hills N.W.R., Burlington, Kansas	" " "
	R.E. Dobbins, U. of Mo., Columbia, Missouri	" " "
	Dr. R. Myers and family, Dept. Bio. U.M.K.C.	" " "
	Loren Bates, Iowa Cons. Commission	" " "
	Richard Bishop, Iowa Cons. Commission	" " "
	Prof. K.W. Anderson and 5 students, Bio. Dept. St. Benedicts, Kansas	" " "
	Dr. David Parmalee and 12 students, Emporia S.T.C.	" " "

Date	Name and Address	Purpose of Visit
10/14	Marree Nicholson, South Australia	Tour
	Curt Kartlehen, Mexico	"
10/21	Paul E. Tichnor*, MDC Agent	Patrol
10/25	Mesdames Sherri Reeves* and Vicki Maiben* OEO, Maryville, Missouri	NYC Program
10/25	Missouri Conservation Agents Swigert* and Ryan*	Patrol
10/27-28	Dr. Paul A. Johnsgard, Zool. Dept. U. of Nebraska	Study Waterfowl
11/4-19	Paul Prevett, U. of Western Ontario	Snow Goose Study
11/5	Eldie Mustard, Biologist SCS, Denver, Colorado	Study Wildlife Habitat
	Robert E. Myers, SCS, Syracuse, New York	" " "
	L. Dean Marriage, SCS, Portland, Oregon	" " "
	Dr. and Mrs. W. Cameron Walker, Hull, England	Birding
11/7	Dr. Mueller and 13 NWMSC Plant Ecology Students	Study Plant Associations
11/22-28	Wm. Cochran and Tom Kjos, Ill. Nat. History Survey	Goose Telemetry
12/1	C.D. Swanson, BSFW, M&E, Minneapolis, Minnesota	Courtesy
	Ron Osika, RCM Police, Winnipeg, Manitoba	Courtesy
12/4-5	Forrest Carpenter, Supvr. Refuge Div., Mpls, Minn.	Investigate R.A. Brown's
	Harry Stiles, Asst. " " " " "	Complaints
12/21	James Hagee, MU, Columbia, Missouri	Collect Small Mammals
12/30	Mike Donahue, MU, Zool. Department	Study Geese Blood

C. Refuge Participation

Squaw Creek National Wildlife Refuge personnel were active with public relations in 1967. Biological Technician Yocum continued as Pack 71 Cubmaster; Operator Hamilton continued as Troop 71 Scoutmaster; WAE Laborer Huffman (Weekend Naturalist) continued as Explorer Post 71 Advisor with Refuge Manager Burgess as Assistant Advisor and Maintenance-man Boyd as Chairman, Explorer Scout Committee. Mr. Yocum is active with PTA.

Mr. Burgess was a member of the local Kiwanis. He continued as a member of the "snow-blue-white-fronted geese committee", Technical Section, Mississippi Flyway Council and in that capacity gave papers at the Technical Section Workshop at Milford, Michigan in April and at the Midwest Wildlife Conference at Madison, Wisconsin relating to the affect of special Canada goose hunting regulations on the take of lesser snow geese.

All staff members assisted with the wild goose study workshop held at Squaw Creek N.W.R. on October 14th for wildlife students and tecnhicians.

"Fowl Cholera in Waterfowl at Squaw Creek National Wildlife Refuge, Missouri" by Richard Vaught, Harold C. McDougle and Harold H. Burgess was published in the April 1967 issue of The Journal of Wildlife Management.

A paper "Affects of Special Regulations and Management on Snow Goose Harvest" was given by Refuge Manager Burgess at the Mississippi Flyway Technical Section Workshop near Pontiac, Michigan in April. It was revised and given again by Burgess at the Midwest Wildlife Conference Madison, Wisconsin in December 1967.

Additional public participation by members of the Squaw Creek staff is listed:

Participation

1/2 Burgess conducted six birders on Christmas Bird Count.
1/9 Burgess supplemented state's midwinter aerial waterfowl survey.
1/10 Burgess conducted BSFW starling control group on tour of refuge blackbird roosts.
1/11 Burgess assisted USGMA Broyles and Director Linder, Topeka Zoo, salvage crippled snow geese; conducted Dr. C.D. MacInnes and Paul Prevett, University of Western Ontario on snow goose survey in S.W. Holt (Mo.) County and Doniphan County, Kansas.
1/19 Yocum attended County Johnson Grass meeting at Craig, Missouri.
1/25 Biological Technicians Cornelius and Yocum started attending weekly adult vocational welding school at Mound City.
1/31 Burgess interviewed Larry Bancroft U. of K. regarding career in Bureau.
2/6 Burgess gave talk on banding to Serosis Club, Oregon, Missouri.
2/9 Burgess attended Missouri Game Conference and Wildlife Society Chapter Meeting at Columbia, Missouri while on annual leave.
2/13 Burgess attended Mound City Council Meeting held at refuge to discuss possible sewage lagoon location.
2/14-16 Clerk-typist Zeliff attended clerk workshop at Minneapolis, Minn.
2/16 Burgess and Yocum attended conference at refuge with MDC Protection District Supervisor Rice and Agents Clifton and McCloud relating to highway hunting and unattended fires.
2/26 Burgess discussed refuge purpose with (1) Instructor H. Gregory and ten Irvindale, Mo. High School biology students (2) Prof. Easterla and ten N.W.M.S. College Ornithology Students and (3) forty members Burrough's Nature Club, Kansas City, Missouri.
3/3 Burgess inspected Central Missouri State College training facilities and discussed wildlife management curriculum with Dr. Richard Myers and found it inadequate for a BSFW career.
3/11 Burgess discussed refuge purpose with Drs. Parmalee and Spencer and 20 Emporia (Ks) State College ornithology students. Burgess supervised five adults and 21 boy scouts of Troop 115, Kansas City, Missouri on overnight camp.
3/14 Burgess inspected CB&Q RR, Mound City spur with Roadmaster Foley and Track Supervisor Cole regarding proposed crossings and trains.
3/13-15 Burgess discussed theme "Cooperating US and State Agents shepherd blue geese up the Missouri River on arctic migration with Photo-writers Hank and Mrs. Bradshaw and supporting party of MDC Agents Rice, Armstrong, Clifton, McCloud with Nebraska G.F.&F Warden Frazen on March 14 and USGMA Hague on March 15 and conducted group on numerous photo forays.
3/18 Discussed refuge purpose and conducted Dr. Myers and Dr. Costsner and CMSC students on tour of refuge.
3/22 Burgess gave wildlife week talk on public lands to Mound City Kiwanis.
3/22-25 Burgess was on assignment to Regional Office, Atlanta, Georgia relating to Area Biologist position.

3/27	Burgess and Yocum conducted Albany Biology Class on nature hike and tour of refuge.
4/4-6	Burgess attended Technical Section Workshop of Mississippi Flyway Council near Pontiac, Michigan and gave paper.
4/6	Burgess gave slide talk on snow geese and refuge to Madison Heights, Michigan Exchange Club.
4/19-20	Burgess attended Missouri goose conferences at Weldon Springs, St. Charles and Columbia, Missouri.
4/21	Burgess and Yocum conducted 40 members of Stanberry (Mo.) High School Biology Classes on nature hikes and tours of refuge.
4/30	Burgess explained refuge purpose to 54 members and friends of Oregon Saddle Club.
5/1	Burgess and Yocum conducted 100 Savannah (Mo.) elementary school children on refuge nature hikes and tours.
5/13	Burgess attended annual meeting Missouri Chapter Nature Conservancy at Maryville, Missouri.
6/6	Burgess talked on Federal Entrance Fees and Golden Eagle Passport Program to Oregon, Missouri Kiwanis.
6/13	Burgess explained Squaw Creek zone goose management at Tri-State Conservation Law Enforcement meeting at Big Lake State Park and conducted tour of refuge.
6/13	Burgess attended Iowa Conservation Commission Biology Seminar at Wilson Island Area, Missouri Valley, Iowa.
7/15	Burgess discussed refuge purpose and conducted marsh field trip for Dr. Richard Myers and six KCMU Biology Students.
7/20	Burgess gave illustrated talk on refuge to Maryville (Mo.) Lions Club.
7/26	Burgess discussed refuge purpose and conducted tour for Drs. Minter and Mueller and 30 members of NWMSC Wildlife Conservation Teachers Workshop.
7/31-8/2	Burgess attended Mississippi Flyway Technical Section Meetings at St. Louis, Missouri.
8/13	Burgess conferred with Regional Office and Mo. Highway Department planners about proposed I-29 feeder road (700 cars daily) through refuge.
8/30	Yocum talked about hunting regulations to Mound City Kiwanis.
9/21	Burgess and Andrews attended St. Joseph Audubon Society Meeting and screen tour of Alaska by Dr. Bailey, Denver, Museum.
9/28	Burgess explained refuge purpose and conducted tour for 20 Tarkio College Ecology Class.
9/30	Burgess explained refuge purpose and conducted tour for 30 members and friends of Copeland Baptist Church, St. Joseph, Missouri.
10/7	Burgess explained refuge purpose and conducted 20 members Shawnee Mission, Kansas High School on tour of refuge.
10/12	Burgess explained Squaw Creek goose management study and regulations at the Tri-State Conservation Law Enforcement Meeting, Forney Lake, Iowa.
10/14	Burgess conducted wild goose workshop for 40 participants. Ron Andrews demonstrated cannon netting and described banding operations.
10/19	Burgess and Area Biologist Monnie attended MDC District Biological and Enforcement Meeting at Big Lake State Park.

10/29 Burgess, Andrews and Huffman explained refuge purpose and conducted 600 persons on restricted refuge tours.
11/5 Burgess, Andrews and Huffman received visitors and conducted 650 people on refuge tours.
11/12 Andrews, Huffman and Hamilton received visitors and conducted 425 people on refuge tours.
11/19 Andrews, Huffman and Hamilton received visitors and conducted 600 people on refuge tours.
11/26 Burgess, Andrews and Huffman received visitors and conducted 125 people on refuge tours.
12/3 Burgess, Andrews and Huffman received visitors, explained refuge purpose and conducted 120 people on refuge tour.
12/5 Burgess gave illustrated talk at Seratoma Club, St. Joseph, Missouri.
12/5 Burgess attended conference with Refuge Supervisor Carpenter, Assistant Supervisor Stiles and R.A. Borwn, Sr., St. Joseph Attorney, former Missouri Conservation Commission and chief critic of Squaw Creek N.W.R. operations.
12/11-13 Burgess and Andrews attended Midwest Wildlife Conference and Canada goose symposium. Burgess gave paper. Andrews was on leave.
12/17 Burgess and Andrews assisted USGMA Broyles and three Kansas F.F.& G. Protectors survey 70,000 lesser snow geese at Brown County Kansas Lake.

D. Hunting

Hunting was not permitted on Squaw Creek National Wildlife Refuge. We were concerned with the hunting in the Squaw Creek area that influences wildlife use of the refuge. In recent years we have been particularly concerned with an overharvest of Canada geese. Some progress has been made toward correcting this situation with special regulations and refuge management since 1964.

The third experimental teal hunting season was opened September 16-24, 1967. Our observations indicated an increased number of hunters, better hunting than in 1966, but poorer teal hunting than in 1965.

The 1967 teal kill was estimated at 1,496 compared to 1,125 in 1966 and 1,760 in 1965 for the Squaw Creek vicinity. Processors' data indicated that almost fifteen percent of the teal kill were green-winged teal.

The 1967 Squaw Creek area hunters were offered a seventy day goose season starting October 20 with an aggregate daily bag of five geese. The Canada goose season was restricted to thirty days and one daily. The white-fronted goose legal bag still consisted of two per day.

The regular duck hunting season opened November 1 - December 10, 1967, with an aggregate bag of four daily including not more than two mallards and one wood duck.

The estimated waterfowl harvest has been calculated by Ronald Andrews from processor data and is shown in Table 17 with estimated peak population and percentages.

Table 17. 1967 Peak waterfowl populations and kills

Species:	Canadas Large	Canadas Small	Snow-Blues	White-Fronts	Mallard	All Ducks
Peaks:	6,340	2,000	172,600	200	155,500	221,910
Est. kill:	1,785	330	19,435	ND	12,580	16,627
% kill of peaks:	24	14	11	ND	8	7½

In 1964 hunters killed 27,690 waterfowl units in 25,000 trips averaging 1.1 waterfowl per trip. If similar success was obtained in 1967, then the 38,177 waterfowl units killed during the regular season represented 34,706 trips and the 1,496 teal killed during the special season indicated 1,360 trips or a total of 36,066 waterfowl hunting trips.

We estimate an additional 550 trips were used to chase squirrels, cottontails, quail, pheasant and raccoon, deer and other game in the refuge vicinity in 1967.

E. Violations

Only two refuge staff members had enforcement credentials. They extended themselves to help fill an enforcement need caused by the assignment of extra U.S. Game Management Agents to Horicon, Wisconsin.

The Missouri Conservation Department Agents also responding well under Supervisor Phillip Rice to law enforcement challenges. The number of cases refused prosecution and the size of the state fines indicate that additional education and changes in procedures may be necessary.

The following case made in 1966 was processed in 1967 by U.S. Commissioner Victor Gehrs, St. Joseph, Missouri.

Date	Name/Address	Violation	Agent	Fine/Cost
12/15/66 1/23/67	Robert D. Groves, Jr. Kansas City, Mo.	Take waterfowl after hours.	USGMA Hague	$25. $16.

The following cases were processed by Magistrate Judge John Bowes, Oregon, Missouri:

9/17/67	Charles Price Kansas City, Mo. George VanVoorst Overland Park, Ks.	Take wildlife from vehicle.	McCloud, Lloyd and Crawford	$ 5. $12. $ 5. $12.

Date	Name/Address	Violation	Agent	Fine/Cost
9/23/67	Scott Harrison Kansas City, Mo.	Take 8 teal/day. (age 13)	USGMA Broyles USRMA Yocum	None
10/20/67	Leland Ellison St. Joseph, Mo.	Take wood duck in closed season.	USRMA Yocum MDCA Ticknor	$10. $12.
	Albert Monroe St. Joseph, Mo.	Take mallard in closed season.	MDCA McCormick MDCA Armstrong	$ 5. $12.
10/21/67	Milton Wardlow Mound City, Mo.	Shot waterfowl with shotgun capable of holding 7 shells.	USRMA Yocum	$10. $12.
	(2nd charge)	Take 2 Canada geese.		$ 5. None
	William S. Young Kansas City, Mo.	Transporting goose without wing.	Rice Lloyd	$ 5. $12.
	Michael O. Hubbard Kansas City, Mo.	Attempt take duck in closed season.	Clifton Ticknor	$10. $12.
10/24/67	John L. Smith Kansas City, Mo.	Attempt take duck in closed season.	USRMA Yocum Ryan	$ 5. $12.
10/25/67	Larry J. Muff St. Joseph, Mo.	Attempt take duck in closed season.	Clifton	$10. $12.
10/26/67	Frank G. Stava Wahoo, Nebr.	Bag two Canada geese.	USRMA Burgess USRMA Yocum	$10. $12.
	Darwin Wegner Fremont, Nebr.	Transport 7 Canada geese belonging to others.	USRMA Yocum	$ 5. $12.
10/27/67	James Lenker	Shooting over Highway 118	Clifton	$ 5. $12.
	Terry Ward and	" " " " "		$ 5. $12.
	Earl Meffert St. Joseph, Mo.	" " " " "		$ 5. $12.
10/28/67	Robert Stevenson St. Joseph, Mo.	Molesting geese on refuge.	USRMA Burgess	$ 5. $12.
10/29/67	Robert Allen St. Joseph, Mo.	Attempt take duck in closed season.	Swigart	$ 5. $12.
	Wm. Adkinson St. Joseph, Mo.	Shooting over Highway 118.	Clifton	$ 5. $12.
11/3/67	Harry Taylor Grandview, Mo.	Take goose on refuge.	Clifton	$ 5. $12.

Date	Name/Address	Violation	Agent	Fine/Cost
11/4/67	Charles Stone St. Joseph, Mo.	Attempt take geese on refuge.	Clifton	$ 5. $12.
	Thomas Montray St. Joseph, Mo.	Shoot over Highway 118.	Clifton	$ 5. $12.
11/5/67	Larry Lake St. Joseph, Mo.	Take goose on refuge.	McCloud Lloyd	$ 5. $12.
	LeRoy Lease St. Joseph, Mo.	Shoot over Highway 118.	McCloud Lloyd	$ 5. $12.
11/6/67	Donald Adams Parkville, Mo.	Attempt take waterfowl after hours.	Clifton	$ 5. $12.
	Vance Smith Amazonia, Mo.	Attempt take waterfowl after hours.	Clifton	$10. $12.
11/9/67	Fred Schultz St. Joseph, Mo.	Attempt take waterfowl after hours.	USRMA Burgess	$ $10. $12.
12/2/67	Robert E. Lee Topeka, Kansas	Attempt take goose after hours.	Clifton USRMA Burgess	$10. $12.

In addition five individuals apprehended for hunting trespass on the Robertson Hunting Club by Holt County Sheriff Carl Mackey were fined $15.00 and $12.00 costs each. These trespass fines appear unusually high in comparison to the $5.00 fines for refuge trespass. However in many refuge cases highway shooting was really involved but refuge trespass was charged by the state whenever possible to make a conservation instead of a highway law case. Also the district U.S. Commissioner Court was disorganized due to the transfer of Mr. Gehrs and the appointment of a new commissioner and a new assistant U.S. Attorney. We hope that we may again take national refuge trespass cases into federal courts next year.

Federal cases pending action or report to refuge:

Date	Name/Address	Violation	Agent
11/9/67	Robert Brennan Topeka, Kansas	Possessing w. swan	USRMA Burgess USGMA Broyles
9/23/67	Marshall Bliss Shawnee Mission, Ks.	Bag 6 teal	USGMA Broyles USRMA Yocum
9/23/67	Stanley Allen St. Joseph, Mo.	Kill baldpate in teal season	USGMA Broyles USRMA Yocum
10/28/67	Edward Haren, Jr. Shawnee Mission, Ks.	Possessing w. swan	USRMA Yocum

F. Safety

On November 11, 1967 our accident prevention record had reached 1,765 days without a lost time accident when the sliding window on the Link-belt dragline came clashing down bruising and cutting the operator's arm and causing a days lost time and several visits to the doctor. Our inspection indicated that the accident was caused by having an unsecured window open while moving the dragline. The operator has since received a disability retirement for health reasons.

Safety meetings and discussions were held regularly during the year when appropriate. New employees were oriented on safety before they were permitted to start other activities.

Safety hazards were corrected as they were observed. A tree guard was built over the D-8 tractor.

VII. OTHER ITEMS

1. The Corps of Engineers continued to promote reactivation of their Squaw Creek - Big Ditch proposal. The Cannon Drainage portion below the refuge has received congressional approval.

2. The report was drafted by Refuge Manager Burgess and Biological Technician Andrews and typed by Clerk Typist Zeliff. Biological Technician Yocum compiled the data for NR-8 and NR-12.

SIGNATURE PAGE

Submitted by:

Harold H. Burgess
(Signature)

Harold H. Burgess
Refuge Manager
Title

Date: February 10, 1968

Approved, Regional Office:

Date: FEB 13 1968

(Signature)

Regional Refuge Supervisor

CREDIT MUST BE GIVEN TO
MISSOURI DEPARTMENT OF CONSERVATION
PHOTO BY DON WOOLDRIDGE

NEG NO. C110-1

SUBJECT

SERIES

LOCATION

DATE

PHOTO FILE

Squaw Creek Photograph #1

Wild ducks swarmed into the flooded utilized natural moist soil foods in the Main Pool during early 1967.

Missouri Conservation Department Photograph

Squaw Creek Photograph #2

The Main Pool was very attractive to waterfowl during the spring of 1967 when abundant natural food plants and sufficient water provided ideal feeding conditions for ducks. The duck areas were covered with smartweeds the light areas with wild millet. June floods and resulting high waters retarded most food plants during the summer. The headquarters area is outlined in the loess hills.

Bureau Photograph

Main Pool
Penny slough
Squaw Creek
Spillway
West Levee
CB&Q RR

002078

NOV 3 1966

CREDIT MUST BE GIVEN TO
MISSOURI DEPARTMENT OF CONSERVATION
PHOTO BY DON WOOLDRIDGE
NEG NO. R634-18
SUBJECT
SERIES
LOCATION
DATE
PHOTO FILE

Squaw Creek Photograph #3

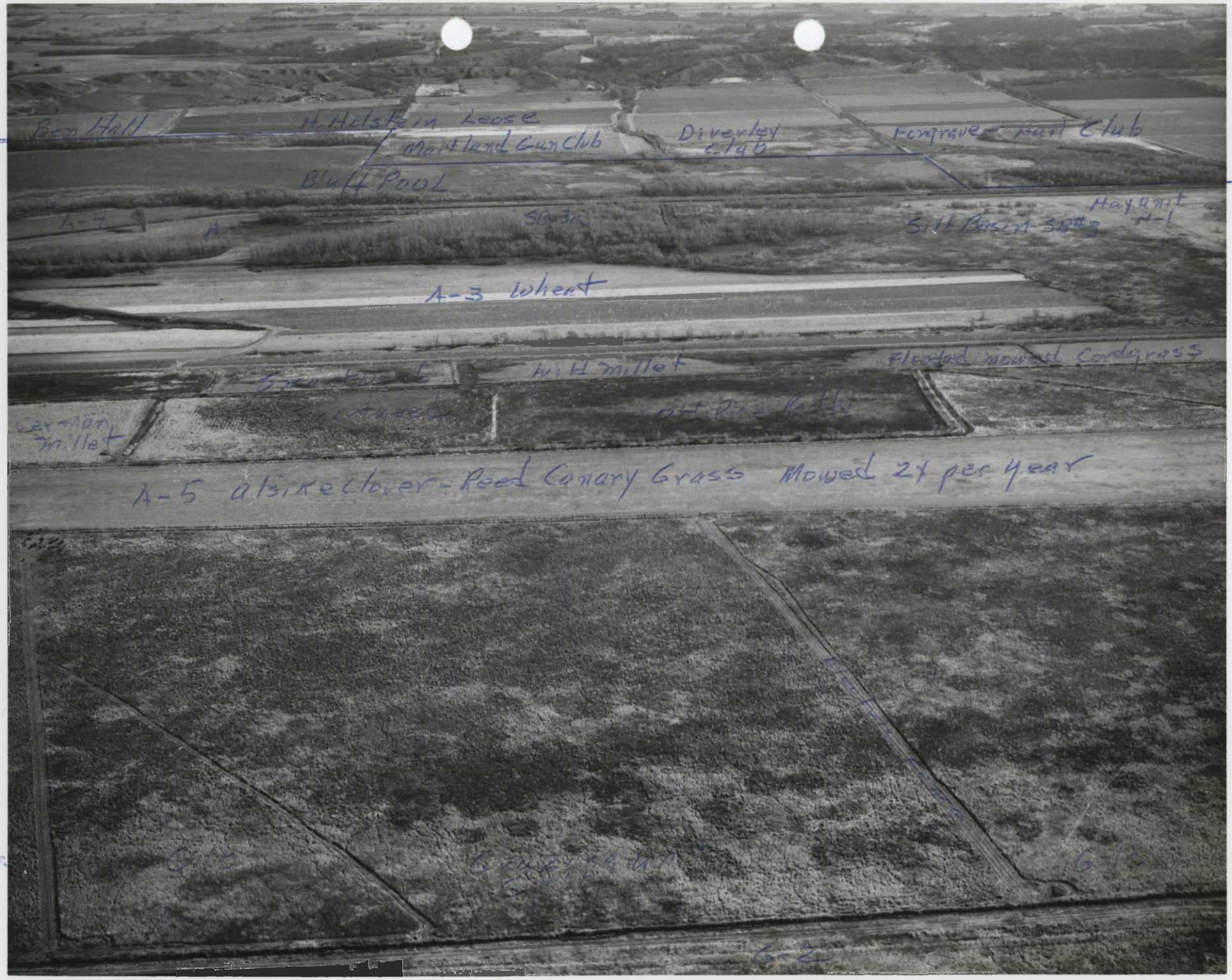
We encourage the mallards to go south in early December by reducing the water supply. This reduces winter die-offs under stress conditions.

Missouri Conservation Department Photograph

Squaw Creek Photograph #4

Experimental grazing - haying - paddy areas. Rotated heavy grazing of G-1's three forty acre units resulted in intensive snow goose and some Canada goose browsing. The mowed alsike-canary grass field, paddies and wheat fields have been intensively used by Canada geese and extensively used by snow geese for several years. Ducks in the thousands were attracted to the flooded paddies. This particular ring of Canada goose hunting clubs continue to pose a threat to our goose management program.

Bureau Photograph


Ben Hall
H. Holstein Leose
Maitland Gun Club
Diverley Club
Fongrave Hall Club
Bluff Pool
A-4
Silt Basin
Hay unit H-1
A-3 Wheat
Wild millet
Flooded mowed Cordgrass
German millet
A-5 alsike clover - Reed Canary Grass Mowed 2x per year

NOV 3 1966

002072

Squaw Creek Photograph #5

A satellite refuge developed at Brown County, Kansas State Lake about twenty miles southwest of Squaw Creek N.W.R. in December with 70,000 lesser snow geese.

HHB 12/19/67

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

WATERFOWL

REFUGE Squaw Creek

MONTHS OF January 1 TO April 29, 19 67

(1) Species	Class	Weeks of reporting period (2) 1/1-7	1/8-14	1/15-21	1/22-28	1/29-2/4	2/5-11	2/12-18	2/19-25	2/26-3/4	3/5-11
Swans:											
Whistling											
Trumpeter											
Geese:											
Canada Large	B	6,190	3,060	4,500	4,500	4,000	4,000	4,000	2,000	11,600	6,000
Cackling Small	B	5	5	2	2	2	2	2	2	240	1,000
Brant											
White-fronted	C							3		50	1,000
Snow	B	16,000	200	3,340	3,340	15	12	300	9	14,130	250,000
Blue	B	7,000	100	2,225	2,225	5	3	100	3	7,130	150,000
Other Total Geese	B	29,195	3,365	10,067	10,067	4,022	4,017	4,405	2,014	33,150	408,000
Ducks:											
Mallard	C	65,000	500	15,140	15,140	18,000	20,000	100,000	20,000	265,500	300,000
Black	C	60	5	15	15	15	20	100	20	100	200
Gadwall											
Baldpate										10	110
Pintail	C	2		10	10	10	10	600	400	41,500	50,000
Green-winged teal	C			10	10	10	10	10	20	140	300
Blue-winged teal											
Cinnamon teal											
Shoveler											10
Wood	C	8		6	6	5	5	10	10	10	20
Redhead	C									10	20
Ring-necked	C									10	500
Canvasback											
Scaup											
Goldeneye											10
Bufflehead											
Ruddy											
Other C.Merganser	C			60	60		5	100		100	10
Total Ducks	C	65,070	505	15,241	15,241	18,040	20,050	100,820	20,450	307,380	351,180
Coot:	C	None	None	None	None	None	None	None	None	None	10

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

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

WATERFOWL
(Continuation Sheet)

REFUGE Squaw Creek MONTHS OF January 1 TO April 29, 19 67

(1) Species	Class	(2) Weeks of reporting period 3/12-18 11	3/19-25 12	3/26-4/1 13	4/2-8 14	4/9-15 15	4/16-22 16	4/22-29 17	18	(3) Estimated waterfowl days use	(4) Production Broods seen	(4) Production Estimated total
Swans:												
Whistling												
Trumpeter												
Geese:												
Canada	B	4,000	3,400	550	220	100	40	10		407,190		
Cackling	B	5,700	3,150	110	300	200	60	50		75,824		
Brant												
White-fronted	C	1,400	6,500	520	40	30	20			66,941		
Snow	B	220,600	308,000	31,000	3,000	180	300	120		5,953,822		
Blue	B	230,600	132,000	15,500	1,000	120	150	60		3,837,547		
Other	B	462,300	453,050	47,680	4,560	630	570	240		10,341,324		
Ducks:												
Mallard	C	100,000	54,000	19,300	10,000	1,500	1,110	230		7,037,940		
Black	C	100	60	40	100		10	10		6,090		
Gadwall	C	50	2,300	300	500	500	500	50		29,400		
Baldpate	C	500	250	700	500	500	500	50		21,840		
Pintail	C	30,000	23,200	2,700	3,000	1,600	1,000	120		1,079,134		
Green-winged teal	C	500	22,200	12,700	10,000	5,000	4,000	1,570		395,360		
Blue-winged teal	C		110	6,800	6,000	6,000	10,200	5,900		245,070		
Cinnamon teal	B			2						14		
Shoveler	C	50	3,200	11,100	15,000	6,400	4,100	1,220		287,560		
Wood	C	200	140	50	50	60	60	50		4,830		
Redhead	C	10	10							350		
Ring-necked	C	500								7,070		
Canvasback												
Scaup	C		20	300	300	300	200	10		7,910		
Goldeneye	C	10								140		
Bufflehead												
Ruddy	C			100	50	30	20			1,400		
Other C. Merganser	C	20								2,435		
H. Merganser	C				2	10				84		
Total Ducks	C	131,940	105,490	54,092	45,502	21,900	21,700	9,210		9,126,677		
Coot:												
	C	10	1,020	6,120	6,000	2,200	2,600	460		128,940		

(over)

	(5) Total Days Use	(6) Peak Number	(7) Total Production
Swans			
Geese	10,341,324	B 462,300	
Ducks	9,126,677	C 351,180	
Coots	128,940	C 6,120	

SUMMARY

Principal feeding areas Habitat Unit - 5.

Principal nesting areas

Reported by Harold H. Burgess

Harold H. Burgess, Refuge Manager

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

(1) Species: In addition to the birds listed on form, other species occurring on refuge during the reporting period should be added in appropriate spaces. Special attention should be given to those species of local and national significance.

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

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

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

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

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

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

Interior Duplicating Section, Washington, D. C.
1953

76242

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

WATERFOWL

REFUGE Squaw Creek National Wildlife Refuge MONTHS OF April 30, TO Sept. 2, 1967

Inventory Class (1)	C	C	C	C	C	C	D	D	D	D
	Weeks of reporting period (2)									
Species	4/30-5/6 1	5/7-13 2	5/14-20 3	5/21-27 4	5/28-6/3 5	6/4-10 6	6/11-17 7	6/18-24 8	6/23-7/1 9	7/2-8 10
Swans:										
Whistling										
Trumpeter										
Geese:										
Canada Large	4	4	5	5	2	2	2	2	2	1
~~Cackling~~ Small	40	40	6	3	3	3	4	4	4	
Brant										
White-fronted	5	5								
Snow	140	13	15	13	13	3	4	4	4	1
Blue	90	4	9	8	8	5	4	4	4	
~~Other~~ Total Geese	279	66	35	29	26	13	14	14	14	2
Ducks:										
Mallard	200	180	118	61	60	60	60	58	58	48
Black										
Gadwall	130	130	135	21	20	20	8	6	6	2
Baldpate	100	110	110	16	10	10	2	2	2	3
Pintail	58	36	24	8	40	20	4	4	4	5
Green-winged teal	210	150	52	74	10	10	2	4	4	2
Blue-winged teal	5720	1500	1100	104	140	130	22	18	18	22
Cinnamon teal		2	2							
Shoveler	2410	1310	278	252	80	50	10	2	2	5
Wood	22	34	31	24	22	22	27	40	40	8
Redhead										
Ring-necked										
Canvasback						1				
Scaup	30	20	6	21	6	10	14	3	3	1
Goldeneye										
Bufflehead										
Ruddy	4									
~~Other~~ Hooded Merganser	2				3	7	3	3	3	
Total Ducks	8886	3472	1856	581	391	340	152	140	140	96
	1060	1350	1160	368	410	350	200	170	170	150
Coot:										

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

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

WATERFOWL
(Continuation Sheet)

REFUGE Squaw Creek MONTHS OF April 30, TO Sept. 2, 1967

Inventory Class:	D	D	D	D	D	D	D	D	(3)	(4)	
	Weeks of reporting period								Estimated	Production	
(1) Species	7/9-15 11	7/16-22 12	7/23-29 13	7/30-8/5 14	8/6-12 15	8/13-19 16	8/20-26 17	8/27-9/2 18	waterfowl days use	Broods seen	Estimated total
Swans:											
Whistling											
Trumpeter											
Geese:											
Canada Large	1	1	1	1	1	1	1	1	259		
~~Cackling~~ Small									749		
Brant											
White-fronted									70		
Snow	1	1	1	1	1	1	1	1	1,526		
Blue									952		
~~Other~~ Total Geese	2	2	2	2	2	2	2	2	3,556		
Ducks:											
Mallard	48	30	30	30	190	110	520	1220	21,567		
Black								5	35		
Gadwall	2	2	2	2					3,402		
Baldpate	3						10	10	2,716		
Pintail	5	10	10	18	32	110	520	1520	16,996		
Green-winged teal	2	2	2	2	10	110	400	440	10,402		
Blue-winged teal	22	2	2	12	240	500	1000	1010	80,934		
Cinnamon teal									28		
Shoveler	5	5	5	5	5	5	5	5	31,073		
Wood	8	8	8	8	30	70	310	310	7,154	none	7
Redhead											
Ring-necked											
Canvasback									7		
Scaup	1	1	1	1	1				833		
Goldeneye											
Bufflehead											
Ruddy									28		
~~Other~~ Hooded Merg.									147		
Total Ducks	96	60	60	78	508	905	2765	4520	175,322	none	7
Coot:	150	100	50	50	50	10	10	15	40,761		

(over)

	(5) Total Days Use	(6) Peak Number	(7) Total Production
Swans			
Geese	3,556	279	
Ducks	175,322	8,886	7
Coots	40,761	1,350	

SUMMARY

Principal feeding areas A-16, West Main Pool and West Pool

Principal nesting areas Wood Duck Pond

Reported by Harold H. Burgess

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

(1) Species: In addition to the birds listed on form, other species occurring on refuge during the reporting period should be added in appropriate spaces. Special attention should be given to those species of local and national significance.

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

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

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

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

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

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

Interior Duplicating Section, Washington, D. C.
1953

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

WATERFOWL

REFUGE Squaw Creek MONTHS OF Sept. 3 TO Dec. 31, , 19 67

(1) Species	Weeks of reporting period (2)									
	1 9/3-9	2 9/10-16	3 9/17-23	4 9/24-30	5 10/1-7	6 10/8-14	7 10/15-21	8 10/22-28	9 10/29-11/4	10 11/5-11
Swans:										
Whistling									1	1
Trumpeter										
Geese:										
Canada ~~XXXXXXX~~ Large	1	23	175	300	340	2220	2725	6340	5520	6660
~~Cackling~~ ~~XXXX~~ Small				10	180	1100	1100	2000	1120	500
~~Brant~~ Ross'									2	5
White-fronted			5	80	100	200	200	200	30	2
Snow		8	370	1815	6000	26000	58300	98600	90000	51750
Blue			165	1550	3005	13000	29100	74000	70000	25875
~~Other~~ Total Geese	1	31	715	3755	9625	42520	91425	181140	166672	84792
Ducks:										
Mallard	1220	1310	1750	13850	16910	25500	71200	100500	120000	142000
Black	5		10	5	10	30	70	100	120	140
Gadwall			100	100		500	1100	1200	200	
Baldpate	205	600	5610	10000	4300	2000	1300	6000	600	
Pintail	1805	2635	6150	3875	8520	50000	70100	52100	50000	7000
Green-winged teal	840	880	1700	7880	3500	10000	15500	31100	50000	12050
Blue-winged teal	1755	2653	1200	1445	300	500	300	140	100	
Cinnamon teal										
Shoveler	25	10	220	40	40	50	400	200	200	200
Wood	345	402	356	115	30	100	60	80	60	20
Redhead							50	50		
Ring-necked							100	60	500	100
Canvasback										
Scaup						10	60	60	100	100
Goldeneye										
Bufflehead				2					10	
Ruddy				8	10	10	10	10	20	10
Other										
Total Ducks	6200	8490	17096	37320	33620	88700	160250	191600	221910	161620
Coot:	30	150	1270	7560	3500	3500	3000	1100	1000	300

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

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

WATERFOWL
(Continuation Sheet)

REFUGE Squaw Creek MONTHS OF Sept. 3 TO Dec. 31, , 1967

(1) Species	(2) Weeks of reporting period 11/12-18 11	11/19-25 12	26-12/2 13	12/3-9 14	12/10-16 15	12/17-23 16	12/24-30 17	12/31 18	(3) Estimated waterfowl days use	(4) Production Broods seen	(4) Production Estimated total
Swans:											
Whistling									14		
Trumpeter											
Geese:											
Canada Large	7450	7450	5730	4400	3450	4300	5200	4820	469,728		
Small	100	100	20	20	20			1	43,897		
Ross'	5	5	5	2	2	2		2	210		
White-fronted	5	5	5	3	3	1			5,873		
Snow	80750	80750	82920	60000	60000	48000	600	210	5,222,511		
Blue	47050	47050	66100	40000	40000	32000	400	170	3,426,255		
Total Geese	135360	135360	154780	104425	103475	84303	6200	5203	9,168,474		
Ducks:											
Mallard	121000	121000	155500	137000	120000	110010	60000	1500	9,241,750		
Black	120	120	160	140	130	110	60		9,310		
Gadwall									22,400		
Baldpate									214,305		
Pintail	1200	1200	3200	250	50	100	10	3	1,807,386		
Green-winged teal	12000	12000	3000	2600	2000	500		1	1,158,857		
Blue-winged teal									58,751		
Cinnamon teal											
Shoveler	200	200	50	50	50	50			13,895		
Wood	20	20							11,256		
Redhead				4	4				756		
Ring-necked	100	100							6,720		
Canvasback											
Scaup	100	100	10	6	6				3,864		
Goldeneye											
Bufflehead									84		
Ruddy									546		
Comm. Merganser				100	100	100			2,100		
Total Ducks	134740	134740	161920	140150	122340	110870	60070	1504	12,551,980		
Coot:	100	10	10	10	10	10			150,920		

(over)

	(5) Total Days Use	(6) Peak Number	(7) Total Production
Swans	14	1	
Geese	9,168,474	181,140	
Ducks	12,551,980	221,910	
Coots	150,920	7,560	

SUMMARY

Principal feeding areas Refuge marshes and winter browse areas. Upland cornfields.

Principal nesting areas

Reported by Harold H. Burgess

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

(1) Species: In addition to the birds listed on form, other species occurring on refuge during the reporting period should be added in appropriate spaces. Special attention should be given to those species of local and national significance.

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

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

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

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

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

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

Interior Duplicating Section, Washington, D. C.
1953

16242

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

MIGRATORY BIRDS
(other than waterfowl)

Refuge Squaw Creek Months of January 1 to April 30, 19~~66~~/ 67

(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 On Wing	Estimated Number Class D
I. Water and Marsh Birds:										
Eared Grebe	1	4/11	B 2	4/9-15	2	4/16				15
Pied-billed Grebe	2	3/26	C 6	4/23-30	6	4/29				100
White Pelican	20	3/28	B 200	4/9-15	60	4/22				1,500
Double-crested Comorant	5	4/2	C 5	4/2-3	5	4/2				10
Great Blue Heron	3	3/28	C 4	3/28-4/30	4	4/30				120
Green Heron	1	4/28	C 2	4/28-30	2	4/30				6
Little Blue Heron	1	4/28	C 1	4/28-30	1	4/30				7
Common Egret	3	4/11	C 3	4/11	3	4/11				3
Black-crowned Night Heron	2	4/15	C 2	4/15-30	2	4/30				30
Yellowcrowned Night Heron	1	4/2	C 1	4/2-8	1	4/2				7
Glossy Ibis	4	4/9	C 4	4/9	4	4/9				4
Sora	1	4/24	D 3	4/24-30	3	4/30				18
II. Shorebirds, Gulls and Terns:										
Semipalmated Plover	57	4/27	D 57	4/27-30	57	4/30				240
Piping Plover	3	4/27	D 3	4/27-30	3	4/27				10
Killdeer	10	3/11	D 10	3/11-4/30	6	4/30	2	2	10	500
American Golden Plover	1	3/26	D 21	3/26-30	1	4/30				100
Common Snipe	2	3/26	D 16	3/26-4/1	10	4/30				560
Upland Plover	2	4/15	D 2	4/9-15	2	4/15				14
Willet	60	4/28	D 60	4/28-30	40	4/30				180
Greater Yellowlegs	10	3/31	D 50	4/23-30	50	4/23				500
Lesser Yellowlegs	100	3/31	D 10,000	4/23-30	10,000	4/30				70,000
Pectoral Sandpiper	1	3/26	D 10,000	4/23-30	10,000	4/30				100,000
Baird's Sandpiper	2	4/11	D 200	4/11-30	200	4/30				4,200
Long-billed Dowitcher	30	4/9	D 30	4/9-30	30	4/30				600
(Continued Shorebirds)										

(over)

(1)	(2)		(3)			(4)		(5)			(6)
										On Wing	Class D
III. Doves and Pigeons:											
Mourning dove	5	1/1	D	200	4/23-30	200	4/30	10	10	20	2,200
White-winged dove											
IV. Predaceous Birds:											
Golden eagle Immature	1	1/1	B	1	1/1-2/21	1	2/21				50
~~Duck hawk~~ Turkey Vulture	7	4/9	C	7	4/9-30	3	4/30				140
Horned owl	4	1/1	D	8	3/1-4/30	8	4/29	2	2	4	480
Magpie											
Raven											
Crow	43	1/1	C	50	1/1-3/2	10	4/30				3,000
Goshawk	1	1/1	D	1	1/1	1	1/1				1
Sharp-shinned Hawk	1	2/11	D	2	2/11-4/31	1	2/11				80
Cooper's Hawk	1	1/1	D	2	1/1-4/30	1	4/30				240
Red-tailed Hawk	20	1/1	D	20	1/1-3/2	4	4/31				2,000
Harlan's Hawk	7	1/1	C	7	1/1-30	2	4/11				300
Swainson's Hawk	1	4/11	D	1	4/11-17	1	4/11				7
Rough-legged Hawk	16	1/1	D	16	1/1-30	1	4/2				1,000
(Continued Predaceous Birds)							Reported by.....				

INSTRUCTIONS

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

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

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

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

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

(6) Total: Estimated total number (the species using the refuge d ng the period concerned.

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

MIGRATORY BIRDS
(other than waterfowl)

Refuge Squaw Creek Months of January 1 to April 30 1967

(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
											Class D Days Use:
I. Water and Marsh Birds:											
(See Previous Page)											
II. Shorebirds, Gulls and Terns: (Continued from previous page)											
Semi-palmated Sandpiper	2	4/2	D	1,000	4/23-30	1,000	4/30				7,000
Marbled Godwit	4	4/21	D	10	4/23-30	10	4/30				70
Hudsonian Godwit	30	4/21	D	40	4/23-30	40	4/28				320
Sanderling	1	4/27	D	1	4/27-30	1	4/27				4
Wilson's Phalarope	2	4/15	D	100	4/23-30	100	4/30				1,000
Ring-billed Gull	10	3/2	C	100	4/1-30	100	4/30				3,000
Franklin's Gull	2	4/9	C	200	4/23-30	200	4/30				1,600

(over)

(1)	(2)		(3)			(4)		(5)			(6)
										On Wing	Class D
III. Doves and Pigeons:											
Mourning dove											
White-winged dove											
(See Previous Page)											
IV. Predaceous Birds: (Continued from previous page)											
Golden eagle											
Duck hawk											
Horned owl											
Magpie											
Raven											
Crow											
Marsh Hawk	38	1/1		40	1/1-2-28	4	4/8				2,500
Sparrow Hawk	1	2/7		3	2/26-4/30	1	4/29				200
Bald Eagle	96	1/1		96	1/1-2/28	1	3/31				5,760
Screech Owl	1	1/20	D	2	1/1-4/30	2	4/30				240
Barred Owl	2	1/1	D	4	3/1-4/30	4	4/30	1	1	2	360
Long-eared Owl	3	1/11	D	25	1/11-2/11	6	2/18				800
Short-eared Owl	1	1/1	C	33	1/1-3/4	2	4/2				2,000

Reported by.....

INSTRUCTIONS

(1) Species: Use the correct names as found in the A.O.U. Checklist, 1931 Edition, and list group in A.O.U order. Avoid general terms as "seagull", "tern", etc. In addition to the birds listed on form, other species occurring on refuge during the reporting period should be added in appropriate spaces. Special attention should be given to those species of local and National significance. Groups: I. Water and Marsh Birds (Gaviiformes to Ciconiiformes and Gruiiforme
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 numb of the species using the refug during the period concerned.

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

MIGRATORY BIRDS
(other than waterfowl)

Refuge Squaw Creek Months of May 1, to August 31, 1967

(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 Days
I. Water and Marsh Birds:										
Common Loon	1	6/4	1	6/4	1	6/4				1
Horned Grebe	2	5/1	1	5/1-7	2	5/7				10
Eared Grebe	1	6/13	1	6/13	1	6/13				1
Western Grebe	1	6/11	1	6/11	1	6/11				1
Pied-billed Grebe	Present	Previously	50	8/1-31	4	8/31	12	12	30	3,000
White Pelican	"	"	150	8/27-31	150	8/31				1,000
Great Blue Heron	"	"	161	8/1-31	75	8/5				5,000
Green Heron	2	5/1	14	8/20-26	2	8/31				400
Little Blue Heron	1	5/5	7	7/21-27	4	8/12				100
Cattle Egret	1	6/8	1	6/8-16	1	6/18				8
Common Egret	Present	Previously	5	8/5	5	8/31				200
Snowy Egret	1	8/6	1	8/6-12	1	8/6				7
Black-crowned Night Heron	Present	Previously	5	5/7-13	1	8/31				40
Yellow-crowned Night Heron	"	"	17	7/1-31	2	8/12				400
Least Bittern	1	5/14	6	6/4-7/8	1	8/12				400
~~II. Shorebirds, Gulls and Terns~~										
American Bittern	1	5/7	2	5/7-20	1	5/20				14
Glossy Ibis	2	6/18	2	6/18-24	2	6/24				14
King Rail	2	6/22	5	8/6-8/31	1	8/15	1	1	3	270
Virginia Rail	1	5/14	2	6/18-24	1	8/27				30
Sora	5	5/1	10	8/20=31	10	8/31	1	1	3	10
II. Shorebirds, Gulls and Terns										
Semi-palmated Plover	16	5/1	16	5/1-7	10	8/31				200
Killdeer	Present	Previously	500	6/18-8/5	25	8/31	3	3	6	5,000
American Golden Plover	"	"	2	8/25-31	2	8/31				28
Black Bellied Plover	"	"	8	5/2-8	2	8/31				60
Ruddy Turnstone	4	5/13	4	5/13-29	4	5/13				28
Common Snipe	Present	Previously	10	8/25-31	10	8/31				70
Upland Plover	2		3	7/31-8/6	3	8/6				30

(over)

(1)	(2)		(3)		(4)		(5)			(6)
III. Doves and Pigeons:										
Mourning dove	Present	Previously	1,000	7/30-8/19	100	8/31	50	50	100	35,000
White-winged dove										
IV. Predaceous Birds:										
Golden eagle										
Duck hawk	1	5/1	1	5/1-15	1	5/15				15
Horned owl	Present	Previously	8	5/1	4	8/31				900
~~Magpie~~ Barred Owl	"	"	8	5/1	4	8/31				900
~~Raven~~ Turkey Vulture	"	"	8	5/21-27	1	8/31				150
Crow	"	"	10	5/1	10	8/31				560
Red-tailed Hawk	"	"	8	5/1	8	8/31				1,120
Marsh Hawk	"	"	2	5/1	2	8/31				220
Sparrow Hawk	"	"	2	5/1	2	8/31				220
Screech Owl	"	"	2	5/1	2	8/31				220

Reported by Harold H. Burgess

INSTRUCTIONS

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

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

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

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

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

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

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

59317

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

MIGRATORY BIRDS
(other than waterfowl)

Refuge Squaw Creek Months of May 1, to August 31, 196 67

(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 Days
~~XXWater and Marsh BirdsX~~										
II. Shorebirds, Gulls and Terns										
Spotted Sandpiper	2		8	7/31-8/12	3	8/31				150
Solitary Sandpiper	Present Previously		6	5/1-7	2	8/31				100
Willet	"	"	107	5/7-13	1	8/31				800
Lesser Yellowlegs	"	"	500	8/6-12	50	8/31				3,850
Pectoral Sandpiper	"	"	500	8/6-8/31	500	8/31				7,500
White rumped Sandpiper	30	5/14	150	5/28-6/4	150	6/4				2,100
Bairds Sandpiper	Present Previously		4	5/1-7	4	5/7				28
Least Sandpiper	3	5/7	25	8/6-12	18	8/29				500
Dunlin	6	5/7	6	5/7=13	2	5/28				50
Long-billed dowitcher	Present Previously		150	5/7-13	40	8/12				1,100
Short-billed dowitcher	1	8/20	1	8/20-31	1	8/31				10
Stilt Sandpiper	8	5/28	75	8/26-31	2	8/31				375
Semi-palmated sandpiper	Present Previously		1,720	5/14-20	200	8/31				1,700
Buff-breaster sandpiper	14	5/14	7	7/25-31	7	7/31				190
II. Shorebirds. Gulls and Terns:										
Marbled Godwit	Present Previously		4	5/1-13	1	5/26				30
Hudsonian Godwit	"	"	50	5/1-28	1	5/30				350
Sanderling	"	"	2	5/28-6/4	2	5/28				14
Avocet	Reported Previously		1	7/25-31	1	7/25				7
Black-necked Stilt	1	5/28	1	5/28	1	5/28				1
Wilson's Phalarope	Present Previously		1,000	5/7-27	10	8/31				20,000
Northern Phalarope	20	5/19	20	5/19-28	1	8/31				200
Ring-billed gull	Present Previously		8	5/7-13	6	8/26				700
Franklin's gull	"	"	300	5/28-30	12	5/30				900
Forester's Tern	6	5/28	6	5/28-8/31	4	8/27				70
Least Tern	2	5/21	21	7/9	21	7/9				25
Caspian Tern	1	5/7	1	7/30-8/31	1	7/30				30
Black Tern	6	5/1	1,980	5/14-20	5	8/6				14,000

(over)

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

Reported by.....

INSTRUCTIONS

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

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

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

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

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

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

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

MIGRATORY BIRDS
(other than waterfowl)

Refuge Squaw Creek Months of Jan. 1 to Dec. 31 195 67

(1) Species	(2) First Seen		(3) Peak Numbers		(4) Last Seen		(5) Production			(6) Total
Common Name	Number	Date	Number	Date	Number	Date	Number Colonies	Total # Nests	Total Young	Estimated Number
I. Water and Marsh Birds:										
Pied-billed grebe	Previously Reported		100	9/26-30	2	10/28				3,000
White Pelican	"	"	3200	9/17-30	1	12/2				32,000
Double-crested Cormorant	"	"	20	9/21-28	20	10/28				200
Great Blue Heron	"	"	550	9/1-16	6	10/28				16,500
Green Heron	"	"	6	9/1-9	1	9/20				60
Common Egret	"	"	6	9/1-28	6	9/28				180
Cattle Egret	"	"	1	9/1-10/15	1	10/15				45
Black-crowned Night Heron	"	"	4	9/10-10/18	4	10/28				200
Yellow-crowned Night Heron	"	"	2	9/22-28	2	9/28				14
American Bittern	"	"	1	9/17-28	1	9/28				11
Sandhill Crane	1	11/10	1	11/5-30	1	11/30				25
Coot	Previously Reported		300	9/1-23	11	9/30				6,900
II. Shorebirds, Gulls and Terns:										
Semi-palmated Plover	Previously Reported		10	9/1-23	1	9/23				23
Killdeer	"	"	130	10/22-28	15	11/26				2,800
Golden Plover	"	"	2	9/1-23	1	9/23				46
Black-bellied Plover	"	"	4	9/17-23	4	9/23				28
Common Snipe	"	"	50	9/24-30	25	9/30				350
Spotted Sandpiper	"	"	3	9/1-7	3	9/1				21
Solitary Sandpiper	"	"	2	9/1-7	3	9/1				14
Willet	"	"	1	9/17-23	1	9/23				7
Greater Yellowlegs	"	"	100	9/10-16	2	9/28				800
Lesser Yellowlegs	"	"	150	9/10-23	150	9/23				2,100
Pectoral Sandpiper	"	"	500	8/1-9	500	9/1				3,500
Least Sandpiper	"	"	12	9/1-24	10	9/24				430
Short-billed Dowitcher	"	"	1	9/1-9	1	9/9				9
Long-billed Dowitcher	"	"	75	9/1-7	10	9/30				750

(Continued)

(over)

(1)	(2)		(3)		(4)		(5)			(6)
III. Doves and Pigeons:										
Mourning dove	Previously Reported		900	9/1-15	2	12/31				6,300
White-winged dove										
IV. Predaceous Birds:										
Golden eagle	2	10/22	2	10/22-23	1	12/2				30
Duck hawk	Previously Reported		1	10/9	1	10/9				15
Horned owl	"	"	6	9/1-12/31	2	12/31				730
Magpie Barred Owl	"	"	5	9/1-21	2	12/20				610
Raven Turkey Vulture	"	"	4	9/1-15	1	9/15				60
Crow	"	"	60	10/22-23	8	12/31				3,660
Cooper's Hawk	1	9/10	2	9/10-26	1	9/10				15
Red Shouldered Hawk	Previously Reported		24	12/16-31	24	12/31				1,220
Harlan Hawk	3	12/31	3	12/25-31	3	12/31				90
Swainson's Hawk	3	12/31	3	12/31	3	12/31				45
Rough-legged Hawk	4	10/27	21	12/16-31	21	12/31				600
Bald Eagle	1	9/20	70	11/25-12/2	27	12/31				2,100
Marsh Hawk	Previously Reported		10	9/24-12/31	10	12/31				1,220
(Continued)						Reported by.....				

INSTRUCTIONS

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

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

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

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

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

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

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

MIGRATORY BIRDS
(other than waterfowl)

Refuge Salt Creek Months of Sept. 1 to Dec. 31, 1967

(1) Species	(2) First Seen		(3) Peak Numbers		(4) Last Seen		(5) Production			(6) Total
Common Name	Number	Date	Number	Date	Number	Date	Number Colonies	Total # Nests	Total Young	Estimated Number
I. Water and Marsh Birds:										
II. Shorebirds, Gulls and Terns:										
(Continued From Previous Page)										
Stilt Sandpiper	Previously Reported		50	9/17-23	50	9/23				350
Semi-palmated Sandpiper	"	"	50	9/17-23	50	9/23				350
Wilson's Phalarope	"	"	2	9/17-30	2	9/30				28
Northern Phalarope	"	"	2	9/17-23	2	9/23				14
Ringbilled Gull	"	"	3	9/17-23	3	9/23				21
Franklin's Gull	"	"	40	9/17-30	40	9/30				560
Least Tern	"	"	20	9/19-23	20	9/23				140
Caspian Tern	"	"	6	9/1-16	6	9/15				90
Black Tern	"	"	1	9/1-28	1	9/28				28

(over)

(1)	(2)		(3)		(4)		(5)	(6)
III. Doves and Pigeons:								
Mourning dove								
White-winged dove								
IV. Predaceous Birds:								
Golden eagle								
Duck hawk								
Horned owl								
Magpie								
Raven								
Crow								
(Continued From Previous Page)								
Pigeon Hawk	1	9/20	2	9/24-10/21	1	12/2		60
Sparrow Hawk	Previously Reported		2	9/10-23	1	12/31		250
Screech Owl	"	"	4	9/1-12/31	4	12/31		490
Short-eared Owl	2	11/15	6	11/15-12/31	2	12/30		270

Reported by.....

INSTRUCTIONS

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

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

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

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

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

(6) Total: Estimated total number c .he species using the refuge du ng the period concerned.

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

59317

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

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

WATERFOWL UTILIZATION OF REFUGE HABITAT

Refuge Squaw Creek For 12-month period ending August 31, 1967

Reported by Harold H. Burgess Title Refuge Manager

(1) Area or Unit Designation	(2) Habitat Type	Acreage	(3)	Use-days	(4) Breeding Population	(5) Production
I	Crops	157	Ducks	4,655,954	25	
	Upland	91	Geese	2,906,322	2	
	Marsh	552	Swans			
	Water	70	Coots	81,032		
	Total	870	Total	7,643,808	27	
II	Crops	410	Ducks	153,930		
	Upland	200	Geese	2,969,859		
	Marsh	250	Swans			
	Water	20	Coots	70		
	Total	880	Total	3,123,859		
III	Crops	510	Ducks	1,176,357	2	
	Upland	70	Geese	3,612,383		
	Marsh	290	Swans			
	Water	100	Coots	1,309		
	Total	970	Total	4,790,049	2	
IV	Crops	155	Ducks	1,493,667	5	7
	Upland	160	Geese	486,871		
	Marsh	265	Swans			
	Water	10	Coots			
	Total	590	Total	1,980,538	5	7
V	Crops	30	Ducks	19,798,974	16	
	Upland	10	Geese	6,400,863		
	Marsh	1166	Swans			
	Water	1012	Coots	138,922	170	
	Total	2218	Total	26,338,759	186	
VI	Crops	150	Ducks	4,926,457	92	
	Upland	20	Geese	3,578,017		
	Marsh	1125	Swans			
	Water	26	Coots	45,619		
	Total	1321	Total	8,550,093	92	
TOTALS	Crops	1412	Ducks	32,205,339	140	7
	Upland	551	Geese	19,954,815	2	
	Marsh	3648	Swans			
	Water	1238	Coots	266,952	170	
	Total	6849	Total	52,427,106	312	7

(over)

INSTRUCTIONS

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

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

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

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

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

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

Interior Duplicating Section, Washington, D. C. 27580

3-1752
Form NR-2
(April 1946)

UPLAND GAME BIRDS

Refuge Squaw Creek Months of January 1 to April 30, 1967

(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 observed	Estimated Total	Percentage	Hunting	For Re-stocking	For Research	Estimated number using Refuge	Pertinent information not specifically requested. List introductions here.
Ring-necked Pheasant	4,000 acres of upland crops	40							100	
Bob-white Quail	Brush and forbs	40							100	

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, phesants, 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.

3-1752
Form NR-2
(April 1946)

UPLAND GAME BIRDS

Refuge Squaw Creek Months of April 30 to September 2, 19 67

(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 observed	Estimated Total	Percentage	Hunting	For Re-stocking	For Research	Estimated number using Refuge	Pertinent information not specifically requested. List introductions here.
Ring-necked Pheasant	Brush, prairie and croplands		25	150					300	
Bob-white Quail	Brush, prairie and croplands		10	50					150	

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, phesants, 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.

3-1752
Form NR-2
(April 1946)

UPLAND GAME BIRDS

Refuge Squaw Creek Months of September to December 31, 19 67

(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 observed	Estimated Total	Percentage	Hunting	For Re-stocking	For Research	Estimated number using Refuge	Pertinent information not specifically requested. List introductions here.
Ring-necked Pheasants	Brushy margins agriculture and cordgrass prairie								300	
Bob-white	Brushy margins								150	

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, phesants, 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.

3-1753
Form NR-3
(June 1945)

BIG GAME

Refuge Squaw Creek Calendar Year 1967

(1) Species	(2) Density	(3) Young Produced	(4) Removals				(5) Losses			(6) Introductions		(7) Estimated Total Refuge Population		(8) Sex Ratio
Common Name	Cover types, total Acreage of Habitat	Number	Hunting	For Re-stocking	Sold	For Research	Predation	Disease	Winter Loss	Number	Source	At period of Greatest use	As of Dec. 31	
White-tailed deer		50					2	1				200	100	

Remarks:

Reported by Harold H. Burgess

INSTRUCTIONS

Form NR-3 - BIG GAME

(1) SPECIES: Use correct common name; i.e., Mule deer, black-tailed deer, white-tailed deer. It is unnecessary to indicate sub-species such as northern or Louisiana white-tailed deer.

(2) DENSITY: 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 total number of young produced on refuge.

(4) REMOVALS: Indicate total number in each category removed during the year.

(5) LOSSES: On the basis of known records or reliable estimates indicate total losses in each category during the year.

(6) INTRODUCTIONS: Indicate the number and refuge or agency from which stock was secured.

(7) TOTAL REFUGE POPULATION: Give the estimated population of <u>each species</u> on the refuge at period of its greatest abundance and also as of Dec. 31.

(8) SEX RATIO: Indicate the percentage of males and females of each species as determined from field observations or through removals.

17060

3-1754
Form NR-4
(June 1945)

SMALL MAMMALS

Refuge Squaw Creek Year ending April 30, 1967

(1) Species	(2) Density		(3) Removals					(4) Disposition of Furs						(5)
								Share Trapping						Total Population
Common Name	Cover Types & Total Acreage of Habitat	Acres Per Animal	Hunting	Fur Harvest	Predator Control *	For Re-stocking	For Re-search	Permit Number	Trappers' Share	Refuge share	Total Refuge Furs Shipped	Furs Donated	Furs Destroyed	
Opossum								SC 66-2	11					30
Raccoon								SC 66-2	12					200
Mink								SC 66-2	1	1				50
Badger								SC 66-2						2
Striped Skunk								SC 66-2	2					20
Red Fox														10
Coyote								SC 66-2	1					20
Franklin's ground squirrel								SC 66-2						10
Gray squirrel														10
Fox squirrel														400
Pocket gopher														40
Beaver								SC 66-2	1	1*				10
Beaver								SC 67-1	1					
Muskrat								SC 66-2	5	5				100
Cottontail								SC 66-2	2					200

* List removals by Predator Animal Hunter

REMARKS: * Taken by refuge after season and turned over to Missouri Department of Conservation.

Reported by Harold H. Burgess

INSTRUCTIONS

Form NR-4 - SMALL MAMMALS (Include data on all species of importance in the management program; i. e., muskrats, beaver, coon, mink, coyote. Data on small rodents may be omitted except for estimated total population of each species considered in control operations.)

(1) SPECIES: Use correct common name. Example: Striped skunk, spotted skunk, short-tailed weasel, gray squirrel, fox squirrel, white-tailed jackrabbit, etc. (Accepted common names in current use are found in the "Field Book of North American Mammals" by H. E. Anthony and the "Manual of the Vertebrate Animals of the Northeastern United States" by David Starr Jordan.)

(2) DENSITY: Applies particularly to those species considered in removal programs. 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, bottom land 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) REMOVALS: Indicate the total number under each category removed since April 30 of the previous year, including any taken on the refuge by Service Predatory Animal Hunter. Also show any removals not falling under headingslisted.

(4) DISPOSITION OF FUR: On share-trapped furs list the permit number, trapper's share, and refuge share. Indicate the number of pelts shipped to market, including furs taken by Service personnel. Total number of pelts of each species destroyed because of unprimeness or damaged condition, and furs donated to institutions or other agencies should be shown in the column provided.

(5) TOTAL POPULATION: Estimated total population of each species reported on as of April 30.

REMARKS: Indicate inventory method(s) used, size of sample area(s), introductions, and any other pertinent information not specifically requested.

32/15

3-1755
Form NR-5

DISEASE

Refuge Squaw Creek Year 1967

~~Botulism~~ Coccidiosis

Period of outbreak Spring 1967

Period of heaviest losses Spring 1967

Losses:

	Actual Count	Estimated
(a) Waterfowl	20	200
(b) Shorebirds		
(c) Other		

Number Hospitalized	No. Recovered	% Recovered
(a) Waterfowl		
(b) Shorebirds		
(c) Other		

Areas affected (location and approximate acreage)

Missouri River Valley

Water conditions (average depth of water in sickness areas, reflooding of exposed flats, etc.

Not appropriate. (This disease hit hardest at Trimble Wildlife Management Area, was diagnosed from snow geese recovered at Sugar Lake, Platte County, Missouri and mild die-off continued at least into Iowa. All cultures for cholera were negative.)

Condition of vegetation and invertebrate life

Remarks University of Wisconsin's prior blood monitoring indicated no ornithosis in our geese although this disease was suspected.

Lead Poisoning ~~[illegible] Disease~~

Kind of disease Foul Cholera

Species affected Snow geese (Fall-Winter 1966-67)

Number Affected

Species	Actual Count	Estimated
Snow Geese	5	20

Number Recovered

Number lost 20 immatures

Source of infection latent in flock

Water conditions low but fresh

Food conditions good

The adults appeared to be able to resist this infection.

Remarks Although lead poisoning did occur it was not an important winter killer at this refuge in 1967 perhaps because waterfowl were encouraged south.

NR-6

Bureau of Sport Fisheries and Wildlife

PUBLIC RELATIONS

(See Instructions on Reverse Side)

Refuge Squaw Creek

Calendar Year 1967

1. Visits

a. Hunting None b. Fishing 800 c. Miscellaneous 26,456 d. TOTAL VISITS 30,056

1a. Hunting (on refuge lands)

TYPE	HUNTERS	ACRES	MANAGED BY
Waterfowl			
Upland Game			
Big Game			
Other			

Number of permanent blinds None

Man-days of bow hunting included above None

Estimated man-days of hunting on lands adjacent to refuge 36,610

Waterfowl 36,060
Small game 500
Deer 50

1b. Fishing (area open to fishing on refuge lands)

TYPE OF AREA	ACRES	MILES
Ponds or Lakes	1000	
Streams and Shores		10

1c. Miscellaneous Visits

Recreation 27,256 Official 300

Economic Use 2,500 Industrial

2. Refuge Participation (groups)

TYPE OF ORGANIZATION	On Refuge NO. OF GROUPS	On Refuge NUMBER IN GROUPS	Off Refuge NO. OF GROUPS	Off Refuge NUMBER IN GROUPS
Sportsmen Clubs	3	60	1	50
Bird and Garden Clubs	10	100	4	400
Schools	20	330	5	30
Service Clubs			11	680
Youth Groups	2	38	2	60
Professional-Scientific	2	4	12	730
Religious Groups	2	60		
State or Federal Govt.	11	36	21	150
Other Sunday Tours	18	2,520		

3. Other Activities

TYPE	NUMBER	TYPE	NUMBER
Press Releases	14	Radio Presentations	14
Newspapers (P.R.'s sent to)	18	Exhibits	12
TV Presentations	14	Est. Exhibit Viewers	
Publications	1	Papers	2

3-1756
(Rev. 4/63)

INSTRUCTIONS

Item 1: Total of a, b, and c, equal d.

"Visit" - definition. Any person who is on refuge lands or waters during a day or part thereof for the purpose of: hunting, fishing, bird-watching, recreation, business or economic use, official visit, or similar interest. INCLUDE - those who stop within the refuge while traveling on a public highway because of an interest in the area. EXCLUDE - persons engaged in oil or other industry not directly related to the refuge, persons using refuge as most direct route or principal avenue of traffic, and those boating on navigable rivers or the Intercoastal Canal, unless they stop to observe wildlife on the refuge.

Computing visits. Where actual counts are impractical, "sampling" is used with midweek and weekend samples varied by season or weather. A conversion factor of 3.5 (of passengers per car) is used when accurate figures are not available. Each refuge will develop a conversion factor for boats based on range of usage. Count a camper once for each 24-hour period or fraction thereof.

Item 1a: Acres - of refuge open for each type of hunting.

Managed hunts require check in and out of hunters, issuance of permits, or assignment of blinds.

Other - INCLUDE crow, fox, and similar hunting.

Lands adjacent to refuge. Normally considered within 1 mile or less of boundary, unless established sampling procedures cover a wider area. For big game hunting, the distance may be greater.

Item 1b: Acres of streams open to fishing, if practical; otherwise just miles open. Information on "shores" is primarily for coastal fishing.

Item 1c: Recreation. INCLUDE photography, observing wildlife, picnicking, swimming, boating, camping, visitor center use, tours, etc. TOTAL Recreation, Official, and Economic Use visits under Item 1.

Industrial. INCLUDE persons engaged in industry, i.e., oil industry or factories. EXCLUDE these from Item 1.

Item 2: INCLUDE the "On Refuge" groups in Items 1c and 1. In "Off Refuge" column include only those group meetings in which refuge employees actually participate. EXCLUDE these from Items 1c and 1.

Item 3: Exhibits - INCLUDE displays, fairs, parades, and exhibits OFF the refuge; EXCLUDE those ON.

-1757
orm NR-7
Rev. June 1960)

NONAGRICULTURA COLLECTIONS, RECEIPTS, AND PLAN GS (1)

Refuge Squaw Creek Year 19 67

	Collections and Receipts (Seeds, rootstocks, trees, shrubs)						Plantings (Marsh - Aquatic - Upland)						
Species	Amount (Lbs., bus., etc.)	(2) C or R	Date	Method or Source	Cost	(3) Total Amount on Hand	Location of Area Planted	Rate of Seeding or Planting	Amount Planted (Acres or Yards of Shoreline)	Amount and Nature of Propagules	Date	Survival	Cause of Loss
Not appropriate in 1967.													

(1) Report agronomic farm crops on Form NR-8
(2) C = Collections and R = Receipts
(3) Use "S" to denote surplus

otal acreage planted:
Marsh and aquatic _____
Hedgerows, cover patches _____
Food strips, food patches _____
Forest plantings _____

Remarks: _____

3-1758
Form NR-8
(Rev. Jan. 1956)

Fish and Wildlife Service Branch of Wildlife Refuges

CULTIVATED CROPS - HAYING - GRAZING

Refuge **Squaw Creek** County **Holt** State **Missouri**

Cultivated Crops Grown	Permittee's Share Harvested Acres	Permittee's Share Harvested Bu./Tons	Government's Share or Return Harvested Acres	Government's Share or Return Harvested Bu./Tons	Government's Share or Return Unharvested Acres	Government's Share or Return Unharvested Bu./Tons	Total Acreage Planted	Green Manure, Cover and Waterfowl Browsing Crops Type and Kind	Total Acreage
Corn	389	31,832	3	200	312	25,367	704		
Soybeans	194	7,613					171	Winter wheat	415
Oats	35	650	15	200			40	Elbon rye	19
Winter wheat	30	650	37	1,200			67		
German millet					20	200	20		
Elbon rye			20	280			20		
Alfalfa	14	30					14		
								Fallow Ag. Land.	100

No. of Permittees: Agricultural Operations 7 Haying Operations 4 Grazing Operations 2

Hay - Improved (Specify Kind)	Tons Harvested	Acres	Cash Revenue	Grazing	Number Animals	AUM'S	Cash Revenue	ACREAGE
Alsike-grass	73	50	$219	1. Cattle	152	525	$525	235
Brome grass	10	10	$ 20					
				2. Other Horse	2	4 3/4	$4.75	2
				1. Total Refuge Acreage Under Cultivation				1600
Hay - Wild	290	300	$170	2. Acreage Cultivated as Service Operation				306

DIRECTIONS FOR PREPARING FORM NR--8'
CULTIVATED CROPS - HAYING - GRAZING

Report Form NR-8 should be prepared on a calendar-year basis for all crops which were planted during the calendar year and for haying and grazing operations carried on during the same period.

Separate reports shall be furnished for Refuge lands in each county when a refuge is located in more than one county or State.

Cultivated Crops Grown - List all crops planted, grown and harvested on the refuge during the reporting period regardless of purpose. Crops in kind which have been planted by more than one permittee or this Service shall be combined for reporting purposes.

Permittee's Share - Only thenumber of acres utilized by the permittee for his own benefit should be shown under the Acres column, and only the number of bushels of farm crops harvested by the permittee for himself should be shown under the Bushels Harvested column. Report all crops harvested in bushels or fractions thereof except such crops as silage, watermelons, cotton, tobacco, and hay, which should be reported in tons or fractions thereof.

Government's Share or Return - Harvested Show the acreage and number of bushels harvested for the Government of crops produced by permittees or refuge personnel. Unharvested Show the exact acreage and the estimated number of bushels of grain available for wildlife. If grazing is made available to waterfowl through the planting of grain, cover, green manure, grazing or hay crops, estimate the tonnage of green food produced or utilized and report under Bushels Unharvesed column.

Total Acreage Planted - Report all acreage planted, including crop failures.

Green Manure, Cover and Waterfowl Grazing Crops Specify the acreage kind and purpose of the crop. These crops and the acreage may be duplicated under cultivated crops if planted during the year, or a duplication may occur under hay if the crop results from a perennial planting.

Hay - Improved - List separately the kinds of improved hay grown. Annual plantings should also be reported under Cultivated Crops, and perennial hay should be listed in the same manner at time of planting

Total Refuge Acreage Under Cultivation Report total land area devoted to agricultural purposes during the year.

3-1570
NR-88
(4/54)

REFUGE GRAIN REPORT

Refuge Squaw Creek Months of January 1 through December 31, 1967

(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 or Suitable Use*		
				Transferred	Seeded	Fed	Total		Seed	Feed	Surplus
Corn, shelled	194	1506	1700	1500	none	50	1550	150		50	100
Corn, ear	25	600	625			475	475	150		50	100
Wheat, winter	15	1200	1215		915	200	1115	100		100	
Rye, Elbon	0	280	280	50	230		280				
Bromegrass	40	50	90		50		50	45	45		
Oats	0	200	200			100	100	100	100		
Little bluestem	0	42#	42#		42#		42#				
White sweet clover	0	20#	20#		10#			10#	10#		
German millet	0	400#	400#		400#		400#				

(8) Indicate shipping or collection points By Jackson Truck Line from refuge.

(9) Grain is stored at Squaw Creek Refuge Headquarters.

(10) Remarks

*See instructions on back.

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 lb., corn (ear)—70 lb., wheat—60 lb., barley—50 lb., rye—55 lb., oats—30 lb., soy beans—60 lb., millet—50 lb., cowpeas—60 lb., and mixed—50 lb. In computing volume of granaries, multiply the cubic contents (cu. ft.) by 0.8 bushels.

(1) List each type of grain separately and specifically, as flint corn, yellow dent corn, square deal hybrid corn, garnet wheat, red May wheat, durum wheat, spring wheat, proso millet, combine milo, new era cowpeas, mikado soy beans, etc. Mere listing as corn, wheat, and soybeans will not suffice, as specific details are necessary in considering transfer of seed supplies to other refuges. 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 break-down by varieties of grain listed in column 6. Indicate if grain is suitable for seeding new crops.

(8) Nearest railroad station for shipping and receiving.

(9) Where stored on refuge: "Headquarters granary," etc.

(10) Indicate here the source of grain shipped in, destination of grain transferred, data on condition of grain, unusual uses proposed.

INT.-DUP. SEC., WASH., D.C. 17065

3-1979 (NR-12)
(9/63)

Bureau of Sport Fisheries and Wildlife

ANNUAL REPORT OF PESTICIDE APPLICATION

Refuge	Proposal Number	Reporting Year
Squaw Creek	1	1967

INSTRUCTIONS: Wildlife Refuges Manual, secs. 3252d, 3394b and 3395.

Date(s) of Application	List of Target Pest(s)	Location of Area Treated	Total Acres Treated	Chemical(s) Used	Total Amount of Chemical Applied	Application Rate	Carrier and Rate	Method of Application
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
4/20-6/30/67	Foxtail grass and other weeds in corn.	A-1,2,3,5,6,7,8,9 & 12 A-13,14,17,19 & 20	600	Atrazine	1200 ai	2# ai/A Pre and post emergent	Water 20 gal/A	Ground sprayer

10. Summary of results (continue on reverse side, if necessary)

Results were good where applied early and poor where applied after weeds got head start in wet year.

35500

3-1979 (NR-12)
(9/63)

Bureau of Sport Fisheries and Wildlife

ANNUAL REPORT OF PESTICIDE APPLICATION

Refuge: Squaw Creek

Proposal Number: 7

Reporting Year: 1967

INSTRUCTIONS: Wildlife Refuges Manual, secs. 3252d, 3394b and 3395.

Date(s) of Application	List of Target Pest(s)	Location of Area Treated	Total Acres Treated	Chemical(s) Used	Total Amount of Chemical Applied	Application Rate	Carrier and Rate	Method of Application
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
4/29-6/1/67	Grasses and broadleafed weeds in soybeans	A-3 & 4	125	TREFLAN	188#	1.5# ai/A Pre-emergent	water 20 gal/A	Ground sprayer

10. Summary of results (continue on reverse side, if necessary)

Excellent except for late-growing sunflowers. No carryover for follow up crop of winter wheat goose browse.

35500

3-1979 (NR-12)
(9/63)

Bureau of Sport Fisheries and Wildlife

ANNUAL REPORT OF PESTICIDE APPLICATION

Refuge: Squaw Creek

Proposal Number: 2

Reporting Year: 1967

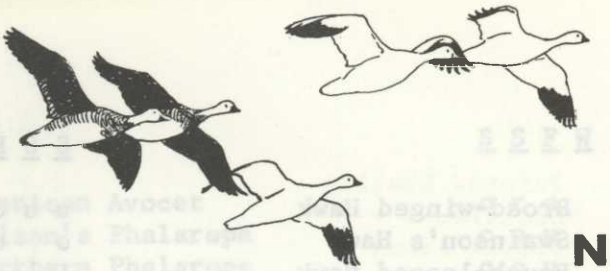
INSTRUCTIONS: Wildlife Refuges Manual, secs. 3252d, 3394b and 3395.

Date(s) of Application	List of Target Pest(s)	Location of Area Treated	Total Acres Treated	Chemical(s) Used	Total Amount of Chemical Applied	Application Rate	Carrier and Rate	Method of Application
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
4/28-7/1/67	Weeds in soybeans	A-3,4,5,6,7,8, 12,14 & 18	72	Amiben	180#	2½# ai/A Pre-emergent	Water 20 gal/A	Ground sprayer

10. Summary of results (continue on reverse side, if necessary)

Good except for late growing sunflowers.

35500



BIRDS OF THE SQUAW CREEK NATIONAL WILDLIFE REFUGE

Squaw Creek National Wildlife Refuge, established in 1935, contains 6,809 acres and is in northwestern Missouri, near Mound City, in Holt County, 40 miles northwest of St. Joseph. This area is a unit in the chain of refuges extending through the Mississippi Flyway from Canada to the Gulf of Mexico.

Located in the flood plain of the Missouri River, the refuge was once a cordgrass marsh with meandering creek channels, which was dredged for agricultural drainage. After the refuge was established, dams and ditches were built to make a series of pools and preserve a wetland habitat. About 1,000 acres of bottomland are farmed by refuge personnel to provide food for large concentrations of migrating or wintering waterfowl. Refuge habitats vary from open pools and marshland to scenic loess bluffs where ungrazed, unburned woodlands provide good upland bird-watching. A sizable acreage of cordgrass is preserved.

Birding possibilities are good all year, although spring and fall offer most variety. Summer is a quiet season, but many nesting upland marsh birds can be found. About 100,000 mallards, 5,000 Canada geese, and some blue and snow geese normally winter on the refuge. About 50 bald eagles are here during that season. Migrant duck populations of 200,000 or more are frequent. Most spectacular is the spring movement of blue and snow geese, when a flock of a quarter of a million birds is not unusual. Several thousand white pelicans visit the refuge in spring and fall. Common egrets are a familiar summer sight, feeding in shallow water with numerous great blue and green herons. Squaw Creek Refuge has one of the highest pheasant populations in Missouri. These birds may be seen easily along roads in morning and evening.

The following birdlist contains 253 species observed since 1937. Another 23 species, rare or accidental, have been added. Those marked with an * nest in the area. Some summer shorebirds, flycatchers, and swallows are early migrants and not breeders. This list is in accordance with the Fifth (1957) A.O.U. Check-list. Abundance symbols are grouped under columns representing the four seasons of the year, as follows:

S - March - May	a - abundant
S - June - August	c - common
F - September - November	u - uncommon
W - December - February	o - occasional
	r - rare

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

	S	S	F	W
Common Loon	r		r	
Horned Grebe	u		u	
Eared Grebe	u		u	
Pied-billed Grebe	c	u	c	
White Pelican	a	r	a	
Double-crested Cormorant	c	r	c	
Great Blue Heron	c	c	c	r
*Green Heron	u	c	o	
Little Blue Heron		o	r	
Common Egret	c	c	r	
Snowy Egret		u		
*Black-crowned Night Heron	o	c	o	
Yellow-crowned Night Heron		o	o	
*Least Bittern	o	o		
*American Bittern	o	u	u	r
White-faced Ibis	r	r	r	
Whistling Swan	r		r	
Canada Goose	a	u	a	c
White-fronted Goose	o		c	
Snow Goose	a	r	a	o
Blue Goose	a	r	a	o
*Mallard	a	c	a	a
*Black Duck	o	o	o	c
Gadwall	c	r	c	
Pintail	a	r	c	o
Green-winged Teal	c	r	c	u
*Blue-winged Teal	c	o	c	r
Cinnamon Teal	r		r	
American Widgeon	c	r	c	
Shoveler	c	r	c	
*Wood Duck	o	c	c	
Redhead		o	o	
Ring-necked Duck	o		o	
Canvasback	u		u	
Greater Scaup			r	
Lesser Scaup	c	r	c	
Common Goldeneye	o		o	u
Bufflehead	u		u	
White-winged Scoter			r	
Ruddy Duck	u	u	u	
Hooded Merganser	u	u	u	
Common Merganser	c		o	c
Red-breasted Merganser	o		o	
Turkey Vulture	u	c	u	
Goshawk				r
*Sharp-shinned Hawk	u	u	u	u
*Cooper's Hawk	o	o	o	o
*Red-tailed Hawk	c	o	c	c
Harlan's Hawk	u		u	u
*Red-shouldered Hawk	o	o	o	o

	S	S	F	W
Broad-winged Hawk	u	u	u	
Swainson's Hawk	o		o	
Rough-legged Hawk				c
Golden Eagle			r	r
Bald Eagle			c	c
*Marsh Hawk	c	o	c	c
Osprey	u		u	
Prairie Falcon			r	
Peregrine Falcon	o		o	
Pigeon Hawk	r		r	
Sparrow Hawk	u	u	u	u
*Bobwhite	u	u	c	c
*Ring-necked Pheasant	c	c	c	c
Sandhill Crane	r	r	r	
*King Rail	u	u	u	
*Virginia Rail	u	o	u	
Sora	c	u	c	
Yellow-Rail	r		r	
Common Gallinule	r	r		
American Coot	a	o	a	
Semipalmated Plover	o	o	o	
Piping Plover	r	r	r	
*Killdeer	c	c	c	o
American Golden Plover	o		r	
Black-bellied Plover	c	r	u	
Ruddy Turnstone	u	r	r	
American Woodcock	r		r	
Common Snipe	c	r	c	r
Long-billed Curlew	r			
*Upland Plover	r	r	r	
*Spotted Sandpiper	c	c	c	
Solitary Sandpiper	o	u	o	
Willet	o		o	
Greater Yellowlegs	o	u	o	
Lesser Yellowlegs	a	a	c	
Knot	r		r	
Pectoral Sandpiper	c	u	c	
White-rumped Sandpiper	c	u	c	
Baird's Sandpiper	o	o	o	
Least Sandpiper	o	o	o	
Dunlin	u		r	
Short-billed Dowitcher	r			
Long-billed Dowitcher	c	o	c	
Stilt Sandpiper	r			
Semipalmated Sandpiper	o	o	o	
Western Sandpiper	r		r	
Buff-breasted Sandpiper	r	r		
Marbled Godwit	r		r	
Hudsonian Godwit	c	r		
Sanderling	r	r	r	

	S	S	F	W
American Avocet	o	r	o	
Wilson's Phalarope	c	o	u	
Northern Phalarope	o	o	u	
Herring Gull	u	r	u	r
Ring-billed Gull	c	o	c	o
Franklin's Gull	a		a	
Bonaparte's Gull	r		r	
Forster's Tern	c	o	c	
Common Tern	o		o	
Least Tern	u	u		
Caspian Tern	r	r	r	
*Black Tern	c	c	o	
*Rock Dove	o	o	o	o
*Mourning Dove	a	a	a	o
Yellow-billed Cuckoo	c	c	u	
Black-billed Cuckoo	o	o	u	
Barn Owl	r		r	
*Screech Owl	o	o	o	o
*Great Horned Owl	c	c	c	c
*Barred Owl	c	c	c	c
Long-eared Owl			r	r
Short-eared Owl	o	o	o	c
Saw-whet Owl				r
Chuck-will's widow	r	r		
*Whip-poor-will	o	o	r	
Common Nighthawk	o	o	o	
*Chimney Swift	o	o		
*Ruby-throated Hummingbird	o	o		
*Belted Kingfisher	o	o	o	
*Yellow-shafted Flicker	c	c	c	u
Red-shafted Flicker	r		r	
*Red-bellied Woodpecker	c	c	c	c
*Red-headed Woodpecker	o	o	o	o
*Yellow-bellied Sapsucker	o	o	o	o
*Hairy Woodpecker	u	u	u	u
*Downy Woodpecker	c	c	c	c
*Eastern Kingbird	c	c		
Western Kingbird	r		r	
*Great Crested Flycatcher	c	c	u	
*Eastern Phoebe	c	c	u	
Yellow-bellied Flycatcher	r		r	
*Acadian Flycatcher	u	u	u	
Least Flycatcher	u	u		
*Eastern Wood Pewee	u	c		
Olive-sided Flycatcher	u		u	
*Horned Lark	o	u	o	c
*Tree Swallow	c	c	c	
*Bank Swallow	a	o	a	
Rough-winged Swallow	o	o	o	
*Barn Swallow	c	o	a	

	S	S	F	W
Cliff Swallow	c	a	a	
Purple Martin	o		o	
*Blue Jay	c	c	c	c
*Common Crow	a	c	c	a
*Black-capped Chickadee	c	u	c	c
*Tufted Titmouse	c	o	o	c
*White-breasted Nuthatch	o	o	o	o
Red-breasted Nuthatch	r		r	o
Brown Creeper	u	u	u	u
*House Wren	c	c	o	
Winter Wren	r		r	r
Bewick's Wren	u	u	u	
*Carolina Wren	o	o	o	o
*Long-billed Marsh Wren	u	u	u	
*Short-billed Marsh Wren	u	u	u	
*Mockingbird	o	o	o	
*Catbird	c	c	o	
*Brown Thrasher	c	c	u	
*Robin	c	c	c	o
*Wood Thrush	o	o		
Swainson's Thrush	o		o	
Gray-cheeked Thrush	o		o	
*Eastern Bluebird	u	o	u	r
*Blue-gray Gnatcatcher	c	c		
Golden-crowned Kinglet	u		u	u
Ruby-crowned Kinglet	o		o	o
Water Pipit	r		r	
Bohemian Waxwing				o
Cedar Waxwing	c	c	c	o
Northern Shrike				o
Loggerhead Shrike	o	o	o	o
*Starling	c	c	c	a
White-eyed Vireo	o	r	r	
*Bell's Vireo	c	c	u	
Yellow-throated Vireo	o	r	o	
Solitary Vireo	r		r	
*Red-eyed Vireo	c	c	u	
Philadelphia Vireo	u		u	
*Warbling Vireo	o	o	u	
Black-and-white Warbler	u		u	
*Prothonotary Warbler	r	r	r	
Tennessee Warbler	u		u	
Orange-crowned Warbler	u		u	
Nashville Warbler	u		u	
Parula Warbler	u		u	
*Yellow warbler	c	c	u	
Magnolia Warbler	u		u	
Myrtle Warbler	c		c	
Black-throated Green Warbler	u		u	
Blackburnian Warbler	u		u	

	S	S	F	W
Chestnut-sided Warbler	u		u	
Blackpoll Warbler	u		u	
Palm Warbler	u		u	
*Ovenbird	u	u	u	
Louisiana Waterthrush	u		u	
*Kentucky Warbler	r	u		
*Yellowthroat	c	c	u	
*Yellow-breasted Chat	c	c		
Wilson's Warbler	u		u	
American Redstart	c		u	
*House Sparrow	a	a	a	a
*Bobolink	u	u	u	
*Eastern Meadowlark	c	u	c	o
Western Meadowlark	o	o	o	o
*Yellow-headed Blackbird	u	u	u	r
*Red-winged Blackbird	a	c	a	a
*Orchard Oriole	c	c	o	
*Baltimore Oriole	o	c	r	
Rusty Blackbird	c		c	o
Brewer's Blackbird	o	o	o	
*Common Grackle	c	c	c	c
*Brown-headed Cowbird	c	c	c	o
*Scarlet Tanager	o	o	r	
*Summer Tanager	r	u		
*Cardinal	a	a	a	a
*Rose-breasted Grosbeak	o	o		
*Indigo Bunting	c	c	o	

	S	S	F	W
Painted Bunting	r	r		
*Dickcissel	c	c		
Purple Finch				r
Pine Siskin				o
*American Goldfinch	c	c	c	o
Red Crossbill				r
White-winged Crossbill				r
*Rufous-sided Towhee	c	c	c	o
Savannah Sparrow	o	u	o	
Grasshopper Sparrow	o	u	o	
Le Conte's Sparrow	o		o	
Henslow's Sparrow	u	u	u	
*Vesper Sparrow	c	o	c	
Lark Sparrow	o	o	o	
Slate-colored Junco	c		c	
Tree Sparrow	c		c	c
*Chipping Sparrow	o	u	o	
Clay-colored Sparrow	o		o	
*Field Sparrow	c	o	c	
Harris' Sparrow	o		o	u
White-crowned Sparrow	c		c	o
White-throated Sparrow	c		c	o
Fox Sparrow	o		o	u
Lincoln's Sparrow	o		o	
*Swamp Sparrow	u	o	u	o
*Song Sparrow	c	c	c	u

- - - - - - - - - - -

These additional 23 species are of such accidental or rare occurrence on the refuge that they have seldom been recorded more than once or twice.

Western Grebe
Cattle Egret
Louisiana Heron
White Ibis
American Flamingo
Brant
Ross' Goose
Black-bellied Tree Duck
Fulvous Tree Duck
European Widgeon
Mississippi Kite
Whooping Crane
Snowy Plover
Whimbrel
Black-necked Stilt
Ground Dove
Snowy Owl
Black-backed Three-toed Woodpecker
Scissor-tailed Flycatcher
Black-billed Magpie
Veery
Lark Bunting
Oregon Junco

- - - - - - - - - - -

Made in United States of America
Reprinted from THE JOURNAL OF WILDLIFE MANAGEMENT
Vol. 31, No. 2, April 1967
pp. 248–253

FOWL CHOLERA IN WATERFOWL AT SQUAW CREEK NATIONAL WILDLIFE REFUGE, MISSOURI

BY RICHARD W. VAUGHT, HAROLD C. MCDOUGLE,
AND HAROLD H. BURGESS

FOWL CHOLERA IN WATERFOWL AT SQUAW CREEK NATIONAL WILDLIFE REFUGE, MISSOURI[1]

RICHARD W. VAUGHT, Missouri Department of Conservation, Columbia
HAROLD C. McDOUGLE, Department of Veterinary Microbiology, University of Missouri, Columbia
HAROLD H. BURGESS, U. S. Bureau of Sport Fisheries and Wildlife, Squaw Creek National Wildlife Refuge, Mound City, Mo.

Abstract: An epizootic of fowl cholera (*Pasteurella multocida*), in lesser snow geese (*Chen h. hyperborea*), blue geese (*Chen caerulescens*), mallards (*Anas platyrhynchos*), and other waterfowl occurred on Squaw Creek National Wildlife Refuge, Holt County, Missouri, during early January, 1964. More than 1,000 geese died in one night. Symptoms and previous case histories of fowl cholera, an infrequently reported disease among wild waterfowl, are reviewed. Pertinent field observations and methods of diagnosis are described. Observations indicated that mallard ducks were the probable early carriers of the disease. Snow, blue, and small Canada geese (*Branta c. hutchinsii*) were quite susceptible while large Canada geese (*Branta c. interior* and *maxima*) were not involved. Stresses caused by limited open water, overcrowding of birds, and inclement weather may have been conducive to the epizootic. Direct mortality from fowl cholera on wintering areas is not indicative of total mortality. Losses may continue along the migration routes. Secondary effects may result in loss of productivity.

This paper describes an epizootic of fowl cholera (*Pasteurella multocida*) in lesser snow and blue geese and other waterfowl on Squaw Creek National Wildlife Refuge, Holt County, Missouri, during late 1963 and early 1964.

Fowl cholera is a serious disease of domestic fowl, but it is infrequently reported as an epizootic disease of wild waterfowl. The earliest documented record of fowl cholera in wild ducks was reported by Quortrup et al. (1946) in Texas. Petrides and Bryant (1951) reported that periodic outbreaks of fowl cholera among ducks have occurred there since. The largest reported losses occurred in California where Sperry (1949 unpublished report filed at Patuxent Wildlife Research Center, Laurel, Maryland) estimated a die-off of 36,000 ducks. Rosen and Bischoff (1950) reported losses of coots, ducks, and gulls to *Pasteurella multocida* over a broad coastal area near San Francisco Bay. More recently, in Maine, a fowl cholera outbreak in eider ducks (*Somateria mollissima*) was reported by Gershman et al. (1964).

The absence of signs of disease before death from fowl cholera has been recorded in numerous cases. Curtice (1902) reported a case in domestic geese where some specimens in prime condition were found dead with scarcely any appearance of previous sickness. Quortrup et al. (1946:99) observed that 10 minutes before death, ducks were apparently in good health except that normal reflexes were not as sensitive as in healthy birds, and they did not become frightened so easily. They also noted, "Many birds died with their heads up in a natural sitting position and rigor mortis was immediate." Rosen and Bischoff (1949: 186) observed ducks in normal flight or in loafing attitudes, or else the carcasses were seen floating on the ponds or lying along the shoreline.

Barger et al. (1958) reported that, when the disease was very acute, the first indication of infection was the finding of dead chickens that had not shown any signs before death. They also found that extremely fat fowl were particularly susceptible to the peracute form of the malady, and outbreaks in chickens were more prevalent during inclement weather. Comparing fowl cholera mortality rates with climatological data, Petrides and Bryant (1951: 209–215) found "little correlation . . . with any condition other than wind" and summarized: "Comparisons of population levels and mortality rates throughout the epizootic period revealed a general increase in severity of the disease throughout the period, though most waterfowl died early in the season because of their great abundance then." Curtice (1902) found considerable quantities of mucus in the throat and mouth, and a tenacious mucus in the nose in chickens. Similar symptoms of fowl cholera were reported by Barger et al. (1958:408) and Dorsey and Harshfield (1953).

Acknowledgment is due Dr. H. M. Wallace, Jr., D. V. M., Mound City, Missouri, Dr. J. R. Anderson, Iowa State University, Ames, and Dr. L. N. Locke, Patuxent Wildlife Research Center, Laurel, Maryland, for necropsies, diagnoses, and chemical studies, and to Dr. A. A. Case and Dr. G. B. Garner, University of Missouri, for chemical analyses. We thank J. A. Hague and Glen McCloud for assistance in collecting specimens, and Lena K. Thornton for laboratory assistance.

FIELD OBSERVATIONS

Waterfowl losses at the Squaw Creek Refuge began in early December, 1963, and continued through the migration period until mid-April, 1964. Dead waterfowl collected for disposal during this period included 1,169 snow and blue geese, 66 Canada geese, one white-fronted goose (*Anser albifrons*), 5,615 mallards, 23 black ducks (*Anas rubripes*), 23 American widgeon (*Mareca americana*), 38 green-winged teal (*Anas carolinensis*), 48 wood ducks (*Aix sponsa*), one pintail (*Anas acuta*), and one canvasback (*Aythya valisineria*). Recorded losses were considered minimal because dead birds in inaccessible areas were not tabulated. Recorded causes of mortality included crippling and lead poisoning.

Mallards were the principal species involved during early December, 1963. Standard diagnostic procedures (Torrey et al. 1934) were used to identify lead poisoning in most cases. A sample of sick and dead birds collected in mid-December indicated that something other than lead poisoning was prevalent. These birds appeared to be in good body condition. Abnormal behavior was observed with lack of fear response, associated with equilibrium difficulties; some ducks would swim in small circles.

Water being pumped from a deep well was suspected to contain lethal levels of inorganic salts or heavy metals that might cause such behavior. Water sample analyses showed less than 1 ppm of nitrate and only a trace of nitrite, both non-dangerous levels. Tests for lead, arsenic, mercury, phenol, phosphates, cyanide, and strychnine were negative.

On January 7, 1964, an apparently healthy flock of 20,000 lesser snow and blue geese returned to the refuge from an early evening feeding flight and separated into four groups. When the flock departed to feed the next morning 1,110 dead geese were distributed throughout the roosting sites. The distribution of dead geese indicated that the entire flock had been exposed to the same fatal agent. Also, the absence of sick geese before and after the die-off suggested that the deaths resulted from an extremely virulent pathogen or potent toxin.

Geese examined externally appeared to be in excellent body condition and the crops of some birds contained corn, an indica-

[1] This project was supported by Federal Aid to Wildlife Restoration, Surveys and Investigation Projects, Missouri 13-R; by funds from the Department of Veterinary Microbiology, University of Missouri; and by funds from the Bureau of Sport Fisheries and Wildlife, Squaw Creek National Wildlife Refuge.

Table 1. Waterfowl examined for pasteurellosis, Squaw Creek Refuge, 1964.

Sample No.	Number and Species		Date (1964)	Where Collected	Necropsy Performed	Pasteurellosis Negative	Pasteurellosis Positive
1	2 snow geese	(dead)	1-10	Squaw Creek Refuge	Dr. Wallace (in practice)	2	0
2	8 blue and snow geese	(dead)	1-10	Squaw Creek Refuge	Univ. of Mo.	0	8
3	5 blue and snow geese	(dead)	1-10	Squaw Creek Refuge	Patuxent Res.	0	5
4	2 mallards	(dead)	1-10	Squaw Creek Refuge	Patuxent Res.	0	2
5	5 blue and snow geese	(dead)	1-10	Squaw Creek Refuge	Univ. of Iowa	0	5
6	6 blue and snow geese	(dead)	1-15	Squaw Creek Refuge	Univ. of Mo.	0	6
7	1 snow goose	(live)	1-15	Squaw Creek Refuge	Univ. of Mo.	0	1
8	5 blue and snow geese	(dead)	4- 3	45 miles NW of Refuge	Univ. of Mo.	0	5
9	1 coot	(dead)	4- 3	45 miles NW of Refuge	Univ. of Mo.	0	1
10	3 coots	(live)	4-10	45 miles NW of Refuge	Univ. of Mo.	0	3
11	1 Canada goose	(dead)	4-10	45 miles NW of Refuge	Univ. of Mo.	0	1
12	1 coot	(live)	5- 1	Squaw Creek Refuge	Univ. of Mo.	1	0
13	4 coots	(dead)	5- 1	Squaw Creek Refuge	Univ. of Mo.	4	0
14	2 mallards	(dead)	5- 1	Squaw Creek Refuge	Univ. of Mo.	2	0
15	2 coots	(live)	5- 4	Squaw Creek Refuge	Univ. of Mo.	2	0

tion of their ability to fly from feeding areas shortly before death.

The position of the dead geese was remarkably uniform. Each was in sitting posture with the head and neck extended over the back. Dirt particles blown across the ice had settled into melted depressions under the carcasses, indicating the geese had remained in the same position throughout the night. A minimum temperature of 12 F and a maximum wind velocity of 23 mph was recorded during the night of the die-off.

DIAGNOSIS AND RESULTS

Necropsies were performed on two snow geese that retained body heat. Gross hemorrhaging of the digestive tract associated with abnormal mucus deposits was found, but a causative agent was not isolated (Sample 1, Table 1).

Myocardial hemorrhages were present in all eight blue and snow geese (Sample 2) examined at the poultry diagnostic laboratory, University of Missouri. The heart blood was dark and poorly clotted. Numerous bipolar microorganisms characteristic of *Pasteurella* were observed upon microscopic examination of stained smears of heart blood. Giemsa's blood stain provided better resolution than methylene blue, gentian violet, or Gram's method of staining.

Bipolar microorganisms did not multiply on salmonella–shigella media, yet grew profusely on tryptose and blood agar plates. Small, fluorescent colonies appeared on inoculated tryptose and blood agar plates in 24 hours at 37 C. A small drop of suspension prepared from a few colonies in sterile saline, injected subcutaneously into the dorsal area of two mice, caused death within 23 hours. Stained blood smears from the hearts of the mice yielded results identical to those found in heart blood from the geese.

Carbohydrates were inoculated from colonies of bipolar organisms isolated from mice and geese. Acid, without gas, was present in dextrose sucrose, and d-mannitol. The bipolar organisms were nonmotile in SIM medium (Difco). Growth on triple sugar iron medium (TSI) slants showed production of acid. Hydrogen-sulfite was not produced in TSI agar. SIM and lead acetate strips were not blackened. Diagnosis: *Pasteurella multocida.*

Seven birds examined at Patuxent Wildlife Research Center and 5 at Iowa State University (Samples 3, 4, and 5) were found to contain bipolar, rod-shaped microorganisms which were isolated from typical fowl cholera lesions. Severe catarrhal enteritis and yellowish colored water in the posterior portions of the esophagus and in the proventriculus were noted. Bacterial cultures of tissue revealed *Pasteurella multocida* in all cases.

Birds collected from January 15 to April 10 also proved positive for fowl cholera, (Samples 6–11). Some of these specimens were collected from a small waterhole 45 miles northwest of the Squaw Creek refuge. Old greyish-yellow lesions measuring up to 2.5 × 7 mm were present in the heart tissue. These birds apparently developed the acute septicemic form of the disease following some unknown previous infection.

A wintering flock of 7,000 large Canada geese showed no evidence of this disease. Deaths were not reported, although they associated with infected snow and blue geese and mallards. One small Canada goose (*Branta canadensis hutchinsii*) collected northwest of the refuge contained fowl cholera microorganisms.

Coots (*Fulica americana*) were absent on the refuge during the winter. After they arrived late in March evidence of the disease was noted among them. A specimen collected on April 3, 1964, (Sample 9) had both new and healed hemorrhages of the liver. A 72-hour broth culture from this bird injected into a domestic turkey (0.5 ml intramuscular and intravenous) caused death in 7 hours 20 min. A mouse injected subcutaneously died in approximately 13 hours. Three apparently healthy coots collected April 10 (Sample 10) contained fowl cholera microorganisms in their livers and spleens, suggesting that this species may be a potential carrier.

Coots and shovelers (*Spatula clypeata*) collected 60 miles southeast of the refuge were negative for fowl cholera. Fowl cholera microorganisms were not isloated from any birds after April 10, 1964.

DISCUSSION

The similarity of pasteurellosis case histories suggests that accumulated stresses including overcrowding may induce spread of the disease. Fowl cholera is spread by contact between healthy and infected birds and by contact between healthy birds and a contaminated environment. Harshfield (1965:363) reported, "The body excretions of diseased birds which contaminate soil, food, or water can be an important factor in dissemination of the disease." Quortrup et al. (1946:98) found that bacterial suspensions were as lethal when administered orally as when administered intranasally. They also found mortality among ducks that had access to drinking water that had been used by infected birds.

High duck densities, strong winds, rapid drop in temperatures, and low water levels are major factors influencing fowl cholera epizootics. Theoretically, every waterfowl concentration in the United States is subject to a fowl cholera epizootic under certain conditions. The source of infection in most wildlife epizootics is difficult to determine. Many birds and animals have been classified as carriers of fowl cholera. Kaschula and Truter (1951) found sea gulls as potential carriers of the infection. Hutyra et al. (1949:107–108) stated that the disease is mostly introduced into premises by the introduction of infected fowls, or by wild birds, particularly sparrows and pigeons as permanent bacilli carriers. Still others found wild ruffed grouse, (*Bonasa umbel-*

lus) quail, raptors, gallinules, and terns to have been disseminators of the disease. The behavior of mallards at the refuge, discussed earlier, is evidence that this species may have been the carrier in the Squaw Creek outbreak. Although coots were not present during the winter, spring migrants were found to be carriers.

Chronic carriers of fowl cholera may be present in any waterfowl concentration. Harshfield (1965) found that birds recovering from the disease may act as carriers for a year. Pritchett et al. (1930) isolated fowl cholera microorganisms from the upper respiratory tract of supposedly normal birds. Similar findings were reported by Van Es and Olney (1940). Evidently the disease may remain in the subacute or chronic stage for a lengthy period, and become acute only when conditions are favorable.

In fowl cholera epizootics, mortality of waterfowl on a single wintering area may not be indicative of total mortality, as the birds represent only a small localized segment of the migratory waterfowl population. Fowl cholera carriers may also infect populations along migration routes and on the nesting grounds. Mortality along migration routes may be misidentified as lead poisoning.

Secondary effects of chronic fowl cholera on productivity could cause additional losses more staggering than direct mortality. In discussing secondary effects of chronic cases in chickens, Beach and Freeborn (1927:25) concluded that chronic pasteurellosis in chickens may cause a rupture of the yolk sac when infection localizes in the ovary. Shook and Bunyea (1939) found ruptured yolks, salpingitis, and hemorrhages of the ovary in fowl cholera epizootics among chickens. Barger et al. (1958) also noted that ovarian changes in chickens are not infrequent in chronic cases of fowl cholera. Further studies are needed to determine whether, and to what extent, fowl cholera mortality is being attributed to lead poisoning, and whether secondary effects of fowl cholera limit or inhibit productivity in waterfowl.

CONTROL AND SANITATION MEASURES

A contributing factor in the Squaw Creek epizootic was the maintenance of open water by pumping during winter. This management technique concentrated large waterfowl populations on relatively small areas with disastrous results. If artificial ecological conditions conducive to fowl cholera can be eliminated or reduced in importance, significant losses to this disease may be prevented. Winter pumping has been curtailed at Squaw Creek to reduce disease potentials and to better distribute wintering waterfowl. Fowl cholera has not recurred there.

Sanitation measures were imposed immediately when the outbreak occurred. Cleanup of carcasses was necessary to avoid spreading the potential diseases. The carcasses were burned. It is suggested that contaminated vegetation be burned and water areas be drained and cultivated as soon after the epizootic as possible. Contaminated agricultural land should also be cultivated.

LITERATURE CITED

Barger, E. H., L. E. Card, and B. S. Pomeroy. 1958. Diseases and parasites of poultry. 5th ed. Lea & Febiger, Philadelphia. 408pp.

Beach, J. R., and S. B. Freeborn. 1927. Diseases and parasites of poultry in California. California Agr. Ext. Circ. 8. 60pp.

Curtice, C. 1902. Goose septicemia. Rhode Island Agr. Expt. Sta. Bull. 86. 12pp.

Dorsey, T. A., and G. S. Harshfield. 1953. Facts about fowl cholera. South Dakota Agr. Exptl. Sta. Circ. 100. 11pp.

Gershman, M., J. F. Witter, H. E. Spencer, Jr., and A. Kalvaitis. 1964. Case report: epizootic of fowl cholera in the common eider duck. J. Wildl. Mgmt. 28(3):587–589.

Harshfield, G. S. 1965. Fowl cholera. Pp. 359–373. *In* H. E. Biester and L. H. Schwarte (Editors), Diseases of poultry. 5th ed. Iowa State Univ. Press, Ames. 1382pp.

Hutyra, F., J. Marek, and R. Manninger. 1949. Special pathology and therapeutics of the diseases of domestic animals. 5th ed. Vol. I. Alexander Eger Inc., Chicago. 962pp.

Kaschula, V. R., and D. E. Truter. 1951. Fowl cholera in sea-gulls on Dassen Island. J. South Africa Vet. Med. Assoc. 22(4):191–192.

Petrides, G. A., and C. R. Bryant. 1951. An analysis of the 1949–50 fowl cholera epizootic in Texas panhandle waterfowl. Trans. N. Am. Wildl. Conf. 16:193–216.

Pritchett, Ida W., F. R. Beaudette, and T. P. Hughes. 1930. The epidemiology of fowl cholera. IV. Further field observation of the spontaneous disease. J. Exptl. Med. 51(2): 259–274.

Quortrup, E. R., F. B. Queen, and L. J. Merovka. 1946. An outbreak of pasteurellosis in wild ducks. J. Am. Vet. Med. Assoc. 108(827):94–100.

Rosen, M. N., and A. I. Bischoff. 1949. The 1948–49 outbreak of fowl cholera in birds in the San Francisco Bay area and surrounding counties. California Fish and Game 35(3): 185–192.

———, and ———. 1950. The epidemiology of fowl cholera as it occurs in the wild. Trans. N. Am. Wildl. Conf. 15:147–154.

Shook, W. B., and H. Bunyea. 1939. The detection of carriers of fowl cholera, and its control, by means of a stained-antigen, rapid whole-blood test. Poul. Sci. 18(2):146–149.

Torrey, J. P., F. Thorp, Jr., and R. Graham. 1934. A note on pathological changes encountered in wild ducks. Cornell Vet. 24(4): 289–298.

Van Es, L., and J. F. Olney. 1940. An inquiry into the influence of environment on the incidence of poultry diseases. Nebraska Agr. Expt. Sta. Bull. 118. 57pp.

Received for publication May 31, 1966.