

ARROWWOOD NATIONAL WILDLIFE REFUGE

PINGREE, NORTH DAKOTA

ANNUAL NARRATIVE REPORT

CALENDAR YEAR 1979

NATIONAL WILDLIFE REFUGE SYSTEM
FISH & WILDLIFE SERVICE
U.S. DEPARTMENT OF THE INTERIOR



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I. GENERAL

A. Introduction

Arrowwood National Wildlife Refuge is located in east-central North Dakota on the James River approximately 30 miles north of Jamestown, North Dakota. The 15,934 acre refuge is located in the drift prairie and encompasses four lakes in the James River Basin. The upland areas contain over 8,000 acres and range from steeply sloped lands where tributary drainages come into the James to nearly flat uplands. The refuge headquarters serves the 12 county Arrowwood Refuge Complex which includes Arrowwood, Valley City and Slade Wetland Management Districts.

The year 1979 was one of extreme high water on the refuge. A heavy snow pack coupled with a late and rapid run off created flood conditions throughout much of the state. The lakes on the refuge filled with water and then continued to rise as Jamestown Reservoir, located immediately below the refuge, filled and backed up into the refuge. This created one continuous lake from the Jamestown Dam to the north end of Arrowwood Lake, a distance of 30 miles.



High water flooded roads, washed out structures, reintroduced rough fish, eliminated any chance for water level management for most of the year and in general created numerous problems with our management program.

B. Climatic and Habitat Conditions

Weather, precipitation and temperature information.*

<u>Month</u>	<u>Received</u>	<u>Normal</u>	<u>Snowfall</u>	<u>Max. Temp.</u>	<u>Min. Temp.</u>	<u>Ave. Temp.</u>
January	.58	.40	4.6	26	-28	-3.9
February	1.51	.36	19.0	33	-34	-1.3
March	2.05	.64	11.7	43	-15	20.4
April	3.11	1.51	7.0	69	- 6	34.1
May	2.10	2.47	1.5	83	21	47.1
June	3.75	3.48		90	40	63.2
July	2.24	2.73		93	44	68.9
August	1.73	2.49		91	34	63.1
September	.53	1.82		92	32	61.0
October	.79	1.18		77	11	43.0
November	.32	.53	3.0	60	-10	25.2
December	.55	.43	2.5	53	-15	23.8
	19.26	18.04	49.3	Ave. Yearly Temp		37.0

*Weather records are from official weather service station located at Arrowwood headquarters.

Heavy snows and persistent below freezing temperatures made operation on the refuge difficult. Because of the cold temperatures, the snow did not crust resulting in constant blowing and drifting of snow. Much time was spent clearing roads. Due to the large snowpack, run off was excessive. Several days of very warm temperatures caused a rapid melt. Most of the refuge creeks knocked out refuge trails and almost all coulee dams were damaged. The headquarter's road was under water for several weeks. The exceedingly high water levels allowed fish, especially carp and other rough fish, to pass over control structures and reinfest refuge lakes. Water levels remained very high throughout the summer. As a result of deep water and excess turbidity from carp, there was virtually no sago pondweed production on any of the refuge lakes. None of the aquatic transects showed evidence of sago, whereas last year nearly 100 percent of the transects had sago.

Water quality is another concern and one we have limited control over. The refuge lakes are sumps for agricultural drainage entering the refuge via the James River and tributary creeks. In addition to adding additional nutrients, the drainage contributes to increased water volume. This year we were active in battling the Rocky Run drainage project. This is a proposed 260 square mile watershed improvement project which empties into the James River about 35 miles upstream from the refuge. Ostensibly called a flood control project, drainage is clearly a primary objective. Loss of wetland habitat and increased volume of water in the James are our biggest concerns. This year we began monitoring water flow in the Rocky Run Watershed to gather data to document our concerns. The project has been voted down several times and was defeated again this year. Like a ghost that never dies, however, it is alive again and a modified project will be voted on in 1980.

C. Land Acquisition

Nothing to report.

D. System Status

1. Objectives

The primary objective for Arrowwood Refuge is waterfowl production. Another major objective is to provide migration habitat for waterfowl, especially during the fall migration period. Refuge objectives, as written several years ago, are still generally valid, although in need of some "fine tuning" with regard to output numbers.

2. Funding

As has been the case for the last several years, the complex funding situation was adequate. This was due in large part to the extra funding that was made available through the Bicentennial Land Heritage Program. A comparison of O & M funding for the last three years is shown below.

	Cost Codes					
	1210	1220	1240	1340*	6810	Total
1977	198,000	5,000	10,000	3,000		216,000
1978	253,000	5,000	10,000	2,000		270,000
1979	297,600	4,500	10,000	2,000	1,500	315,600

*The 1340 funds are for Valley City WMD and represents salary costs for our Biological Technician when he helps the Valley City National Fish Hatchery during spawning operations.

BLHP funding amounted to \$449,000 for the year. Approximately \$153,000 of this amount was used for habitat rehabilitation and included purchasing two new dump trucks, which will be delivered in 1980, two new slip-on fire fighting pumper units, and about \$55,000 in grass seed for converting cropland to Dense Nesting Cover. Most of the remaining funds were used at Long Lake Refuge for a new headquarters site. Most of the costs were for a new office-shop complex. About \$60,000 was carried over for rehabilitation of the Depuy March Spillway on Arrowwood Refuge. No work could be done this year because of high water problems.

We expressed concern in last years narrative that BLHP funding might terminate before we got some important facilities funded and constructed. By changing priorities and being assured of funding through fiscal year 1980, we feel most of our major needs will be met. A new office for Arrowwood, now scheduled for fiscal year 1981, is the only major item that we are concerned about. It has top priority so if BLHP is funded in FY 81, we should get the office.

II. CONSTRUCTION AND MAINTENANCE

A. Construction

With the help of Valley City YCC personnel, a much needed 40' x 80' pole building was erected. This building is large enough to store all our large equipment and will provide the needed protection this station has needed for many years.



Valley City YCC crew setting poles for the new pole barn.



The completed building protecting valuable equipment from the elements.

No work was done to complete the waterfowl impoundment by headquarters because of high water. The project remains about 75 percent completed.

B. Maintenance

Constructing a pole building, handling BLHP work, and coping with high water problems all year reduced our general maintenance work. Attention was given to repairing roads where spring run off flooded and washed out crossings. Fences were repaired where necessary to control cattle trespass and YCC reshingled the roof on the pumphouse.

C. Wildfires

Two wildfires occurred on Arrowwood Refuge this year. On September 19 a fire was discovered about 2:00 p.m. on the west side of the road into the picnic grounds in Burn Unit B-3. Strong southwest winds pushed the fire rapidly to the north, but it was stopped by a firebreak. Wind direction slowed the spread of the fire to the west, the only direction that had any fuel to burn. The fire was extinguished after it had covered a strip about 200 yards wide and about a half mile long. The fire was assumed to be caused by a carelessly dropped cigarette.

The second fire occurred on the southwest end of Jim Lake during the night of October 29. The fire was reported to refuge personnel about 12:30 a.m. by a refuge neighbor who also contacted the Jamestown Fire Department. The fire was contained by the fire department and refuge neighbors by the time refuge equipment arrived on the scene. This fire was also caused by man, probably someone parked on the south end of the lake who dropped a cigarette or started the fire for "kicks". About 103 acres of grassland were burned with no long-term damage done.

III. HABITAT MANAGEMENT

A. Croplands

The following table summarizes the crops planted on the refuge in 1979.

Unit	Acres	Summer Fallow	Small Grain	Small Grain & Sweet Clover	Wheat (Browse)	Other	Refuge Share	Permittee Share
F-1	161		76	58	27		43	118
F-2	75	19	20	16		20	18	38
F-3	30	10		10		Sunflowers 10	13	29
F-4	22		11	11		Sunflowers		
F-5	107		36	51	8	12	34	73
F-6	26		10	8	8	Sunflowers	8	18
F-7	85	12	42	11	8	12	20	53
F-8	69		41	12		Millet 16 Corn	22	47

Most refuge crops were well utilized by wildlife. Geese utilized all the browse provided by winter wheat and most of what sprouted on harvested grain stubble fields. A 16 acre field of standing durum in F-1 was heavily used by ducks, geese, and white-tailed deer, but a field of spring wheat in F-5 received only light use. Sunflowers were utilized by migrating black birds and mourning doves and were an important food supply for resident species through the winter months.

DNC Plantings

The refuge has approximately 3,000 acres of dense nesting cover. Heavy winter snow again reduced the amount of residual cover in these plantings, but adequate moisture resulted in good growth and cover conditions for

June and July nesters. No additional seedings were made during the year. Parts of D-5 and D-7 were hayed this year. On D-5, haying on a third of the field was done to rejuvenate the area. On D-7, two strips infested with quack grass were hayed prior to breaking out for reseeding in 1980.

B. Grasslands

1. Grazing

Nine of the refuges 30 grazing units were grazed in 1979. The grazing fee was \$5.18 per animal unit month. Other grazing information is summarized below.

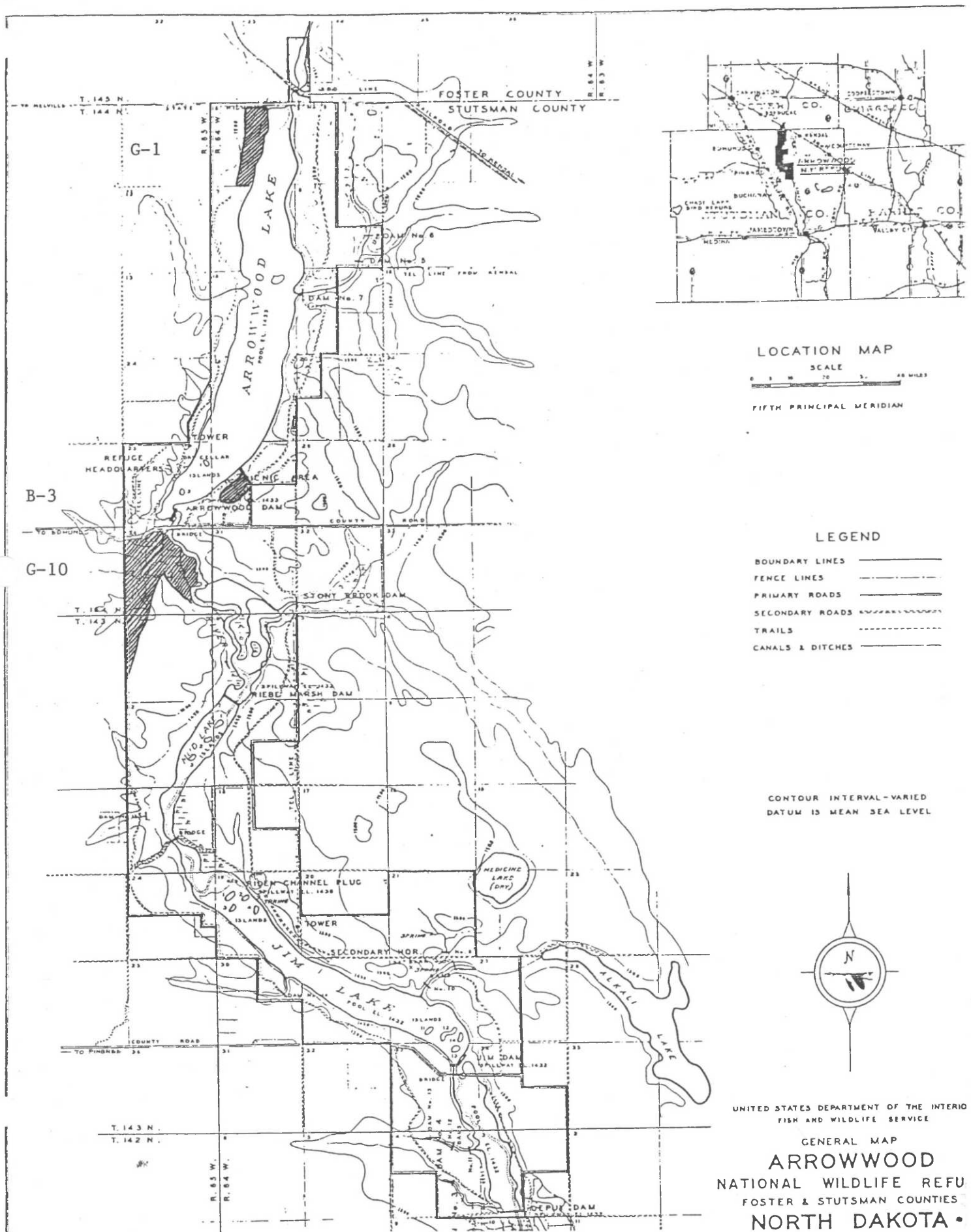
Grazing Unit	Acres	Period Grazed	AUM's Allowed	AUM's Used	Receipts
G-2	193	1/1-7/1	190	172.78	895.00
G-3	146	5/9-6/25	140	135.02	699.40
G-5	144	5/7-6/30	160	133.06	689.25
G-9	217	5/2-6/29	150	105.83	548.20
G12 & 13	426	5/20-6/30	170	110.53	572.55
G-19	360	5/9-6/30	200	83.46	432.32
G-21	270	5/5-6/16	250	221.40	1146.85
G-26	327	5/1-6/30	320	241.50	1250.97
G-27	220	5/5-6/30	270	199.04	1031.03

Our grazing program is designed to put pressure on cool season exotic species of grasses. We have problems getting local permittees that have sufficient numbers of cattle to give us the grazing pressure we want. Another problem occurs when you get adequate stocking rates, cattle have a tendency to get through the fence into adjoining pastures where the grass is more plentiful and palatable.

2. Prescribed Burning

Prescribed burns were conducted on only three tracts on the refuge. The cool wet spring dampened our efforts to carry out an extensive burning program. The burn areas are shown on Figure 1. The 170 acre G-1 Unit has severe buckbrush, Symphoricarpos occidentalis. We attempted a burn on this unit on June 4. Buckbrush was at the three-quarter leaf stage and bluegrass, Poa pratensis, was flowering. Conditions were not good for a burn with air temperature at 69° F and relative humidity a rather high 52 percent. The burn was spotty and did not generate sufficient heat to carry well.

FIGURE 1. Location of prescribed burns conducted during 1979.





Modified Daubenmier transects have been set up on selected refuge native grassland sites to evaluate management practices.



Bio Tech Gary Erickson beginning a prescribed burn in heavy buckbrush on Burn Unit 3.

Later that same day, we burned a small portion of Burn Unit 3. The burn area is east of the picnic ground and contains about 40 acres. Temperature reached 72°F and relative humidity had dropped to 35 percent by the time fuel was ignited. This fire was hot and carried well. Buckbrush and bluegrass were set back significantly by this burn.

Our final burn occurred in Grazing Unit 10 on June 11. This burn had lots of brush and carried well with 80°F temperature, 20 percent relative humidity and a 20 mph wind to push it along. Despite a lot of green vegetation, the coverage was complete. Warm season native species responded very well to this burn. Prairie Sandreed, Calamovilfa longifolia, and Big Blue Stem, Andropogon gerardi, were especially notable. The burn area was about 350 acres.



Prescribed burn on G-10. Note the green growth.



Range Ecologist Blake Smith checks growth of Big Blue Stem two months after the burn.

C. Wetlands

Refuge lakes quickly filled to overflowing when the spring run off period started. Flooding caused problems with road crossings and hampered water management activities. By the end of October we had finally got water levels down to desired levels. No drawdown occurred on the Depuy Marsh Unit and a contract to replace the Depuy Marsh Spillway had to be postponed because of too much water.

The following are average elevations for each month.

Spillway Elevation	1436.66	1436.00	1436.38
<u>Month</u>	<u>Arrowwood</u>	<u>Jim Lake</u>	<u>Depuy</u>
January	1436.33 est.	1435.70 est.	1434.42 est.
February	1436.33 est.	1435.70 est.	1434.42 est.
March	1436.33 est.	1435.70 est.	1434.42 est.
April	1441.21	1437.81	Water Over Spillway
May	1441.01	1440.04	Water Over Spillway
June	1438.58	1438.56	Water Over Spillway
July	1438.10	1437.20	Water Over Spillway
August	1436.86	1436.00	1435.90
September	1436.17	1434.56	1434.68
October	1435.30	1433.75	1434.50 est.
November	1435.30 est.	1433.75 est.	1434.50 est.
December	1435.30 est.	1433.75 est.	1434.50 est.



Numerous coulee dams were washed out during the run-off period. Most of these sites could not be repaired before freeze up and will not hold much water until 1981, assuming they are repaired in 1980.

Natural wetlands on the refuge filled to capacity. Type I's held water for considerable time into the summer and the III's and IV's held good water all year.

D. Forestlands

Nothing to report.

E. Other Habitat

Nothing to report.

F. Wilderness and Special Areas

Nothing to report.

G. Easements for Waterfowl Production

Nothing to report.

IV. WILDLIFE

A. Endangered and/or Threatened Species

Four immature bald eagles were observed in November in the Arrowwood and Jim Lake units.

B. Migratory Birds

1. Waterfowl

a. Ducks

By May 7 the refuge lakes were completely thawed. Peak duck migration occurred the first week of May when about 11,300 were present. By mid-May only the resident breeding population remained on the refuge. In the fall, migrating ducks peaked around October 24 with about 21,000 ducks present. Due to the warm fall, many species were present through mid-November. Several patches of open water persisted on the Mud Lake unit until November 17. A few mallards and widgeon used these open areas. Several canvasbacks were seen as late as November 15 on the James River just south of the refuge.

Waterfowl Use Days Summary

<u>25 Year Average</u>	<u>Swan</u>	<u>Geese</u>	<u>Ducks</u>	<u>Coots</u>	<u>Total</u>
1954-1978	6,986	266,945	1,314,380	272,955	1,861,266
1979	5,820	615,230	990,600	580,200	2,191,850

Pair counts conducted May 25 - June 1 yielded about the same number of pairs as last year. However, the brood counts of July and August revealed very few broods. High water and a total absence of sago pondweed growth may account for this years low waterfowl productivity. Productivity information is summarized on the following table.

1979 Duck Production

<u>Species</u>	<u>Pairs</u>	<u>Prod. Rate</u>	<u>No. of Broods</u>	<u>Brood Size</u>	<u>Total Prod.</u>
Mallard	110	.45	49.5	5	247.5
Gadwall	97	.45	43.6	5	218.0
Widgeon	6	.45	2.7	5	13.0
Pintail	38	.45	17.1	5	85.5
BWT	142	.45	63.9	6	383.4
GWT	10	.45	4.5	5	22.5
Shoveler	40	.45	18.0	5	90.0
Wood Duck*			From Nest Box Check		475.0**
			Dabbler Total		1604.9
Redhead	34	.45		5	76.5
Canvasback	9	.45		5	20.0
Ruddy	18	.45		5	40.5
Scaup	4	.45		5	9.0
			Diver Total		146.0
			Total Ducks		1750.9

Productivity rate of .45 was computed using procedures outlined in the wildlife inventory plan.

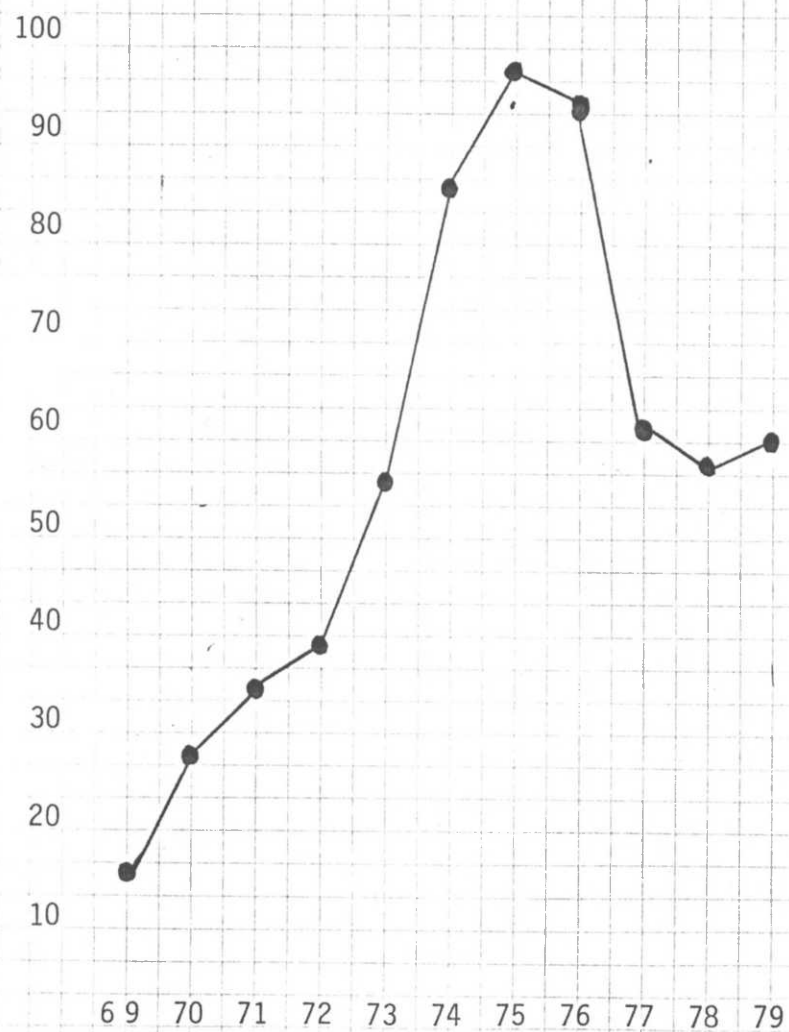
*Total count, not pairs.

**Number of eggs hatched, actual survival not known.

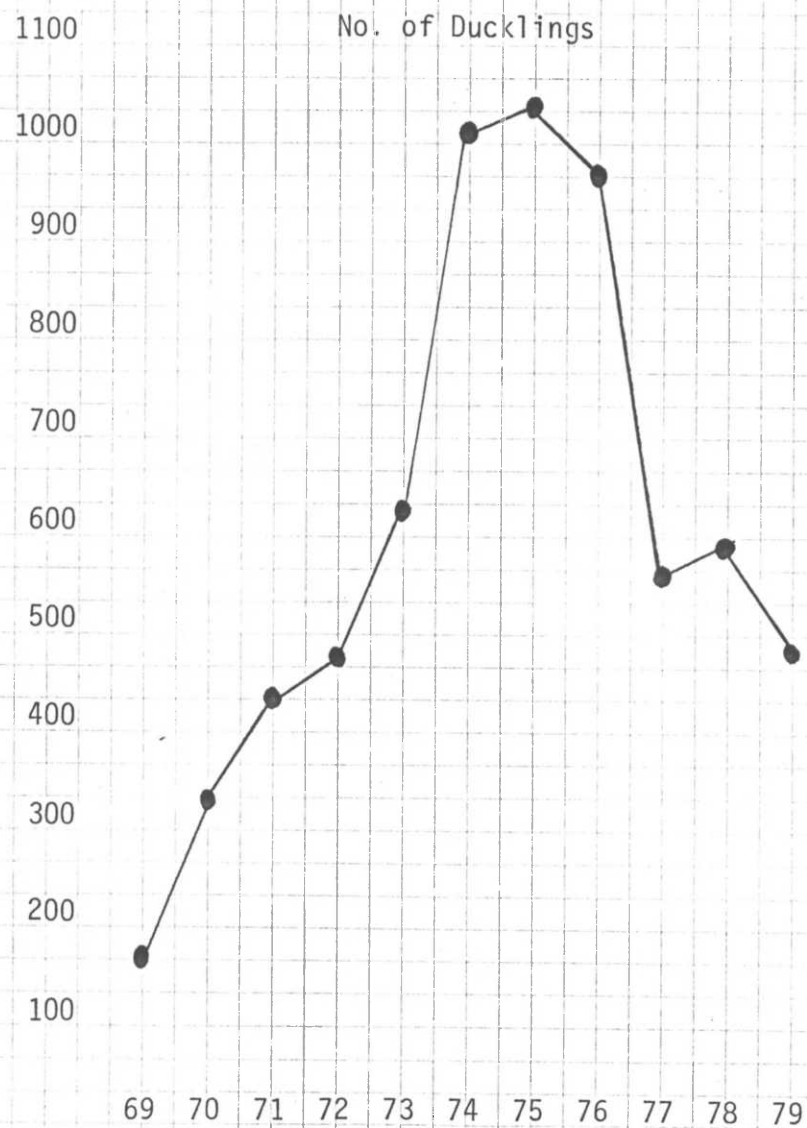
Arrowwood Breeding Pairs and Duck Production

<u>Year</u>	<u>Pairs</u>	<u>1975-1979 Production</u>
1975	1070	4,264
1976	901	4,717
1977	832	2,376
1978	618	3,776
1979	597	1,750

Successful Nests



No. of Ducklings



Wood Ducks

Although Northern Prairie Wildlife Research Center has ended its ten year study of wood duck reintroduction on Arrowwood Refuge, the nesting boxes are checked annually. This years results are given below.

Number of Nests	89
Successful Nests	60
Unsuccessful Nests	29
Percent Successful	67
Number of Eggs Laid	676
Number of Eggs Hatched	475
Infertile Eggs	97
Dead Embryos	104
Houses Out	313
Houses Available	281
Percent Use By WoodDucks	30
Average Clutch Size All Nests	8.3
Average Clutch Size All Hatched Nests	7.9

Eggs were collected from nest boxes for artificial propagation purposes for the ND Game and Fish Department. One hundred and sixty eggs were collected including 153 wood duck eggs and 7 Hooded Merganser eggs. These egg removals probably reduced production figures somewhat.

It is planned to relocate some nest houses which have received no use over the years to more suitable locations. Presently these unused houses are mounted on posts along the Mud Lake channel, an area devoid of trees.

In addition to housing wood ducks this year, a raccoon and her young filled one house demonstrating that these metal houses aren't altogether predator proof.

b. Geese

The first geese to show up this year were white fronts which appeared the third week of March. They were followed by peak numbers of Canadas and snows in mid-April. These were migrant birds which flew over by the thousands but only a few hundred dropped in briefly.

Our small local flock of Giant Canadas produced two broods during the summer. In an attempt to build this small flock, we got some additional birds from the ND Game and Fish Department. Thirteen yearling Canadas were released on June 6 and 60 young of the year were released in August. All released geese were banded with FWS bands and carried green plastic leg bands with white lettering. These released birds were subjected to local hunting pressure and appeared to be vulnerable to hunting through the season.

In the fall, migrant snow geese numbers peaked on October 20 when 8,600 were counted. Small Canada numbers were down from past years with 6,600 being the largest number recorded.



During the winter, nesting structures were filled with flax straw to provide nesting material.

An interesting nesting record occurred on the Mud Lake Unit this year. On June 1 a pair of free flying snow geese and a nest were observed. This is the first breeding record of snows in North Dakota.



The female, a blue phase, and the male, white phase, nested on a grassy mound surrounded by water from six to nine inches deep. The male was not seen after June 6.



The female shown here had a metal leg band, but we were not able to get close enough to read it.



The snow goose nest with four eggs.

The female remained on the nest until June 19 when three of the four eggs hatched. No further observations were made until August 14 when the female and two juvenile young were observed flying over Arrowwood Lake. They were observed frequently after that field feeding with the local flock of Canada geese. The last observation was made September 5.

This nesting of snow geese in North Dakota, far from their high arctic breeding areas, is certainly an observation. While it is possible these were escaped captive birds, a check with numerous people in North and South Dakota did not reveal any cases of escaped birds.

c. Swans

Two hundred whistling swans were observed on the Arrowwood Lake in late April. In the fall an estimated 720 swans used the refuge.

2. Other Water Birds

No census of shore birds, gulls, terns, and other marsh and water birds is taken. However, there is nothing unusual to report high water reduced habitat for shore birds.

3. Raptors

One great-horned owl nest produced three owlets to flight stage. Two ferruginous nests and four red-tailed hawk nests were recorded on the refuge. A screech owl nested in one of the wood duck boxes.

C. Mammals and Non-Migratory Birds

1. White-Tailed Deer

Refuge personnel attempted to conduct an aerial census of deer during January but the defrosters in the plane we flew in had difficulty keeping the windows from fogging over so, we had to abandon the project. On January 18 the ND Game and Fish Department flew a survey and got an actual count of 442 deer. They assumed they got an 80 percent count which would have put the total population at about 550 deer. This count compares to the all time high count of the previous year which was 568 actual count and the estimated population over 600.

Both counts occurred during harsh winters and the population represents deer that moved into the refuge from considerable distance. With the end of winter the deer dispersed and refuge deer numbers dropped. Reproduction appeared excellent despite the harsh winter. Most does were seen with twins and two sets of triplets were observed.

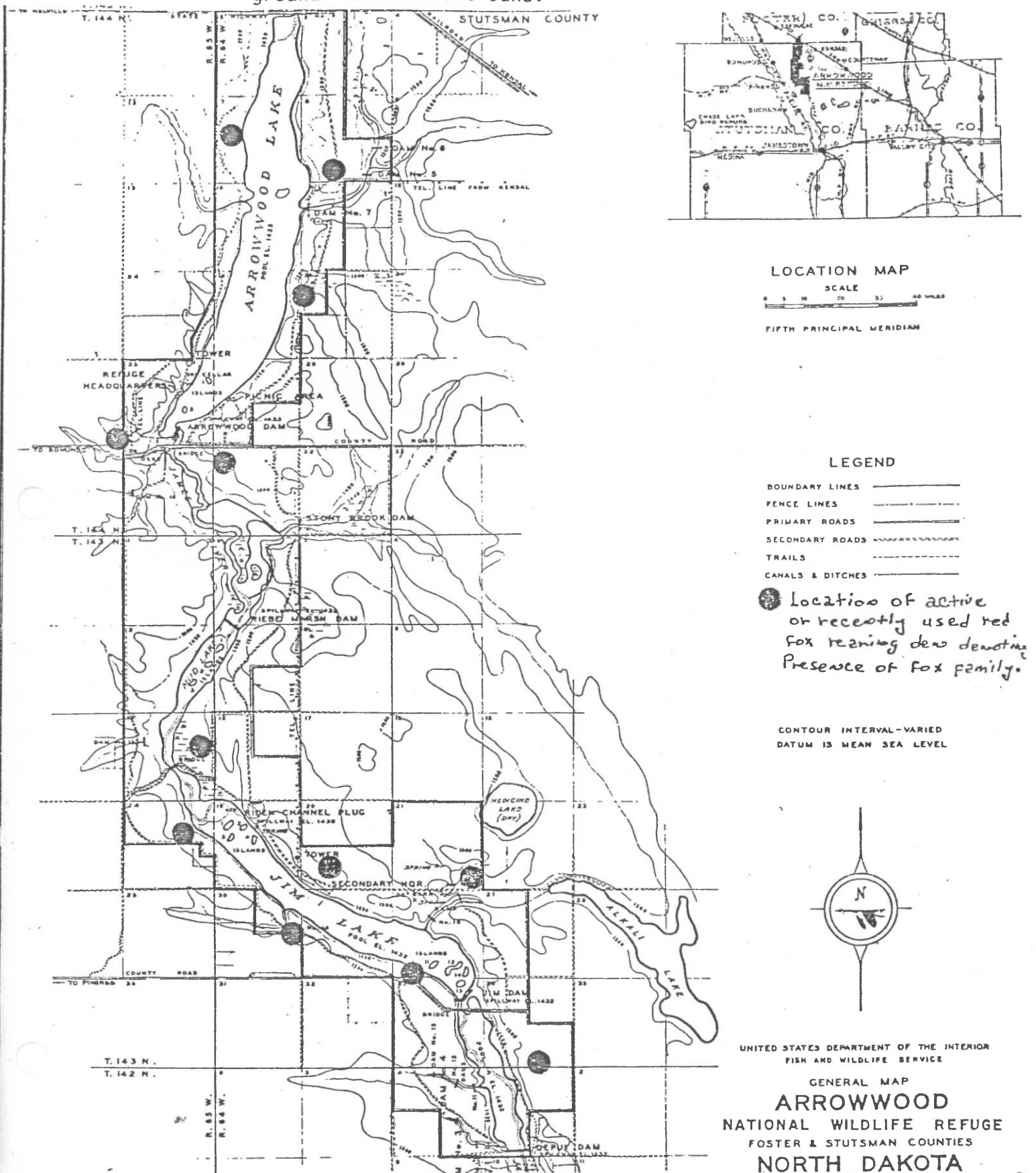
The refuge was open to archery deer hunting and firearms deer hunting. We estimate only 30 deer were harvested. We were concerned about the apparent inadequate harvest because of the large number of deer we held on the refuge for the last two winters could damage winter habitat if not reduced. However, the mild winter of 79-80 allowed deer to range widely all winter and no significant movement of deer into the refuge occurred.

2. Predators and Furbearers

a. Red Fox

An aerial search for fox dens was conducted by Alan Sargeant from the Northern Prairie Wildlife Research Center on June 5 and verified by ground checks on June 7 and 8. (See details under Field Investigations.) Twelve fox dens were found on or immediately adjacent to the refuge (see Figure 2). This is considered a moderate to high den site of fox. Trappers had moderate success in catching fox and details of there activities are summarized under the section on recreation.

Figure 1. Locations of active or recently used red fox rearing dens on Arrowwood NWR in spring 1979 found during a brief aerial search of the Refuge conducted on 5 June and verified by ground visits on 7-8 June.



b. Coyotes

Observations of coyotes were less frequent this year than last. Several sightings occurred in the Mud Lake Unit and bow hunters reported seeing coyotes along Jim Lake and in the Grasshopper Hills area. No coyotes were trapped this year.

c. Raccoons

Numbers were down from the high population evident the last couple of years. A couple of dead coons were seen in the spring when breakup started. One sick coon was reported by Assistant Manager John Sidle about this same time. We suspect canine distemper or other disease may have gone through the population and reduced the population.

d. Skunks

The number of skunks using the refuge has been high for the past three years. Trappers reported taking 56 skunks this year compared to 50 last year and 44 in 1977.

e. Mink

Apparently the high water, return of fish, and prolonged spilling of water attracted many mink to refuge waters. Trappers took 43 mink this fall compared to 13 the year before.

f. Muskrats

These little marsh and creek dwellers made a surprising comeback this year. We reported only a couple of observations last year and remarked that numbers were extremely low. An aerial count over Depuy Marsh revealed 41 muskrat houses in the fall and sightings of houses and muskrats were common over the remaining portions of the refuge. No muskrat trapping was permitted this year.

g. Beaver

Water conditions seemed to favor beaver and lodges and food caches started appearing in many parts of the refuge by fall. Only Depuy Marsh did not have evidence of beaver. Activity was most evident on the James River above Arrowwood Lake, Kollman and McKanzie Creeks, James River above Mud Lake, Mud Lake and Foresberg Pond.

h. Other

Weasel numbers appeared to increase this year. Numerous sightings of long-tailed weasels were made throughout much of

eastern North Dakota. Badgers continue to be present with the overall number low but perhaps increasing.

3. Other Mammals

White-tailed jackrabbits were abundant during the early months of 1979. Shelterbelts and native trees received considerable damage in the general area from the gnawing of rabbits. Franklins and Richardson's ground squirrels were also on the increase this year with much duck nest predation attributed to the Franklin's Ground Squirrel.

4. Resident Birds

a. Sharp-Tailed Grouse

Counts of sharp-tailed grouse are normally made the second week of April. However, due to the late winter and deep snow, counts were not made until the first week in May. Despite the late counts, a substantial increase in number of grouse was recorded. A summary of dance ground counts is shown below.

Ground Number	Year														
	66	67	68	69	70	71	72	73	74	75	76	77	78	79	
1	12	9	9	9	7	14	8	10	15	22	19	12	0	0	
2	14	10	15	10	5	8	5	0	5	2	12	14	0	0	
3	5	0	0	3	3	0	10	14	12	11	12	0	9	12	
4	8	12	11	5	7	7	8	16	10	10	8	12	5	21	
5	5	12	10	14	17	17	18	16	18	22	15	22	7	20	
6	7	7	7	0	0	0	9	17	12	12	11	8	8	13	
7	18	17	18	25	22	19	13	0	7	10	13	19	7	18	
8	0	7	0	0	0	0	0	0	0	0	0	0	0	0	
9	20	16	14	5	11	18	22	18	14	19	15	18	10	15	
10	5	12	17	12	12	11	10	16	9	11	13	11	2	6	
11	17	15	12	11	11	9	11	17	13	0	0	0	0	0	
12	3	5	5	0	0	0	0	0	0	0	20	13	6	9	
13					12	13	8	11	12	12	3	0	8	0	
14(52)						4	8	6	0	0	0	0	0	0	
15(59)						6	13	9	4	0	0	0	4	0	
16							2	0	0	0	0	0	0	0	
62											9	14	14	18	
63											12	16	0	17	
53											8	10	5	7	
51											8	8	8	11	
New Ground Off-Refuge - No Number													8	0	0
17													9	11	
Totals:	114	116	118	96	107	126	155	150	131	131	178	185	102	178	

b. Ring-Necked Pheasants

Two severe winters back to back substantially reduced pheasant numbers.



To aid in rapid recovery the Game and Fish Department provided us with 90 adult hens and 10 adult roosters for an early spring release. The birds were released in the Mud Lake Unit in May.

The release appeared to be successful. Numerous sightings of released hens with broods were made through the summer.

c. Hungarian Partridge

These birds continue to be observed through the year. Most sightings occurred along the tour route adjacent private property. At least three coveys were present in this area through the fall and early winter.

d. Prairie Chickens

See the report under part VI. Other Items, Field Investigations.

5. Other Wildlife

Fish

The prolonged high water brought into refuge waters a fresh invasion of carp, buffalo, bullheads, and other fish from Jamestown Reservoir. A good winterkill had occurred in all refuge lakes the year before and an excellent aquatic vegetative response had occurred during the summer of 1978. We had hoped for a repeat in vegetative response in 1979, but the high water and greatly increased turbidity caused by actions of the fish, eliminated any chance of the sago beds getting reestablished.

Personnel from the ND Game and Fish Department test netted Jim Lake and Arrowwood Lakes on August 15. Various sized gill nets and frame nets were set out overnight and pulled the next day. The results of the netting effort are shown in the following photos.



The fish came in two basic sizes, large and small. These were the large fish that had come upstream with the high water.



These were basically the young of the year that the larger fish had produced.

The nets yielded 261 pounds of fish from Arrowwood Lake and 453 pounds from Jim Lake. Out of the nearly 35,000 fish netted, only 39 were Northern Pike and 3 were Walleyes.

V. INTERPRETATION AND RECREATION

A. Information and Interpretation

The refuge maintains two trails which are open to the public until they are blocked by snow. One trail is self-guided and the other trail leads to the picnic area. During the late spring and summer months, there were about 1,200 visits to the refuge. In addition to self-guided tours, several groups including YCC and students from North Dakota State University were given guided tours.

B. Recreation

1. Wildlife Oriented

a. Deer Hunting

Once again the refuge was open for rifle hunting with the initial two and a half days of the November 9-18 season open only to 120

hunters holding permits. This two and a half day permit period is designed to limit the number of hunters for the first few days of the refuge hunt. Thereafter, anyone with a valid zone permit may hunt in the refuge

Although the hunter turnout was good, hunting success was poor. One significant reason may be that many fields surrounding the refuge had not yet been harvested resulting in less of a concentration of deer on the refuge. Some of the sunflowers remained unharvested into December. An estimated 30 deer were taken during the gun season.

The refuge was open to bow hunting from August 31 to September 28 and November 19 to December 31. After the opening day flurry, pressure was moderate with one or two hunters present most evenings during the week and 10 to 20 hunters present on week-ends. No deer were known to be taken off the refuge.

b. Upland Bird Hunting

Upland bird hunting commenced November 19 and continued through December 9 except for sharp-tailed grouse which continues until December 31. There was a lot of interest in this special late season. Twenty-five hunters used the refuge on opening day. The hunting was tough and many people soon lost interest. Those hunters with dogs flushed and bagged most of the birds. No estimates were made of the harvest, but very few sharp-tailed grouse were harvested because of their wary nature at this time of year.

c. Fishing

A few people tried fishing on open portions of the refuge but with no known success. Bow fish for carp and other rough fish was popular for a few weeks in late spring as the fish wallowed and spawned in the shallows. Peak visits for this sport were ten fishermen.

d. Enforcement

Periodic checks and patrols were made around the refuge when goose hunting interest was high and intensive patrolling was conducted during the firearms deer season. No one was cited for a violation.

VI. OTHER ITEMS

A. Field Investigations

1. Prairie Chicken Restoration

The greater prairie chicken formerly occurred on the refuge in good numbers prior to the establishment of the refuge in 1935 and for a few years thereafter. In fact, one of the reasons for the refuge's establishment was for the preservation of prairie chickens. Ironically, the creation of the refuge hastened the decline of the prairie chicken. Refuge policy was to agriculturally utilize every upland acre. Non-use upland acreage (the amount of upland not annually farmed, hayed, or grazed) on the refuge went from 10,000 acres in 1937 to zero in 1951. From 1951 to 1955, every upland acre on Arrowwood was utilized. During this period, prairie chicken numbers went from 100 in 1951 to ten in 1952 and then to zero in 1953 and 1954. There were a few males seen after that, but the damage was done and prairie chickens never recovered. The last booming ground in the area (located 1/8 mile from the refuge) disappeared in 1957.

By 1966 controlled grazing, burning, and DNC rotation had rejuvenated a large portion of the uplands. In 1971 prairie chicken eggs obtained from penned females, were placed in three located sharp-tail nests. Although all nests were destroyed by predators, it appeared the method was feasible and would work if the predator problem could be solved. Predator-proof fences were tested with sharp-tail nests and were successful. Unfortunately, the substitution work was discontinued and work on reintroducing prairie chickens ceased.

In 1979 it was decided to try the egg substitution method again with each nest surrounded by an electrified fence. On June 8 two sharp-tail nests were located and fenced. On June 11 the sharp-tail eggs were replaced with 20 prairie chicken eggs obtained from the Carlos Avery game farm in Minnesota. One nest received 12 eggs and the other 8.

The flushed hens returned and continued to incubate. One nest, however, was partially destroyed by a ground squirrel and the rest of the eggs were abandoned by the hen. The other nest hatched two eggs. An examination of all remaining eggs revealed that the majority were infertile.

It is hoped to continue this project next year using an improved framed fence and acquiring a better supply of prairie chicken eggs. Hopefully we can make the booming of the prairie chicken a familiar sound on Arrowwood Refuge again.



Sharp-tail grouse nests were found by nest dragging. A low level fence was quickly installed around each nest site. The top strands were energized to further discourage predators.



The nests were checked after the prairie chicken eggs were substituted. The hens appeared to readily accept the eggs.

2. Mink Study

Northern Prairie Wildlife Research Center personnel, headed up by team leader Al Sargeant, were involved with spring live trapping of mink on the refuge. Three mink were caught and taken to Northern Prairie Wildlife Research Center for use in testing radio collar designs. This work was done as part of a pilot investigation to determine the feasibility of conducting a radio telemetry study of mink in the Prairie Pothole Region of eastern North Dakota.



The mink proved extremely difficult to trap and several imaginative techniques were used to entice them into the traps.

3. Predator Behavior

This study supplements field studies of mammalian predator-waterfowl interactions with experiments in specific aspects of predator behavior. During 1979 cooperation continued with the Pennsylvania State University on a two-year graduate student study of red fox - Arctic fox interactions utilizing holding pens and a ten acre enclosure at the Northern Prairie Wildlife Research Center. Theft of ten red foxes during midwinter jeopardized experiments planned for summer 1979 and additional foxes had to be secured. During spring 1979 active or recently used rearing dens of 12 fox families were found on or immediately adjacent to Arrowwood NWR during a brief aerial search of the refuge.

On 7-8 June the dens were verified by ground visits and six red fox pups were secured to replace foxes lost in the theft, and to fill other research needs at the Center. Some fox families were almost certainly overlooked during the search and no evidence was found of one or two coyote families known to be using portions of the refuge. The aerial search, although incomplete, revealed that the refuge was occupied by a moderate to relatively high density of red foxes during spring 1979.



Yikes! Mother told me to stay in the den. Six fox pups were flushed from separate dens and captured by the efforts of this surefooted, well coordinated efficient crew.

B. Cooperative Programs

Nothing to report.

C. Items of Interest

With the exception of Gloria Kosse, who was left to hold down the fort, all complex staff participated in flood protection activities at the Valley City National Fish Hatchery from April 22 through April 26. A desperate diking and sandbagging effort was required to prevent the Sheyenne River from inundating Fish and Wildlife Service facilities there. We thank Hatchery Manager Dale Lamberton for recognizing all employees who participated in the flood fight. Special Achievement Awards including a \$50 cash award was presented to each participant.

Snow plowing and flooding caused many county roads in the vicinity of the refuge to lose gravel. We gave the county permission to open a pit on the refuge with the understanding that the gravel be used only on roads in those townships near the refuge. All known gravel sources off the refuge have been exhausted so the county was very much in need of this gravel source.

A deposit of gravel was found adjacent the west side of Arrowwood Lake. The county moved in their crushing equipment and began processing the gravel. At the close of the year about 6,000 yards of gravel had been crushed. There is about 3,000 additional yards to process and this will be done in 1980. The refuge will take one third of the gravel as a share for the gravel removed. This will be used as needed and will represent a considerable savings in BLHP funds because now the gravel will not have to be purchased.

D. Safety

One unfortunate result of the flood fight was that Ron Strömstad, our Bio Tech at Long Lake, suffered a ruptured disc, was put on the temporary disabled list, and had to undergo corrective surgery. At that time Ron decided to go back to school to get a degree in Wildlife Management and resigned from the service.

Fire resistant clothing was purchased for use in prescribed burning program.

Safety meetings were held periodically in conjunction with staff meetings.

CHASE LAKE

Chase Lake National Wildlife Refuge, an unmanned satellite refuge, is located in west-central Stutsman County on the outwash plain of the Coteau region of the Missouri Plateau. All but 230 acres of the refuge's 4,385 acres is wilderness. Fifty percent of the refuge is water, 45 percent native and cultivated grasses, and the remainder marsh and brush. The refuge's large lake is highly alkaline and supports no fish populations. Two islands, totaling 16 acres, lie within the lake and harbor the refuge's breeding colonies of gulls, terns, cormorants, and pelicans.

The breeding colony of white pelicans is the largest in the United States and numbers of breeding birds is monitored each year. Population figures from 1972 to 1979 are presented below.

Pelican Population

	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>
Number of Nests	4,827	3,911	4,062	4,220	4,755	4,619	4,589	4,051
Number of Eggs	7,334	7,941	No Egg	County	- - -	- - -	- - -	- - -
Young Produced	1,500	1,800	1,200	2,500	2,425	2,494	2,420	1,883
Breeding Population*	9,654	7,822	8,124	8,440	9,510	9,238	9,178	8,102

*This figure is double the number of nests figuring two adults per nest.

Numbers were down from last year. This may be related to the unusually cold spring which delayed nesting chronology by two weeks and the slightly reduced size of the island as a result of high water.

In addition to the nesting pelicans, 209 double-crested cormorant nests were recorded this year. Approximately 22 cormorant nests with one week old young were found on August 29 which is quite late in the breeding season. Several pelican nests with one to two week old young were also observed on the same date.

The white pelicans range out to wetlands to feed during the day. Previous field studies based on the composition of regurgitated boli indicated that tiger salamanders were the most important prey species in 1976 and 1977. It was speculated that high water levels in 1976 flooded shoreline vegetation providing cover for smaller fish such as fathead minnows, thereby making it more difficult for the pelicans to feed on them. Thus the proportion of tiger salamanders was higher in wet years although still the most important prey species. 1979 was a very wet year and examination of boli on the islands revealed very few tiger salamanders. Black bullheads, fathead minnows, and other fish species dominated the diet. Pelican food preferences are probably related to the abundance of the easiest prey available. Arrowwood Lake, where many pelicans feed, was surveyed this year by the ND Game and Fish Department. The survey revealed an abundance of small and large fish. Black bullheads and fathead minnows were the dominant species in the 24 x 6 and 23 x 4 frame nets.

The number of nesting Giant Canada Geese was monitored at Chase Lake. In the spring a total of seven pair of geese were seen on the lake from the air. A subsequent aerial observation of three nests was made later on. Two nests were located on the two islands within the lake and the other nest along the lakeshore. The clutch size of each nest was six. The lakeshore nest was later destroyed by predators. On June 25 three broods of five, five and four goslings were observed. Each brood was accompanied by two adults. Assuming a 70 percent survival rate, the number of young surviving to flight stage was ten.

Chase Lake was open to archery deer hunting in September and again following the close of the firearms deer season in November. The refuge was also open to firearms deer hunting during the regular statewide deer season. During the first two and a half days of the season only, 30 special permit holders were allowed on the refuge. For the remainder of the season, the refuge was open to anybody holding a license for the large zone around the refuge.

Hunter interest was high on opening day with about 25 hunters showing up. At least three bucks and one doe were taken. Hunter interest dropped off drastically after the first few days and only an occasional hunter put in an appearance.