

BIG STONE
NATIONAL WILDLIFE REFUGE
ORTONVILLE, MINNESOTA

ANNUAL NARRATIVE REPORT
Calendar Year 1991

U.S. Department
of the Interior
Fish and Wildlife Service

NATIONAL
WILDLIFE REFUGE SYSTEM

REVIEW AND APPROVALS

BIG STONE NATIONAL WILDLIFE REFUGE

Ortonville, Minnesota

ANNUAL NARRATIVE REPORT

Calendar Year 1991

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Manager (WAM-1) Review

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INTRODUCTION

Big Stone National Wildlife Refuge is part of the Big Stone Lake-Whetstone River Project of Minnesota and South Dakota. The project was authorized under the Flood Control Act of 1965 (Public Law 89-298). House Document No. 579, 87th Congress and Document No. 193, 88th Congress set forth the plans, purposes, and role of the two federal agencies involved: the U.S. Army Corps of Engineers (COE) and the Fish and Wildlife Service (FWS).

Project purposes included flood control, general recreation, and fish and wildlife. Benefits accruing to the project on a percentage basis were calculated as follows:

Flood Control	7.6%
Recreation (Big Stone Lake only)	11.1
Recreation (U.S. Highway 75 facilities	28.2
Overlook, Dam Drive and Fishing Areas	
Wildlife	<u>53.1</u>
	100.0

The 1965 project was designed to improve the water quality of Big Stone Lake by modification of the Whetstone River silt barrier. It also provided flood protection benefits to downstream lands along the Minnesota River and provided wildlife habitat and an area for public recreation. The subject lands were purchased in fee title by the COE in 1971 and transferred to the FWS in May 1975.

The refuge now overlays 11,275 acres of the Minnesota River Valley in western Minnesota. Big Stone County contains 1,028 refuge acres while Lac qui Parle County contains 10,247 acres. A unique visual and geological feature of the refuge is the red, lichen covered granite outcrops for which the refuge was named. Most of the granite outcrops are highly visible from the refuge main entrance road and auto tour route near Ortonville. Another unique feature of the refuge is the ball cactus (Mammillaria vivipara). The only population of this cactus in the State of Minnesota is located in the Minnesota Valley in Big Stone and Lac qui Parle Counties. Big Stone NWR is primarily a grassland system with an interesting prairie-floodplain forest transition. Bottomland forest predominates along the Minnesota and Yellowbank River corridors, with scattered trees found in prairie coulees and surrounding wetlands. Beyond the river corridor, upland prairie is the dominant environment.

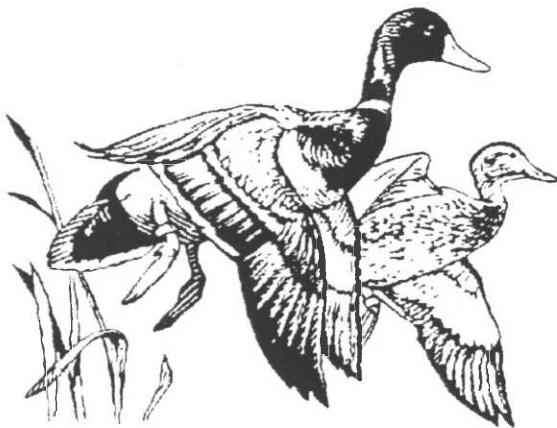
Management emphasis to date has been centered around upland nesting cover restoration including native grass seeding, DNC plantings and native prairie rehabilitation. Future programs will include much more aquatic habitat management through water control development and manipulation.

Refuge objectives overall are:

- To provide migratory bird production, resting and feeding habitat, with emphasis on duck production,
- To preserve, restore, and enhance a diversity of indigenous plant and animal communities on the refuge,
- To provide opportunities for compatible wildlife related recreation, and
- To promote greater appreciation of wildlife and natural ecosystems by providing educational and interpretive opportunities for people.

The refuge master plan provides for the development of projects and programs to permit increased utilization and enjoyment of refuge resources and authorizes new refuge acquisition of 4,000 acres. Implementation of the master plan will extend some existing uses and initiate new activities. These public use programs and related development include:

- Operation of the auto tour route and east pool drive,
- Maintenance of prairie interpretive hiking trail,
- Development of the Ruby Red marsh interpretive hiking trail,
- Maintenance of sixteen public hunting and fishing accesses.



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A. HIGHLIGHTS

The drought we experienced over the last several years ended with substantial summer rains (Section B).

Progress continued on the refuge acquisition plan with the purchase of 160 acres and appraisals completed on two additional properties totaling 788 acres (Section C.1).

Land acquisition created a controversy among Lac qui Parle County land owners and politicians (Section D.3).

Predator reduction was initiated along with our on-going nesting study on the east pool islands (Section D.5).

Two forestry technician positions were added to our staff structure and filled with two 180 appointments (Section E.1).

Heinecke became an active Service representative for the Upper Minnesota Partnership Group (Section E.7).

Refuge operations inspection by regional office staff was conducted in April (Section E.8).

The refuge volunteer program continues to be viable. An appreciation dinner was held for the volunteers (Section E.4).

Adequate rainfall and run-off provided manageable water levels in our new Ducks Unlimited impoundments (Section F.2).

Extensive grazing was again used as a grassland management tool (Section F.7).

An April wildfire consumed 185 acres and damaged stationary pumps and equipment (Section F.9).

A significant increase in waterfowl usedays was noted primarily due to increased goose and mallard use (Section G.3).

An outbreak of avian cholera was discovered resulting in nearly 7,000 waterfowl deaths (Section F.17).

The "no hunting zone" was again closed to deer hunting after six years of being open to deer hunting (Section H.8).

Partial overlay work on the auto tour route and new construction of the tour route entrance project was accomplished (Section I.1 and 2).

B. CLIMATIC CONDITIONS

The weather patterns do seem to be changing in this area. The past few winters have been relatively snow free and mild and this held true for the winter months of 1991. Ice out on the east pool occurred March 31. Both Minnesota and Yellowbank Rivers were ice free at this time showing little run-off potential to fill our water management units (Fig. 1). Due to low spring run-off, pumping was begun in pool 4 and discontinued when the pool reached its normal summer level of 955.0. Temperatures begin to rise quite early in the spring accompanied by prolonged and extreme windy conditions.

Extremely heavy rains occurred during the months of May, June and July (Fig. 2). Pools 4A and 5 were filled to capacity for the first time when the Yellowbank River ran bank full for nearly a week. Temperatures in the 70's and 80's prevailed during the month of August except for three days when they reached the low 90's. September was typical for Minnesota, nice weather with a few warm days to remind us of the summer. October brought us cooler temperatures and dropped to 12° on October 30th. A major snowstorm occurred in the Twin Cities area the next day and was aptly named the "halloween storm." The first official snowfall occurred here on October 31. Refuge pools froze over the weekend of November 2 with approximately 28,000 geese and 15,000 mallards present. December began with wind chills of 40° to 60° below zero. But this only lasted for two days and the remaining days of December were mild and pleasant.



Figure 1. The Yellowbank River and other drainages initially produced little spring run-off.

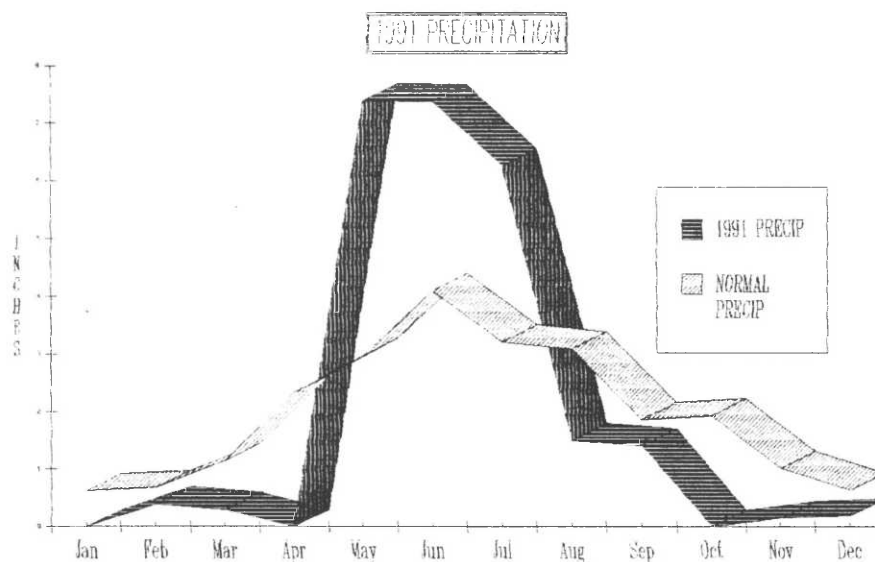


Figure 2. 1991 precipitation as compared to normal.

TABLE I - CLIMATIC CONDITIONS - 1991

Month	PRECIPITATION		TEMPERATURE	
	Melted	Normal	Max.	Min.
January	.0	.63	44°	-15°
February	.4	.68	62°	-14°
March	.3	1.14	57°	-1°
April	.0	2.32	87°	21°
May	7.39	2.98	90°	30°
June	7.38	4.10	91°	54°
July	6.27	3.21	103°	46°
August	1.50	3.09	93°	53°
September	1.41	1.86	87°	32°
October	.0	1.93	82°	12°
November	.15	1.02	53°	-10°
December	.2	.64	48°	-10°
ANNUAL TOTALS	25.00	23.60	103°	-15°

Precipitation normal is calculated over a 30-year period average, 1951 to 1980.

Source of precipitation data is the maintenance facility on Big Stone NWR.

Source of temperature data is KDIO Radio Station which is located two miles north of Ortonville.

C. LAND ACQUISITION

1. Fee Title

From 1986 through 1990 we have been reporting on the progress of land acquisition proposals to increase Big Stone from its original size of 10,795 acres to approximately 14,400 acres (Fig. 3). Acquisition cost at today's real estate market is estimated at \$2,700,000 and relocation costs for eight residences is about \$200,000.

Some acquisition progress was made in 1991. Three tracts were appraised and offers made. They included: M. Mueller (160 acres) for \$128,000, Hedge (535 acres) for \$179,225, and Rein (253 acres) for \$218,400.

Marvin and Lucille Mueller accepted our offer and chose to remain on the building site as a lifetime estate. Land use expires at the end of 1992.

Gayle Hedge rejected our offer since he has about four years remaining on a grazing agreement. He was offered a lease option and rejected that but indicated he would definitely sell at the end of the grazing agreement.

Wallace Rein rejected our original offer on 132 acres as he didn't want to divide the farm into two units. The second offer on the full 253 acres was also rejected. He indicated he would wait until his CRP payments on 132 acres have expired (about three years) and would then sell to us.

Our land acquisition program generated a great deal of hostility this year which surprised us as we didn't get much feedback during our master planning process. For a complete discussion see Section D.3.

Since the master plan and the accompanying acquisition plan was approved in 1986, a total of 480 additional acres have been acquired and include:

- Kolb - 40 acres
- Schmidt - 40 acres
- Lotthammer - 160 acres
- G. Mueller - 80 acres
- M. Mueller - 160 acres

4. Farmers Home Administration Conservation Easements

Two conservation easements proposed in 1990 are still not complete. The 200 acre Charles Clapp tract in Lincoln County was surveyed in November 1990 but the FmHA is still wrangling with the former owner. No action has yet been taken on the 190 acre Wendorff tract in Lyon County.

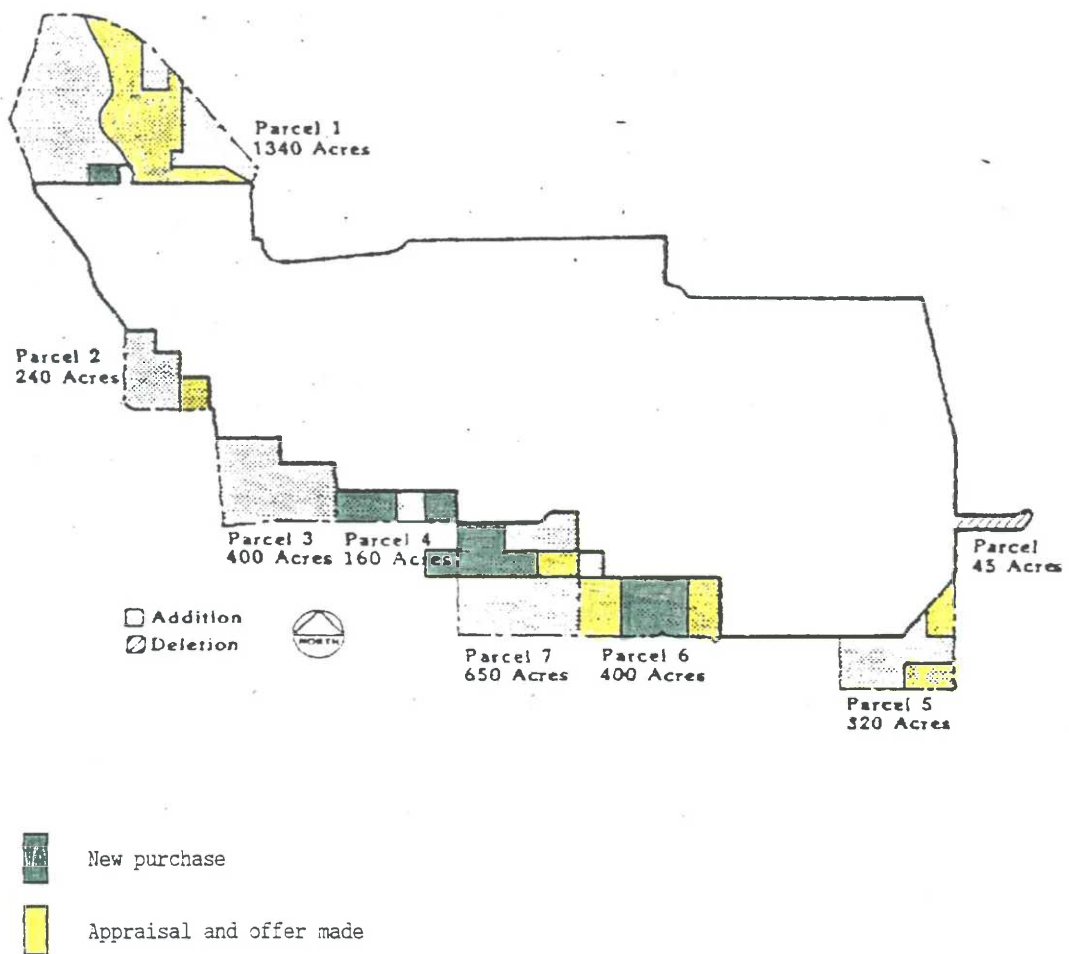


Figure 3. Proposed Boundary Changes and Acquisitions to Date

D. PLANNING

1. Master Plan

The refuge master plan was completed and approved in November 1986.

2. Management Plans

The hunting plan was completed and submitted in November.

3. Public Participation

Most public participation in 1991 consisted of informal discussions concerning a variety of subjects of interest to local citizens.

Considerable discussion took place around the area concerning the closure of the auto tour route area to deer hunting. Nearly all comments were favorable.

On June 25, 1991, a public meeting was held in Madison Minnesota, concerning refuge acquisition proposed in the master plan. The meeting was called by the Lac qui Parle County Commissioners in response to complaints by a few local citizens. Approximately 200 people attended the meeting. Also, in attendance were representatives from Congressman Vin Weber's office and Minnesota State Representative Doug Peterson. Realty Specialist Hietikko and Refuge Manager Heinecke answered questions and tried to address concerns. Primary concerns were weeds, taxes, condemnation, paying over market value, and the need for acquisition. Many concerns were expressed that had nothing to do with Big Stone NWR. It appears that nothing significant resulted from the meeting.

On August 7, a meeting was held in Willmar, Minnesota, with Senator Dave Durenberger concerning refuge acquisition. Among items discussed were relocation benefits and the master plan process. The Senator seemed satisfied with our explanations.

4. Compliance with Environmental and Cultural Mandates

A 404 permit for construction of dike and water control structures 7A and 7B was applied for in June. We recently learned that the Corps of Engineers lost our application and that we now must re-submit the application.

Permit requirements have been completed for the Highway 75 bridge replacement project.

Minnesota statutes, enforced by the Minnesota Department of Health have required property owners to seal all known abandoned wells. In compliance with this mandate, a total of three wells, two drilled and one dug well, were sealed. Lee Well Drilling of Milbank sealed the wells and one cistern at a cost of \$1648. Well locations include the Tucholke, Schwarze and Mueller tracts. Locating additional abandoned wells is ongoing.

5. Research and Investigations

Waterfowl Nesting Study

The 1991 waterfowl nesting study on the refuge was conducted to continue the accumulation of data from nesting studies undertaken in each of the past seven years. Such information of interest has included nesting habitat preferences of upland nesting waterfowl between warm and cool season grasses, nest density, nest success, and habitat productivity.

In response to a problem with waterfowl nest predation, as shown in past study years, an island predator removal program was implemented in the spring of 1991. It was therefore important to continue studying nest success on these islands to evaluate the benefits, if any, of the predator removal program.

A total of 375 acres were used for the 1991 nesting study. This included the following: seven islands in the east conservation pool, six seeded warm season grass fields, two fields of cool season dense nesting cover (DNC), and one field of alfalfa. Habitat searched included 95 acres of tame grass and native prairie islands, 131 acres of seeded, warm season natives, 110 acres of DNC, and 39 acres of alfalfa.

Those areas best suited to predator removal were those which could theoretically have predators removed on a seasonal basis without additional emigration. Islands of upland cover surrounded by water served as an appropriate alternative to enclosures. The east pool, west pool, and pool 4 offer this advantage and were the areas used in the predator control program. In 1989 the Big Stone staff completed a comprehensive waterfowl nesting study initiated in 1984. In 1990 we directed our efforts to the waterfowl nesting biology of the east pool islands. A proposal and environmental assessment was prepared for predator reduction on those islands and additional nesting data was needed there (Fig 4).



Figure 4. Waterfowl nesting data collecting continued in conjunction with the predator reduction program.

CMK 5-91

Nest searching began April 19, and continued until June 27, with additional visits to active nests until July 12. Up to four nest searches were made on each study area. On mainland fields and field 7 (Hoernemann's Island), the standard cable and chain drag between two vehicles was used. Island nest searches on the islands were conducted using two all-terrain vehicle (ATV's) with a 75 foot length of one half inch chain or foot searches. Transport of the two ATV's was accomplished with the use of a pontoon boat.

A total of 98 nests were located including one non-useable nest destroyed by an investigator. Blue-winged teal nests were the most common found, making up 68% of the total. Mallard nests accounted for 29.9 percent followed by gadwall, with only 2.1 percent. Of the 97 nests under observation, 33 of these successfully hatched for an apparent success rate of 34.0 percent. Mayfield corrected nest success was 15.9 percent. Figure 5 compares Mayfield success for the past eight study years and shows 1991 as having the highest success rate since 1987; the fourth highest since the initial 1984 study year. Mallard nests were the most successful, which was also the case for study year 1990.

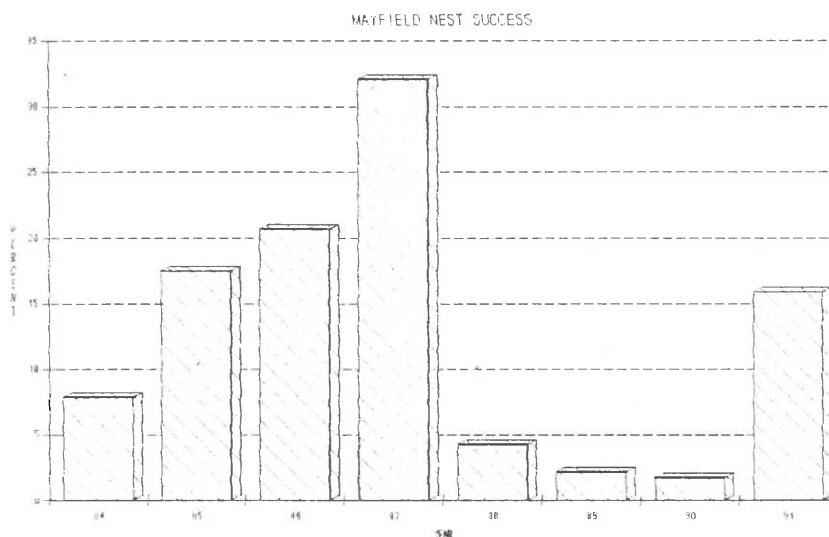


Figure 5. Mayfield Nest Success, 1984-1991

Nest density for the 1991 study year was found to be the third best since the initial 1984 study. Apparent density was 0.26 nests per acre or 26 nests per 100 acres. Expanded nest density, based on Mayfield success rates, was 0.88 nests per acre or 55 nests per 100 acres (Table II).

TABLE II - COMPARISON OF NESTING DENSITIES
DURING 1984-1991 STUDY PERIOD

	1984	1985	1986	1987	1988	1989	1990	1991
Actual no. nests found	81	51	118	136	94	198	83	98
Acres Searched	613	660	746	693	657	305	198	375
Apparent nest density (per 100 acres)	13.2	7.6	15.8	19.6	14.3	64.9	41.9	26
Expanded number nest initiations	215	92	203	212	419	759	167	207
Expanded nest density (per 100 acres)	35.1	13.9	27.2	30.7	63.7	249	85	55

Nest predation was again the major factor in nest fate of study nests. Predators destroyed 61 of the nests or 62.9 percent. Three others were abandoned. Red fox made up 32.8 percent of all predations. Raccoon was close to being as strong a factor as fox with 29.5 percent of the predator incidence. Mink was also a problem (23.0 percent). And unknown predators made up the balance of 9.8 percent.

Results from the east pool study area showed a substantial improvement in nest success from 1990. Twenty-three of the 38 useable nests were hatched. Predation accounted for 13 of the 15 unsuccessful nests or 34 percent of useable nests. Table III shows island nest information for 1990 and 1991. Despite the number of normal nests being almost the same (39 and 38), apparent nest success went from 15.4 percent to 59.0 percent and corresponding Mayfield nest success climbed from 4.2 percent in 1990 to 40.1 percent in 1991.

Apparent nest density for the east pool area was 0.46 nests per acre with an expanded nest density of 0.67 nests per acre.

TABLE III - EAST POOL ISLAND NEST SUCCESS 1990 VS 1991

Island	Number Normal Nests		Number Hatched		Apparent Success (%)		Mayfield Success (%)	
	90	91	90	91	90	91	90	91
A	0	1	0	1	0	100	0	100
B	3	1	0	0	0	0	0.4	0
C	10	18	0	14	0	73.7	1.2	65.1
D	6	3	0	1	0	33.3	0.1	22.1
E	9	11	1	4	11.1	36.4	3.0	19.6
H	5	2	2	1	40.0	50	21.6	29.7
I	6	2	3	2	50.0	100	32.9	100
7	39	38	6	23	15.4%	59.0%	4.2%	40.1%

Island K (Gravel Pit Island) and Field No. 7 (Hoernemann's Island) are included in the west pool study area. A total of 24 nests were found with three being successfully hatched and 21 being destroyed by predators. All but two nests were in Field No. 7 where an annual nest predation problem continues to persist. Apparent and Mayfield nest success for the west pool area was 12.5 percent and 1.9 percent respectively. Apparent nest density was .35 nests per acre with an expanded density of 2.3 nests per acre.

The mainland fields study area includes all non-island units of seeded, warm season grasses and dense nesting cover. As a whole, 33 observable nests were found with seven of these being successful. This shows an apparent nest success rate of 21.2 percent and a Mayfield success rate of 10.8 percent. Twenty-five or 75.8 percent of the nests were destroyed by mammalian predators and one was abandoned. Apparent nest density was .15 nests per acre and expanded density was .29 nests per acre.

For the past seven waterfowl nesting study years the trend between native, warm-season grasses and dense nesting cover was such that WSN fields, while having less nests per acre, had a higher nest success rate than DNC. This trend continues in 1991.

Experimental Predator Reduction

For the first year in 1991 an intensive predator removal program was implemented on east pool, west pool, and pool 4 islands in hopes of increasing nest success (Figs. 6 and 7). This is in response to past nest studies showing the substantial effect that mammalian predators were having on the success of waterfowl nests. One full-time, seasonal biological aid trapped these islands beginning in early May. Table IV shows what species of predators were removed from the islands as well as the 1990/1991 nest success rates for each of the islands trapped.



Figure 6. Island H, one of eight east pool islands selected for predator reduction program.

RMP 4-91



Figure 7. In addition to live traps, legholds, conibears and snares were used to trap raccoon, fox, skunk and mink from islands.

EJR 5-91

East pool islands, as already discussed, showed a marked improvement in nest success from 1990 to 1991 (4.2% Mayfield success to 40.1% Mayfield success). Despite this, island B, D, E, and H still had over 50 percent of the nests under observation destroyed by predators. The direct effects of predator removal on the success of east pool island nests is unknown. Continued implementation of the program will provide more data from which a conclusion can be drawn. It is encouraging, however, to see a substantial increase in nest success.

West pool islands K and 7, are also part of the predator controlled area. Mayfield nest success for field seven was only slightly higher in 1991 at 0.96 percent, up from 0.2 percent in 1990. For island K and 7 combined, Mayfield success was 1.9 percent.

TABLE IV - COMPARISON OF NEST SUCCESS ON PREDATOR CONTROLLED PORTIONS OF STUDY AREA

Predator Controlled Area	Predators Removed				Total	Mayfield Success Rate	
	Rn	Fx	Sk	GS		1990	1991
ISL A	1	2			3	0	100
ISL B	1				1	0.4	0
ISL C	1			1	2	1.2	65.1
ISL D	3				3	0.1	22.1
ISL E	2				2	3.0	19.6
ISL H					0	21.6	29.7
ISL I	2		1		3	32.9	100
ISL K	10		2		12	--	36.8
Field 7	31	3		2	36	0.2	0.96
Pool 4 Islands					0		7.3

Rn - Raccoon
 Fx - Red Fox
 Sk - Striped Skunk
 GS - Ground Squirrel sp.

Pool 4 islands had no predators removed, with the only two nests found being destroyed by mink.

Comparing predator controlled areas as a whole to non-predator controlled areas, the data shows greater nest success in the predator controlled areas. Apparent success was 40.0 percent. Mayfield nest success was 19.2 percent. Non-controlled areas had apparent nest success of 21.9 percent and Mayfield nest success of 10.8 percent.

The 1991 nest study results can best be described overall as being consistent with what has been observed in past study years. Nest success was below what is needed to sustain a waterfowl population.

Despite the increased success on predator controlled, east pool islands and an overall nest success that was higher in the predator controlled areas, conclusions regarding the predator control program are difficult to make after only one season. This initial season was a good primer to discover appropriate procedures and equipment for successful predator removal based on the conditions that the removal area present.

E. ADMINISTRATION

1. Personnel



2 4 3 1

Figure 8. Permanent Staff

1. James Heinecke, Refuge Manager, GS-11, 11-22-77-PFT
2. Rich Papasso, Assistant Refuge Manager, GS-9, 7-10-83-PFT
3. Carole Gerber, Office Assistant, GS-5, 5-20-79-PPT
4. Norman "Butch" Christensen, Maintenance Worker, WG-7, 5-1-72-PFT



Figure 9. Biological Aid-Emergency Fire Fighters
Chris Kane and Dave Wenner

RMP 8-94

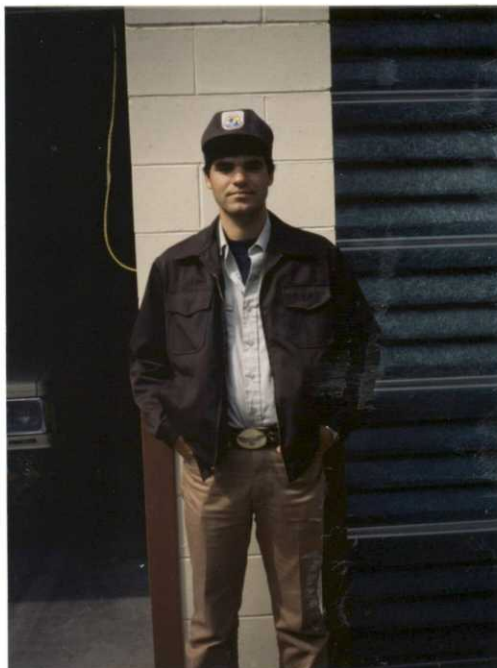


Figure 10. Biological Aid Eric Rozowski.

RMP 8-91

5. Christopher Kane, Biological Aid (Wildlife), 4-21-91, GS-4, TFT
6. Eric Rozowski, Biological Aid (Wildlife), 4-21-91, GS-4, TFT
7. David Wenner, Biological Aid (Wildlife), 4-15-91, GS-4, TFT

In 1991, our staffing structure (Table V) changed considerably with the addition of two forestry technicians (seasonal fire fighters) funded from fire management money. A total of one FTE was permanently assigned to this station and the positions were filled with two temporary 180 day appointees. Christopher Kane and David Wenner were hired for these positions, entered on duty in April and remained on board until the end of the fiscal year. These individuals were trained as fire fighters and were "on call" for interagency fire duty if required. In addition to their required fire related duties they performed a variety of refuge biological and maintenance functions.

Local recruitment authority was used to fill these positions as Forestry Technicians. However two veterans applied and were on the certificate. Neither veteran could pass the required step test at 45. To overcome the problem of passing over a veteran, the forestry technician certificate was canceled and a biological aid certificate was used with amended position descriptions to reflect emergency fire fighter duties.

In addition to these two positions, Eric Rozowski was selected to fill an additional biological aid position from the same certificate. He entered on duty in April and remained until August. His primary duty, in addition to a variety of biological and maintenance tasks, was to conduct the mammalian predator reduction program (Section D.5).

A considerable recruitment effort was made for these positions and included vacancy announcements sent to two state job services offices, ten universities, vocational schools, community colleges and the nationally advertised Job Seeker publication. In all, 84 applications were received for the three positions.

TABLE V - STAFF STRUCTURE

	<u>Permanent</u>		<u>Temporary</u>	<u>Total FTE</u>
	<u>Full Time</u>	<u>Part Time</u>		
FY 91	3	1	3	5.1
FY 90	3	1	2*	3.9
FY 89	3	1	1	3.6
FY 88	3	1	2*	3.6
FY 87	3	1	2*	3.6
FY 86	3	1	1	3.8
FY 85	4	1	2*	4.8
FY 84	4	1	2	4.8
FY 83	3	1	2*	4.1

*Includes work study.

3. Other Manpower Programs

Because three temporary biological aid positions were on board this year, we made no real attempt to hire seasonal workers from other state programs. However we left the opportunity open for work study students from our usual contact list of local colleges, universities and vocational schools. No eligible students under the work study program ever materialized.

4. Volunteer Program

The 1991 organizational meeting of the Big Stone National Wildlife Refuge volunteers was held on April 9, 1991 at the refuge office.

A total of 21 volunteers donated 191 hours (Table VI) for volunteer duties. Most of these hours were spent on public use programs such as opening and closing the auto tour route gate along with litter patrol and monitoring the tour route. The auto tour route opened on weekends on April 6, 1991 and volunteers began opening and closing the gates on April 10 for week day usage. Due to reconstruction of Highway 75 during the month of July and resurfacing of the auto tour route in September the hours of public use were considerably less than usual. Bio Aid Chris Kane donated some volunteer time doing some public use monitoring, invertebrate sampling, deer survey work and work connected with the avian cholera disease problems.

Testing for lyme disease was again made available to the volunteers. Some, but not all of the volunteers, took advantage of this testing. Cost to the station for these pre and post season tests was \$100 per person tested.

A volunteer appreciation dinner was held August 28, 1991. Twenty four persons were in attendance including volunteers, spouses and staff members. The volunteers and their spouses' dinners were paid for with station funds. Each volunteer was presented with a "Big Stone NWR" mug and cap. Total cost including dinner, caps and mugs was \$442.56.

TABLE VI - 1991 VOLUNTEER CONTRIBUTIONS

	INVERTEBRATE SAMPLING	ATR	AVIAN CHOLERA	DEER SURVEY
Ila Beckman		0		
Selma Felton		9		
Jim Foster		10		
Neva Foster		10		
Dorothy Gmitterko		4		
Mary Gustafson		5		
Orin Haukos		5		
Christopher Kane	8	8	8	14
Enid Kurth		0		
Marvin Kurth		0		
Ann Lundberg		10		
Roger Lundberg		10		
Randy McLain		15		
Jane Nitz		5		
Dave Olson		15		
Marge Olson		15		
Arnold Souba		10		
Linda Souba		10		
Arno "Dick" Strube		10		
Joyce Strube		10		
TOTAL	8	161	8	14
GRAND TOTAL	191 HOURS			

5. Funding

Big Stone's FY 91 budget included \$1,000 in 1221 (Drug Interaction Funds), \$94,772 in 1261 (Operations Funds), \$55,000 (Maintenance) and \$20,000 (Maintenance Management System) in-1262, \$15,000 in 1120 (Private Lands Funds), and \$22,500 in 9120 (Fire Funds). At the end of the year, an additional \$13,000 was added to our private lands funds to cover the cost of the purchase of a mini-van and \$230 was added to the fire fund total. Budget total for FY 91 was \$221,502 (Table VII).

TABLE VII - BIG STONE FUNDING FY 84 TO 91
(Thousands of Dollars)

Activity	FY 91	FY 90	FY 89	FY 88	FY 87	FY 86	FY 85	FY 84
1210/1260	169.7	162.8	148.6	146.8	128.7	122.0	143.6	129.7
1220	1.0	---	---	---	---	---	---	---
1240/9120	22.8	5.2	---	---	---	---	---	---
Total O/M	193.2	168.0	148.6	146.8	128.7	122.0	143.6	129.7
1120	28.0	13.0	4.0	---	---	---	---	---
1510	---	---	---	---	---	.2	---	---
1520/1210	---	---	---	---	---	8.5	---	9.1
ARMM	---	---	---	---	27.8	26.9	76.4	27.0
Total Other	28.0	13.0	4.0	0	27.8	35.6	76.4	36.1
Total FY Allocation	221.5	181.0	152.6	146.8	156.5	157.6	220.0	165.8

6. Safety

Four safety meetings were held in 1991. A number of videos were shown including "Deadly Crossing," (railroad crossing safety), a video on chain saw safety, "Tractors-Power Take-Off," and "Phases of Proper Rescue-Operating Tractors and Equipment," and "Plan to Get Out Alive," (a fire safety video).

On April 10, 1991 a stress test was administered to Norman Christensen by the Ortonville Area Health Services at a cost of \$142.00. The physician's charges for reading the test were \$165.00. This test is required in lieu of the step test for fire management duties.

Lyme disease testing was made available to all employees and volunteers. Total cost was \$741.00.

One accident occurred at Big Stone National Wildlife Refuge this year. On May 23, 1991, Christopher Kane received a minor injury to the leg while working with a barbed wire gate. The puncture wound required stitches.

Safety Officer Gerald Mohl conducted a safety inspection of the refuge as part of the refuge operations inspection. Of particular concern for us was his view of the Ruby Red Quarry as it relates to public use. No official determination has been received to date.

7. Technical Assistance

Heinecke served as a member of the Big Stone County water planning task group. The group was responsible for gathering data, holding public hearings, and developing a comprehensive water management plan for Big Stone County. This plan was completed for review in 1991.

Heinecke is the Service representative on the Upper Minnesota River Partnership Group consisting of the Service, the Minnesota DNR, the Minnesota PCA, and the U.S. Army Corp of Engineers. This group will develop and implement an integrated management plan (IMP) for the four mainstem reservoirs on the Upper Minnesota River. The group will also eventually serve as a technical advisor to the Minnesota River Implementation Planning Group (MRIP) and other citizens groups. The group had three organizational meetings in 1991.

8. Other

A station operations inspection was conducted by regional office personnel April 15-18. Personnel participating in the evaluation included: Ed Crozier and J.C. Bryant (WAM-1), Meredith Weltmer, Fire Coordinator, John Ellis, Regional Biologist, Bob Dahlgren, Assistant Regional Biologist, Scott Yess, Fisheries Biologist and Beulah Wikstrom, Administrative Technician, Agassiz NWR. After-the-fact visits to complete the evaluation included Gerald Mohl, Regional Safety Officer, and Tom Worthington, Regional ORP. A total of 63 action items were identified. All participants were impressed by this station's diversity, accomplishments and potential.

Meetings and/or training attended by refuge staff included the following:

January

- Heinecke attended a Pesticide Workshop for applicator licensing in Montevideo.
- Papasso met with the Lac qui Parle County Highway Engineer regarding the Highway 15 bridge replacement over the Yellowbank River.
- Christensen attended an Underground Storage Tank Workshop in Willmar.
- Papasso met with the Big Stone County Highway Engineer regarding site work at the auto tour route entrance.

February

- Heinecke, Papasso and Gerber attended the Regional Conference held in Minneapolis.

March

- Heinecke and Papasso attended the 40 hour In-Service Law Enforcement refresher training held in Des Moines, Iowa.
- Christensen attended the Maintenance Workshop held at Crab Orchard NWR.
- Papasso met with Assistant Regional Biologist Dahlgren on the station biological evaluation.

April

- Gerber hosted a volunteer coordination meeting at the refuge office.
- Kane and Wenner attended S-130, S-190 fire training at Morris, MN.
- Rozowski met with Fergus Falls Wetland District trappers on training detail.
- Heinecke attended a meeting concerning Minnesota River projects with the Corps of Engineers at Watson, MN.
- Heinecke Attended the Citizens for Big Stone Lake meeting held in Milbank, SD.

May

- Kane and Wenner attended tractor safety certification held at Morris, MN.
- Heinecke attended the Ortonville Marina Task Group and Big Stone County water planning group meeting.

- Heinecke met with John Ramsour, RO Engineer, concerning the auto tour route paving contract.
- Heinecke met with Jeff Donahue, RO Ascertainment, concerning land acquisition.

June

- Heinecke and Papasso attended a Lac qui Parle County board/public meeting concerning future refuge acquisition held at Madison, MN.

July

- Heinecke attended a Chippewa County ASCS Docket meeting concerning farm bill, wetland restoration and river cleanup proposals held in Montevideo.

August

- Heinecke met with Senator Durenberger, John Eadie and Bob Heitikko, concerning refuge acquisition in Willmar, MN.
- Papasso and Christensen completed correspondence course work for pesticide license renewal.

September

- Heinecke and Papasso attended the WAM-1 WAMJAM held at Detroit Lakes, MN.
- Heinecke attended the first Upper Minnesota River Partnership meeting in St. Paul, MN.
- Heinecke and Papasso attended the firearms requalification session at Fargo, ND.

October

- Papasso participated in a law enforcement detail for canvasback protection at Upper Mississippi River Refuge, La Crosse, WI.
- Heinecke and Papasso met with WAM-1 Supervisor Crozier and ORP Worthington concerning tour route interpretation and the goose hunting firing line.

November

- Gerber attended the regional Administrative Workshop held in Minneapolis, MN.

December

- Heinecke and Papasso met with GSA Representative, Jennifer Paton, Chicago, concerning office relocation.

F. HABITAT MANAGEMENT

1. General

In an effort to improve habitat quality and diversity, the refuge has provided food plots, wetland development strategies, re-established native and domestic grasslands. Maintenance of these grasslands has been accomplished by prescribed burning, grazing and mechanical and chemical weed control. By incorporating cooperative and cash rent farming agreements, the refuge was able to maintain permanent food plots and temporarily convert stagnated grasslands to agriculture prior to grassland re-establishment. These efforts are discussed separately under appropriate management sections.

Additional manual labor was again required to maintain the tree and shrub planting north of the maintenance facility. Extremely wet conditions prevented the planned seeding of orchard grass and as a result the tree planting became invested with thistle and quack grass. Roundup was applied between the rows and manually applied around each tree along with hand cutting of undesirable vegetation. Each year the planting has become better established and is now beginning to function as a wind break and wildlife cover.

Other general habitat management work included rotary mowing of approximately 15 acres of Siberian elm seedlings which had invaded a DNC grassland stand on the Ruby Red Peninsula.

An old shack and barn were razed on the newly acquired Gordon Mueller tract. The old farmstead will be cleaned up and rehabilitated in 1992.

2. Wetlands

A. General

The Big Stone National Wildlife Refuge, overlies a portion of the Minnesota River Valley, now encompassing an area of 11,275 acres. A dam on the eastern boundary produces a large water impoundment on the refuge. With the use of a bascule gate, spillway and low flow structure, a maximum water level of 952.3 msl can be maintained during the summer period. At that level, approximately 4,000 wetland acres with an average depth of three and one half to four feet and a maximum depth of 12 feet exists. In the remaining 7,275 refuge acres, there are 274 permanent and/or seasonally flooded depressions totaling approximately 260 acres.

Under an operating agreement between the refuge and U.S. Army Corps of Engineers (COE), the COE operates the gates located at the Highway 75 dam.

Establishment of annual target water levels and dates is the responsibility of the refuge with concurrence of the COE Water Control Center to accommodate flood control mandates and refuge habitat management objectives. Each year the FWS recommends target water levels but actual levels could be modified due to predicted flows into the watershed, primarily the Whetstone River, Minnesota River and Yellowbank River.

B. Water Conditions

The 1991 water program called for normal (952.3 msl) east conservation pool levels for the entire year (Fig. 11).

On January 1, the east conservation pool was at 952.15 msl. Spring runoff was inadequate to fill the pool to summer operation level until heavy rains were received in early June. The conservation pool reached 954.47 msl by June 7. The pool level fluctuated due to heavy summer rains but reached the summer operating level of 952.3 msl on August 6. The conservation pool froze over on November 2 at 952.0 msl. This was two to three weeks earlier than normal.

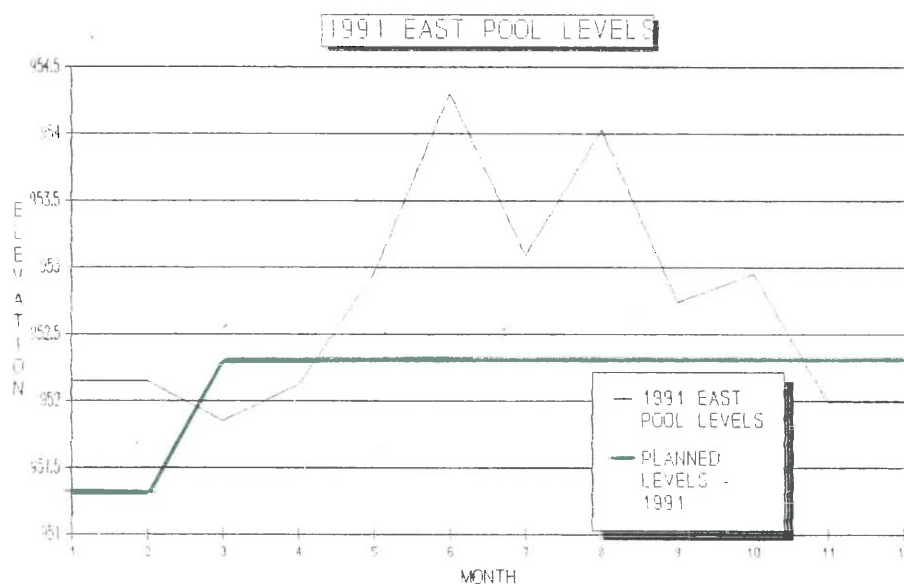


Figure 11. Actual and planned pool levels during 1991.

Three rivers empty into the refuge. The peak flow on the Minnesota River, measured at Ortonville, occurred July 2 at 1890 CFS. Peak flow on the Whetstone River, measured at Big Stone City, South Dakota occurred Aug. 3 at 3270 CFS. Peak flow on the Yellowbank River, measured at Odessa, Minnesota occurred August 4 at 2010 CFS. These flows compare to more normal (1986) flows of 2570 CFS on the Minnesota, 4720 CFS on the Whetstone, and 4070 CFS on the Yellowbank.

C. Management

As in 1990, spring runoff in 1991 was inadequate to fill pools 4, 4A, and 5 to normal operating levels. However, heavy rains in early June filled all pools to operating levels. Heavier than normal rains continued for most of the summer keeping them at optimum levels. Invertebrate sampling was begun in pools 4, 4A, and 5.

Pools 4 and 4A

Pool 4 was at 952.3 msl on April 4 so pumping was begun from the Minnesota River that evening. Pool 4 arrived at 955.0 on April 20 and pumping was discontinued. Pumping continued for 16 days at 12 hours per day and moved 446 acre feet of water into pool 4. Heavy rains continued throughout the summer and pool 4 was at 955.9 on October 22. Mowed cattail areas in pool 4 came back to bladderwort, sedge, and pondweeds (Figs. 12 and 13). Small areas in pool 4 contained phragmites and willow. In November, 63 muskrat houses were counted in pool 4. Pool 4 will be held full in hopes that the muskrats will continue to create openings in the cattails.



Figure 12. Mowed cattail openings prior to flooding in Pool 4.

JWH 3-91



Figure 13. Pool 4 on 4-22-91. Mowed cattails covered by water.

JWH 4-91

In June, invertebrate sampling was begun in pool 4. Sampling was conducted during the third week of June with invertebrate traps and on July 30 with sweep nets. Sampling was conducted in the north borrow ditch, mowed cattail, and standing cattail. Traps were suspended 1-2 feet from the bottom and left in place from 3-6 days. Identified orders of aquatics included Amphipoda, Ephemeroptera, Hemiptera, and Diptera. It appeared that most invertebrates were located in standing cattail.

Heavy rains in the Yellowbank River watershed brought water surging into pool 4 on June 3. Stop logs were placed in structure 4A when the pool level reached 955.8. Stop logs were also placed into the cross-connect between pools 4 and 4A. Heavy rains then pushed water over the entire structure and pool 4A rose to 956.6. Pool 4A was held at this level to begin to stress woody vegetation. This stress was beginning to show by August 24 (Fig. 14).



Figure 14. Woody vegetation in 4A beginning to show stress from high water on 8-1-91.

JWH 8-91

Invertebrate sampling was conducted in pool 4A with results similar to pool 4. One difference noted was the large numbers of Coleoptera associated with reed canary grass in standing water.

Pool 5

On March 25, pool 5 was at 952.0 msl and remained at this level until early June when heavy rains caused the Yellowbank River to flow into pool 5 through the diversion channel. Pool 5 was at 955.4 msl by June 10, 956.5 on June 24 and up to 957.5 by August 5. On this date, two stop logs were removed from structure 5 to stabilize pool 5 at 956.0 msl.

Pool 5 froze up on November 2 at 954.8.

Invertebrate sampling was conducted in pool 5 similar to that conducted in pool 4. At the trap site in the upper end of pool 5 (newly flooded) Coleoptera and Hemiptera were noted. At the lower end of pool 5 in emergent cattails, aquatic inverts noted were Coleoptera, Amphipoda, Diptera, Hemiptera and Odonata.

Scrapeouts

Several scrapeouts were constructed in 1989 along the banding road and on the Roehl quarter in an attempt to increase pair ponds on the refuge. These ponds were constructed in areas with a high water table by scraping off the topsoil, removing the mineral soil to the required shape and then evenly replacing the topsoil. These scrapeouts appear to be successful as most were well used by waterfowl and have come back nicely to aquatic vegetation (Fig. 15).



Figure 15. Scrapeout constructed in 1989 on 8-12-91.
Note development of aquatic vegetation.

JWH 8-91

Aquatic invertebrate sampling at two scrapeout sites noted Plecoptera, Coleoptera, and Hemiptera.

Heavier than normal rains kept many temporary wetlands full throughout the summer. During the fall, these wetlands were heavily used by migrating waterfowl (Fig. 16).



Figure 16. Temporary wetland in private cropland on 8-1-91. Recharged by heavy rains.

JWH 8-91

On the recently acquired Albert Lotthammer tract, eroded top soil was removed from three temporary wetlands. Agricultural practices over the years had reduced basin capacity by pulling topsoil into the wetland basins (Figs. 17 and 18).



Figure 17. October 21, 1991 - Removing soil from temporary wetland on newly acquired Lotthammer tract. Soil had been pulled into wetland over 75 years of agriculture.

*JWH 10-91



Figure 18. October 21, 1991 - Temporary wetland restored to approximate original depth.

JWH 10-91

4. Croplands

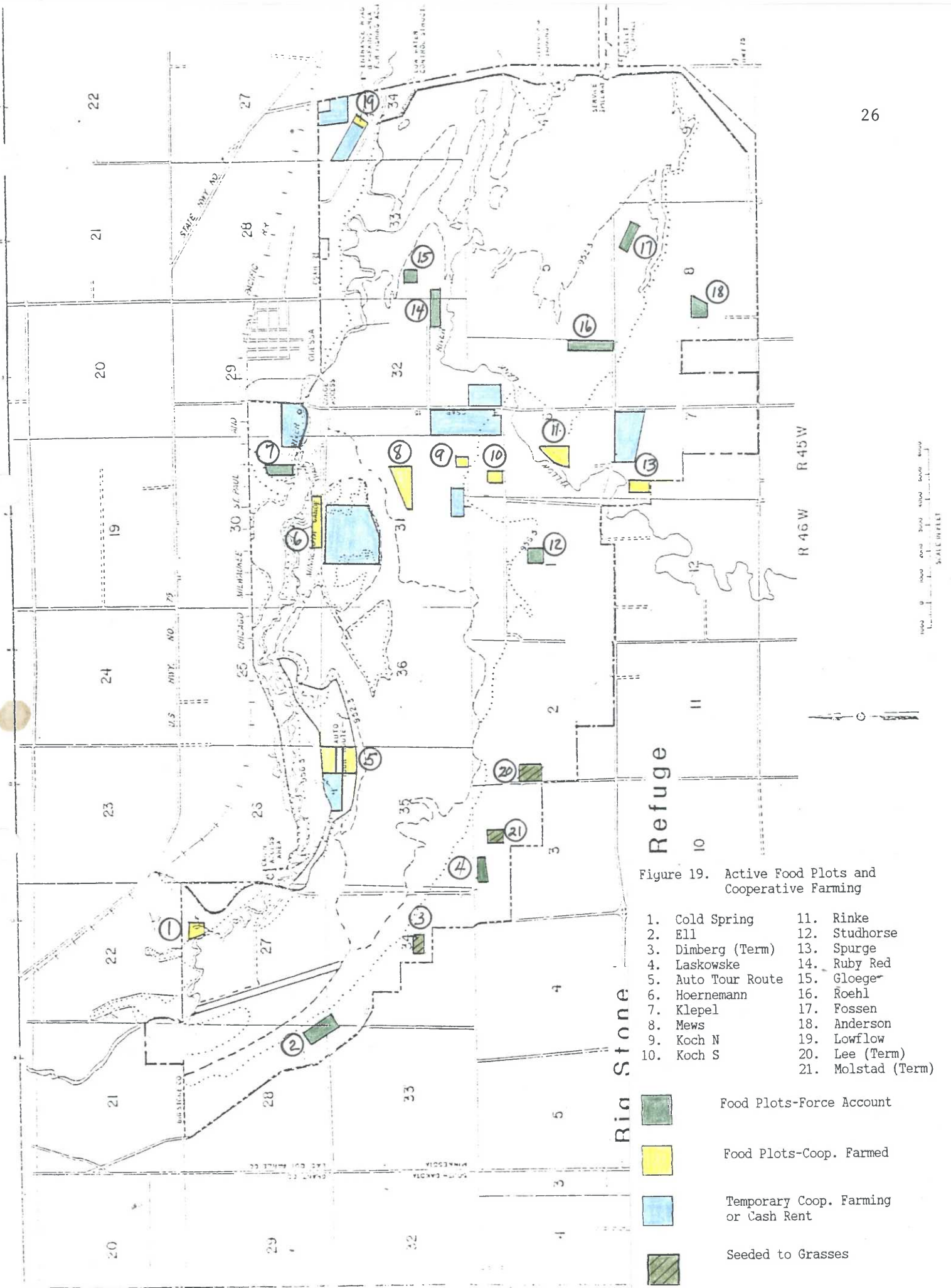
Nineteen permanent food plots were maintained (Fig. 19) in addition to temporary (short term) farming under cooperative agreements or special use permits for land conversion to permanent nesting cover. In 1991, 475 acres were in agricultural crop production.

A. Force Account Farming

Refuge personnel farmed nine permanent food plots covering 54 acres. These food plots ranged in size from four to 15 acres. Crops included 34 acres of corn and 20 acres of soybeans. By the end of the year nearly all food plots with available corn were consumed by wildlife. Soybeans were still plentiful with the exception of the Laskowski unit which was a total failure due to wet conditions and excessive weed infestation.

B. Cooperative Farming

To assist with our on-going land conversion process and to meet standing crop commitments with MDNR, ten cooperative farming agreements with five farmers and four special use permits with four farmers were maintained covering 421 acres (Fig. 19). Of this total, 115 acres were included in ten permanent food plots. We were able to accomplish cooperative assistance on these small units only because they were in close proximity to larger fields in the process of conversion. It has been difficult to get cooperative farming assistance on these smaller uneconomical units by themselves. Refuge shares of all cooperative farming remaining in these fields included 69.3 acres of corn four acres of soybeans, and five acres of sorghum. Other crops grown as the cooperators' share were 14 acres of sorghum, 31 acres of corn and 138.7 acres of soybeans. Cash rent crops included 129 acres of corn and 30 acres of soybeans.



We entered into an additional cooperative agreement this year to farm stagnated dense nesting cover (DNC) prior to reestablishment of indigenous native grass for harvest. This agreement was with Jim Lund for 11 acres on farm unit 143 (Koch tract). The operator plowed and disced this field in preparation for 1992 cropping.

One hundred bushels of surplus corn were transferred to Trempeleau NWR for use in their banding program.

5. Grasslands

Activities directed toward improving and maintaining grasslands in optimum nesting cover included grazing (Section F.7), haying (F.8), prescribed burning (F.9), mechanical and chemical weed control of broadleaf weeds (F.10), and manual cutting of invading exotic woody vegetation.

In June a total of 21 acres on three areas were seeded. They included Molstad (5 acres) seeded into alfalfa, Dimberg (4 acres) seeded into ND444 Indiangrass for future seed harvest and Lee (12 acres) seeded into our indigenous big bluestem and Indiangrass mixture.

Molstad and Lee units were temporarily cropped in 1990 to prepare for seed downs whereas the Dimberg unit was a permanent food plot that was too rocky and did not produce well. The Indiangrass seeded there was acquired from Morris Wetland Management District (WMD) and seeded at the rate of 14 pounds bulk per acre with 70 percent pure live seed content.

Indigenous native grass seed harvesting with our Gleaner combine was accomplished on nearly 90 acres this year. Approximately 7975 pounds of a cleaned mixture of big bluestem and Indiangrass was collected. Litchfield WMD, Morris WMD, and Sherburne NWR took 2300, 1975 and 1800 pounds respectively. To insure that all the available seed was harvested in a timely manner we contracted Matt Drobny for additional combining at a cost of \$400.

7. Grazing

One grazing permit was issued to the Sisseton Cattle Company for 800 AUM's at a rate of one AUM per acre for the period of April 15 to May 27, 1991. Charge for the permit was \$1,000.00. The grazing permittee is responsible for erecting and maintaining a temporary electric fence.

The area grazed was that portion of the refuge lying west of old County Road 1 and south of the Sellin trail. The purpose was to enhance warm season native grasslands within the grazing area. This portion of the refuge is almost impossible to keep in a prescribed burn rotation due to configuration and staff levels. Management by prescribed grazing is a viable alternative (Fig. 20).

Much of the grazed area was a sheep pasture for approximately 50 years and was in a degraded state. It is recovering at an excellent rate. We are especially pleased at the rate at which warm season grasses and forbs are reappearing on thin soiled high site, bluff prairies that were essentially monotypic Kentucky bluegrass (Figs. 21 and 22).



Figure 20. Cattle grazing on southwest bluff on 4-5-91.

JWH 4-91



Figure 21. Spring grazed river terrace prairie on 8-23-91.
Note development of forbs and warm season grasses.

JWH 8-91



Figure 22. Spring grazed bluff prairie on 8-1-91 showing development of warm season vegetation.

JWH 8-91

8. Haying

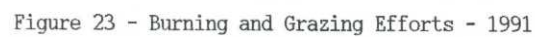
Four special use permits were issued to three farmers on four areas of the refuge during the year. Total revenue for haying was \$706.00.

Don Schumacher hayed 12 acres of DNC in the tour route and 12 acres of DNC on the Klepel tract for \$2.00 per round bale. Haying done on these fields was to periodically maintain vigor of the stand. He also hayed County Road 15 road ditches and slopes as required highway maintenance. Schumacher was high bidder on the road ditches with a bid of \$40. All haying was done after mid-July to minimize nest destruction.

Marvin Schmeichel was high bidder for Highway 75 Dam - emergency spillway maintenance haying. His bid was \$200.00. Since the Corps of Engineers routinely mows this area each year, it was decided that if there was haying interest, bidding for haying would be done in lieu of force account mowing.

9. Fire Management

Ten units totaling 1,416 acres were proposed for prescription burning in 1991. Six units were completed (Fig. 23). The actual number of acres burned including wildfire was 1,075. Total cost for prescribed fires including salaries, equipment and fuels was \$ 723 or nearly \$.81 per acre (Table VIII).







-  - Burn Units Completed
-  - Burn Units Cancelled
-  - Grazed
-  - Wildfire

TABLE VIII - 1991 BURNING ACCOMPLISHMENTS

Unit #	Habitat	Acres Burned	Cost	Remarks
4	Native grass for Harvest	90	110	
13	Native Prairie	0	0	Canceled-Wildfire in Adjacent Unit
14	Native Prairie/Seeded Natives	475	256	
15	Seeded Natives	60	75	30 Acres 2nd Year Seeding
24	Native Prairie	185	0	Wildfire
25	DNC/Brush	117	102	High Humidity/Cool Fire
26	Native Prairie/Seeded Natives	0	0	Improper Winds/Grazed
30	Native Prairie	0	0	Grazed
31	Seeded Natives/Native Prairie	140	125	2nd Year Seeding
33	Seeded Natives	8	55	2nd Year Seeding
		1,075	\$723	- Cost per acre = \$.81

A wildfire occurred on April 6 started by the diesel motor operating a pump along the pool 4 dike. The Odessa Fire Department was called to the scene at our request and extinguished the fire around the motor, pump and fuel tank. Fire was also knocked back as it approached a tractor operating a PTO driven Crisifulli pump nearby. The fire burned through the cattails along the river eastward, crossed the river and burned native prairie upland. It continued overnight and burned itself out at the lowflow road. A total of 185 acres were consumed (Figs 24 and 25). Repair of damages to the motor and trailer it was mounted on cost \$86. Cost for fire suppression by Odessa Fire Department was \$150.



Figure 24. A portion of the northeast corner of the refuge burned by a 185 acre wildfire in April.

RMP 4-91



Figure 25. Wildfire originated at this temporary pumping station along the Pool 4 dike.

RMP 4-91

10. Pest Control

This year only a minimum effort was made with chemical and mechanical weed control primarily to maintain existing nesting cover seed bed preparation or to reduce weeds prior to seed harvesting. Banvel was used to reduce milkweed and thistle on native grass seed harvest fields. Roundup was applied on three areas prior to seed down. Table IX shows chemical and mechanical weed control efforts in 1991. The Minnesota Department of Agriculture expressed interest in several refuge leafy spurge areas for establishment of insect populations used to control spurge biologically in 1990. No decision had been made whether the sites were suitable.

TABLE IX - PEST CONTROL - 1991

<u>Treatment</u>	<u>Acre Treated</u>	<u>Purpose</u>	<u>Location or Cooperator</u>
<u>By Force Account</u>			
Tordon 22k	13 Ac	Leafy spurge	Spot treated native prairie
Banvel	40 Ac	Reduce milkweed and Canada thistle	Syndicate native grass
2,4-D Amine	36 Ac	Broadleaf control in corn	Food plots (6)
Roundup	16 Ac	All vegetation prior seeding	Lee, Dimberg, Molstad
Roundup	4 Ac	Vegetation around seedlings	Tree planting at Shop
<u>By Refuge Cooperators</u>			
Eradicane	210 Ac	Grass control in corn	Lund, Klepel, Hillman, Gloege
Banvel	210 Ac	Broadleaf control in corn	Lund, Gloege, Klepel, Hillman
2,4-D Amine	18 Ac	Broadleaf control in corn	ATR-Schumacher
Treflan	168 Ac	Foxtail in soybeans	Lund, Klepel, D. Klepel, Hillman
Basagran	168 Ac	Broadleaf in beans	Lund, Klepel, D. Klepel, Hillman
Haying	12 Ac	Thistle in DNC	Klepel Tract by Schumacher

15. Private Lands

Food Security Act work was performed in Lincoln, Lyon and Chippewa Counties. This work included 158 wetland appeals (approx. 500 basins), six minimal effect inspections, 36 "window" commenced exemptions (approximately 150 basins), four wetland restoration inspections, two FmHA tract inspections, and one third party exemption inspection. In addition, advice was given to approximately 20 landowners on wildlife matters such as impoundments, grass seedings, food plots, wetland values, etc.

Two wetlands were restored by force account in Lincoln County. The restorations cost approximately \$500 and restored two acres. One wetland totaling 0.5 acre was restored in Chippewa County for \$500 (Fig. 26). Contractor was Jim Mercie, Madison, Minnesota. Two wetland restorations were postponed; one in Lyon County due to wetness, and one in Lincoln County due to a problem with a neighbor. Approximately ten contacts were made with landowners where wetland restorations were deemed impractical. Previously restored private wetlands provided excellent habitat conditions (Fig. 27).



Figure 26. Brad Olson wetland restoration in Chippewa County held water soon after completion.



Figure 27. Private wetland in Lyon County restored in 1988 shown on 8-13-91. Water levels were very low in 1989 and 1990. Heavy rains filled the basin in 1991.

JWH 8-91

G. WILDLIFE

1. Wildlife Diversity

Wildlife diversity at Big Stone is sustained by the variety of habitat types available, including native prairie, seeded nesting cover, wetlands, wet meadow, floodplain forest, granite outcrops, wood lots, food/cover plantings, and various successional stages of trees and brush on subirrigated pool edges. Efforts to maintain this diversity have included prescribed burns, grazing, water level manipulation, and mechanical/chemical vegetation control. An amalgamation of eastern and western bird species migrate through the Minnesota River Valley and central and Mississippi flyway waterfowl populations intermingle throughout our flyway border area.

2. Endangered and/or Threatened Species

The bald eagle, listed as threatened in Minnesota, is an occasional visitor during the spring and fall migrations. In 1991, 625 use days were recorded with a spring peak population of 24 occurring in March just as the east pool ice was breaking up. A lesser fall peak of 15 eagles occurred in November prior to freeze up. Fall migrants remained for an extended time feeding on dying waterfowl infected with avian cholera.

The ball cactus, listed as threatened in Minnesota and found only in the granite outcrops, seems to be holding its own on refuge protected portions of this habitat or even increasing on some isolated rock outcrops. Its existence is immediately threatened on portions of the Ortonville Stone Company lands however. Ball cactus also occurs on outcrop lands north of the current refuge boundary on the Gayle Hedge property. Its future there is reasonably secure provided that acquisition of parcel 1 occurs in the near future (Fig. 28).



Figure 28. Ball cactus, listed as endangered in Minnesota is found only on the rock outcrop in and around the refuge.

CMK 6-91

3. Waterfowl

A. Migrations

Total waterfowl use days in 1991 were 3,368,550, up nearly 34 percent from 1990 and is a significant increase from years shown in Figure 29. When broken down by groups we recorded 1,869,419 duck use days, 1,308,567 Canada goose use days, 2,400 snow/blue goose use days, 1,165 swan use days and 186,996 coot use days. Duck use showed the most significant change, increasing nearly 42 percent from 1990 while Canada goose use increased 30 percent from 1990. Snow goose use continued to decline. After decreasing 32 percent, in 1990 from a 1989 peak of nearly 10,000 use days, populations dropped 64 percent from 1990. Coot use showed a modest decline of 12 percent while swan use remained stable and low.

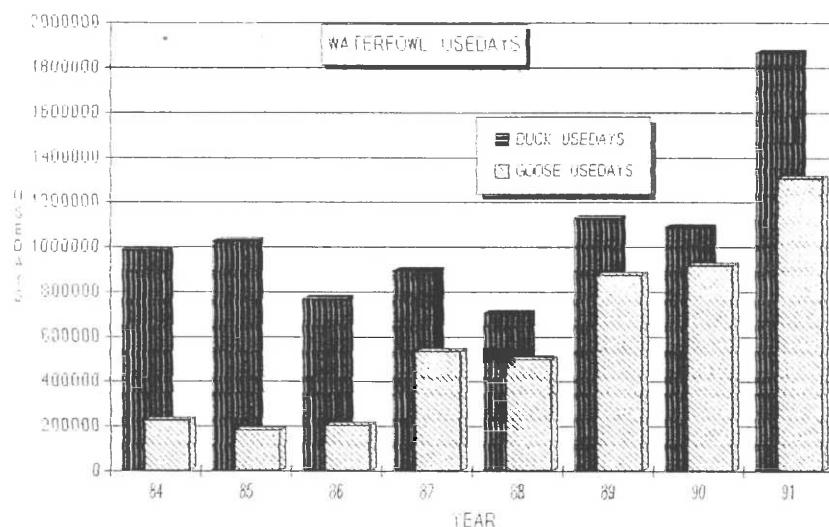


Figure 29. Waterfowl Usedays, 1984-1991

Generally both the spring and fall migrations were less than spectacular with the exception of the fall mallard flight, peaking at 55,000. This was considerably higher than most stations reporting to MDNR. Both spring and fall peak populations are shown on Table X. A particular concern was again the lack of diving duck species, especially scaup and ringnecks, during the fall flights.

Canada geese were abundant during the fall right on through the end of the year keeping a small portion of the west pool ice free. At the Lac qui Parle State Wildlife Refuge and surrounding area, their fall goose peak was 129,250. Fall peaks there in 1990 were 100,000, 180,000 in 1989 and 130,000 in 1988. This year a large number of geese in the area lingered well into the winter and over 60,000 were still present on the Power Plant cooling pond in February 1992 (Fig. 30). A major movement of waterfowl out of the area did occur around December 11.



Figure 30. Over 50,000 Canada geese set up winter residence at the Big Stone Power Plant cooling ponds.

RMP 12-91

TABLE X - 1991 SPRING AND FALL MIGRATION - PEAK POPULATIONS

	<u>Spring</u>	<u>Fall</u>		<u>Spring</u>	<u>Fall</u>
American coot	1,400	2,000	Black	10	50
Canada geese	2,500	30,000	Wood	875	1,200
Snow/blue geese	40	120	Redhead	365	100
Tundra Swans	54	15	Ring-necked duck	700	300
Mallard	1,200	55,000	Canvasback	20	20
Gadwall	400	1,200	Lesser scaup	1,000	600
Pintail	200	30	Bufflehead	75	100
Green-winged teal	200	350	Ruddy	110	75
Blue-winged teal	1,100	1,000	Goldeneye	75	100
Wigeon	300	300	Hooded merganser	180	120
Shoveler	200	50	Common merganser	100	20

Refuge personnel assisted with the mid-December goose count conducted throughout the flyway. Mid-December counts (December 9, 1991) for our area of coverage are shown in Table XI.

TABLE XI - MID-DECEMBER GOOSE COUNTS - 1983-1991

<u>Location</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>
Big Stone Power ¹ Plant	0	0	0	1,125	1,100	7,650	30,000	19,800	51,000
Bentsen Lake	1,700	1,600	500	13,200	23,000	6,500	28,000	56,300	1,800
Big Stone NWR	200	10	0	0	0	0	4,000	825	300
Lac qui Parle WMA	16,000	60,500	8,000	104,000	70,000	59,000	163,000	67,000	27,000

¹Includes Big Stone Lake; most birds found at power plant.

B. Production

Waterfowl production was estimated from breeding pair count data applied to various standard production formulae available for geese, diving ducks and dabbling ducks. Certain data generated from our nesting studies such as average eggs per clutch, hen success, etc. were integrated into these standard formulae. Production to fledgling estimates are shown in Table XII and Figure 31. Percentage by species to fledgling is shown in Figure 32. Many goose nests were discovered on the east pool islands confirming breeding pair count production estimates that goose production is increasing (Fig. 33).



Figure 33. Canada goose production continued to increase on all natural and man-made islands throughout the refuge.

CMK 5-91

TABLE XII - WATERFOWL PRODUCTION TO FLEDGLING 1984-1991

<u>Species</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>
Coot	500	675	700	525	180	431	385	249
Canada geese	100	87	92	168	115	140	291	319
Mallard	100	96	177	321	259	196	166	106
Gadwall	150	87	51	96	88	44	62	20
Blue-winged teal	370	227	407	724	390	613	431	244
Shoveler	125	24	7	82	56	91	39	3
Pintail	10	--	13	11	13	8	5	0
Wood duck	150	189	212	169	125	137	146	394
Ruddy duck	--	19	15	12	7	30	61	37
Redhead	100	108	75	39	4	61	103	127
Lesser scaup	15	--	15	--	4	--	3	0
Hooded merganser	40	41	57	128	52	84	77	50
Wigeon	30	--	--	6	13	--	--	0
Green-winged teal	5	--	--	6	5	13	--	0
TOTAL PRODUCTION	1695	1553	1821	2287	1311	1848	1769	1549



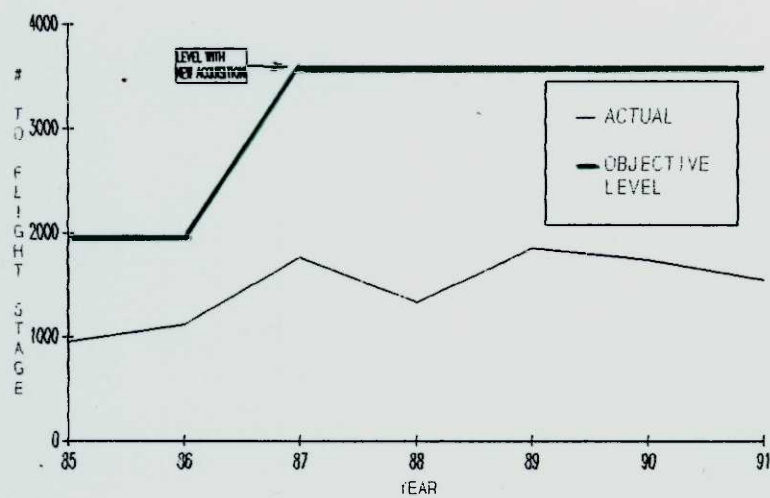


Figure 31. Actual and objective level waterfowl production 1985-91.

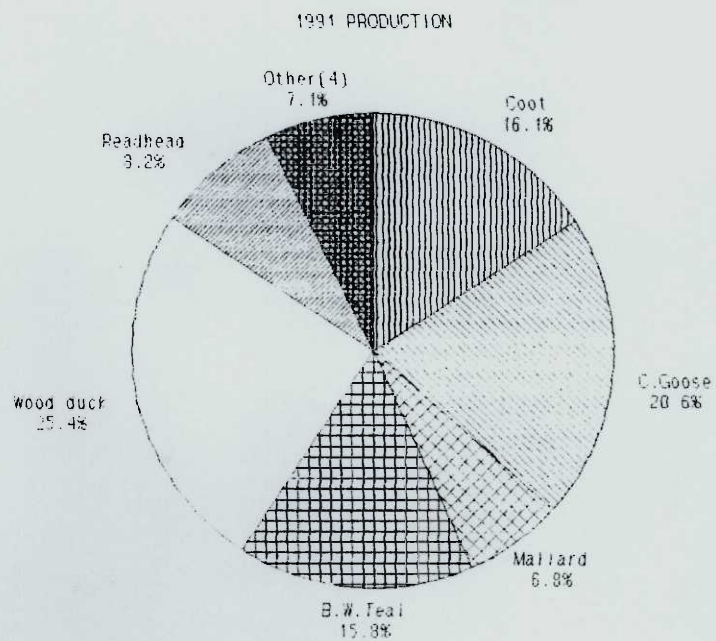


Figure 32. 1991 production of major waterfowl species.

C. Artificial Waterfowl Nesting Structures

Fifty five useable nest boxes were inspected for wood duck and hooded merganser use immediately following the nesting season. Box utilization data is shown in Table XIII. Box usage decreased for the third consecutive year from a high of 86 percent in 1988. Hooded merganser usage again was higher than wood duck, using 58 percent of the total boxes actively used.

Four vertical concrete culvert nesting structures were available in various marsh locations throughout the refuge. None were used by either mallard or Canada geese in 1991. One structure was completely hidden by cattails, two culverts had their bottom fill material slump out making them useless and one culvert was located in a marsh which never refilled from the drought.

In December a total of 18 large round hay bales were placed in pools 3, 5 and the west pool over the ice for 1992 nesting use. Plastic strapping was placed around each bale to improve durability (Fig. 34).



Figure 34. Large round hay bales were placed over ice, uprighted and strapped at eighteen locations in Pools 3, 5 and west pool marshes.

TABLE XIII - NESTING BOX USE - 1985-1991

<u>Overall Box Use</u>	<u>1991</u>	<u>1990</u>	<u>1989</u>	<u>1988</u>	<u>1987</u>	<u>1986</u>	<u>1985</u>
No. of useable boxes	55	63	56	42	47	45	50
No. used by ducks	23 ²	31 ¹	33	36	36	35	32
Percent utilization	42	59	86	77	78	64	70
Successful clutches	14	21	26	16	31	30	19
Percent successful	58	68	79	44	86	86	59
<u>Wood Ducks</u>							
No. of nests	10	9	12	7	8	16	11
Percent of total used	42	28	36	19	22	46	34
No. successful	8	7	9	6	8	14	10
Percent successful	80	78	75	86	100	88	91
Total eggs hatched	61	67	87	49	72	136	81
Total eggs unhatched	24	27	36	29	30	32	27
No. of dump nests	1	1	0	1	2	0	1
<u>Hooded Mergansers</u>							
No. of nests	14	23	21	29	28	19	21
Percent of total used	58	72	64	81	78	54	66
No. successful	6	14	17	10	23	16	9
Percent successful	43	61	81	34	82	84	43
Total eggs hatched	39	119	195	87	24	162	62
Total eggs unhatched	95	116	81	325	111	97	190
No. of dump nests	4	6	3	15	5	2	10

¹ One box contained two successful nests; 32 actual nests.

² One box contained two successful nests; 24 actual nests.

4. Marsh and Water Birds

The east pool cormorant-heron-egret rookery, the only rookery on the refuge, was surveyed in early June. A total of 1128 nests were counted in 331 trees and an estimated 2,957 young were produced (Table XIV). Total number of nests increased 19 percent from 1990 while the actual number of trees used decreased 6.5 percent. Although a number of previously tagged trees were lost (fallen) or abandoned, 43 new trees were used.

In 1990 a new survey technique was implemented by marking each tree with a numbered metal tag and counting nests in each tree. This system is more accurate in terms of total colony expansion or reduction. However, species composition is speculative due to disturbance of the adults. Species composition is estimated by percentage extrapolation from number of known nests (33.8%). Production is estimated by expanding average number of young from known species nests.

TABLE XIV - EAST POOL ROOKERY USE - 1987-1991

			No. Nests			No. Young				
	1991 ¹	1990 ¹	1989	1988	1987	1991	1990	1989	1988	1987
Double Crested Cormorant	811	819	287	448	540	2190	2211	689	1084	1350
Great Blue Heron	62	13	65	52	51	161	34	169	138	128
Great Egret	240	54	35	77	80	576	131	85	216	200
Black-crowned Night Heron	15	25	6	2	4	30	50	12	4	8
	1128	911	393	579	675	2957	2426	955	1442	1686

¹ Number of nests extrapolated from percent of known nest species.

Western grebes still continue to breed on Big Stone somewhere in the east pool. Although the location of the colony still remains a mystery, young were periodically observed throughout the summer.

White pelicans were frequent visitors during the summer, moving up river from their Marsh Lake nesting colony to feed on the east and west refuge pools. In July, pelican populations peaked and remained near 180 individuals.

7. Other Migratory Birds

In 1990, a bluebird trail was established containing 14 nesting boxes in four locations throughout the refuge. In 1991, the first nesting season, thirteen boxes were available for use. Over the course of the nesting season, seven bluebird broods and fifteen tree swallow broods were produced.

8. Game Mammals

With a continuation of the trend of very mild, relatively snow free winters since 1986, deer numbers remained very low. Since the major component of the refuge herd is migratory, many deer remained outside the refuge in private agricultural lands, wood lots, creek and river bottoms. It is also believed that with the significant acreages set aside in the Conservation Reserve Program in both Big Stone and Lac qui Parle Counties, deer are finding suitable habitat outside of the refuge year round. Without major movements into the refuge, resident populations during the summer months were also low, determined by the low frequency of adult and fawn observations and general lack of deer sign throughout the refuge. Lack of snow cover prevented us from any aerial censusing throughout the winter.

A muskrat house transect was again run in November to determine yearly trends in refuge populations. Comparing 1991 populations to that of 1986 (base year) numbers were down 9.1 percent. However, as a result of the 1987-1990 drought period when muskrat numbers all but disappeared, 1991 showed a dramatic increase of 963 percent from 1990. A total of 170 houses were recorded as compared to 16 in 1990 and 187 in 1986. The most dramatic increase was observed in Pool 4 which contained 63 to only 32 in 1986. This is attributed to the management of more stable water regimes since the Pool 4 control structure was installed in 1988.

A predator scent post survey was again conducted in September in cooperation with MDNR. Three established segments with ten scent stations each, .3 miles apart, were surveyed. Two segments were located in or adjacent to the refuge while the third was located adjacent to the Rothi WPA approximately six miles northeast of the refuge. Visits to the stations included five fox, thirteen raccoons, seven skunks, and four deer. Fox visits declined 7 percent while raccoon increased 325 percent and skunk increased 600 percent from 1990. Big Stone Refuge recorded the highest raccoon index (464) of any reporting station in the state during the 1991 survey.

10. Other Resident Wildlife

The ringneck pheasant continues to play a significant role in filling our public use demands. A relatively snow free, mild winter left us optimistic for a good productive year. In spite of a somewhat cool, wet spring, August roadside counts indicated excellent production. Refuge transects covered 32 miles of interior and bordering roadways and were surveyed July 20 to August 15. Early brood sightings were small indicating low brood survival but late in the survey period, larger, more numerous broods began to appear; possibly second nesting attempts after weather moderated. Our survey showed a 31 percent increase in primary morning counts from 1990 and only a six percent decline from the base year 1987. The index, expressed in birds per mile was 1.97. MDNR counts showed a 75 percent increase from the five-year mean in the west central zone. Big Stone County showed an eight percent decrease while Lac qui Parle had 345 percent increase.

For the second consecutive year moose were observed on the refuge. In May, the refuge staff and public sighted a young bull south of Odessa. This moose could have been the remaining survivor of two bulls observed throughout 1990. Also in May the refuge staff sighted what appeared to be a cow on the auto tour route. Neither moose was again sighted during the year.

11. Fisheries Resources

Fisheries Assistance Biologist Scott Yess, Winona, MN conducted fish population surveys in May in the east pool and in the Ruby Red Quarry pond. Sampling was conducted by gill netting and electroshocking and results are as follows:

East Pool

Yellow Bullhead

Black Bullhead

Carp

White Sucker

Pumpkinseed Sunfish

Yellow Perch

Redhorse Sucker

Fathead Minnow

Orange Spotted Sunfish

Northern Pike (12) Average weight 2½ pounds

Walleye (16) Average weight 2.75 pounds

Quarry Pond (South of Odessa)

Northern Pike (10) Average weight 3½ pounds

Rock Bass

Large Mouth Bass

Pumpkinseed Sunfish

16. Marking and Banding

In 1991, Big Stone was assigned a pre-season banding quota of 400 mallards. Banding efforts began September 15 with the use of rocket nets and were discontinued September 23. A total of 122 mallards and one blackduck were banded which included 51 juvenile females, 122 adult males, 14 adult females and 34 juvenile males. Mallard banding was very sporadic this year as many birds were utilizing flooded small grain fields early due to the heavy rains. Feeding flights off-refuge occurred daily making it difficult if not impossible to attract birds to our baited site. While attempting to meet our quota, non-quota banding of wood ducks was more successful. A total of 142 wood ducks were banded including 15 juvenile females, 30 juvenile males, 12 adult females, 84 adult males and one unknown.

17. Disease Prevention and Control

In October 1991, Canada geese were discovered on Lac qui Parle State Wildlife Refuge dying of confirmed avian cholera. These circumstances were similar to that die-off which occurred there in 1989. After learning of the cholera problem there, a survey of the east refuge pool was taken and nine geese were found and later confirmed by the Fish and Wildlife Health Lab, Madison, Wisconsin as having cholera.

An aerial flight of the refuge on November 14 revealed a large number of dead waterfowl around the remaining open water areas of the east and west pools. An airboat, borrowed by the MDNR from Agassiz NWR was used to pick up dead waterfowl and later an airboat was borrowed from Sherburne NWR to continue bi-weekly patrols. In addition to the state area and refuge, waterfowl began dying at the Big Stone Power Plant cooling ponds and Bentsen Lake. Biological Aid, Chris Kane was brought back on board to handle the cholera clean-up, disposal and monitoring duties. At year's end approximately 6,700 waterfowl were recovered in all areas. Monitoring of the cooling ponds continued during January and February 1992 from this office. Table XV displays total waterfowl recovered from our areas of monitoring responsibility.

TABLE XV - AVIAN CHOLERA SANITATION EFFORTS

<u>Species</u>	<u>Refuge West Pool</u>	<u>Refuge East Pool</u>	<u>Power Plant</u>	<u>Bentsen Lake</u>	<u>Species Totals</u>
Canada Geese	25	150	490	157	822
Snow Geese	0	0	1	0	1
Mallard	165	46	47	3	261
Scaup	3	5	0	0	8
Ringneck	1	1	0	0	2
Ruddy	0	0	0	1	1
R.B. Merganser	0	0	1	0	1
Goldeneye	0	0	3	0	3
Bufflehead	0	0	1	0	1
P.B. Grebe	0	1	1	0	2
Western Grebe	0	0	2	0	2
Gulls	0	0	4	0	4
Coots	7	0	0	0	7
Total	201	203	550	161	1115 ¹

¹Undoubtedly a small percentage of the total retrieved died from other causes, i.e. cripples, or other trauma, etc.

H. PUBLIC USE

1. General

Public use efforts in 1991 were directed at maintaining existing interpretation and recreation facilities and programs and developing plans for expanded use through the master planning process. Existing facilities include the five-mile auto tour route, the undeveloped canoe route, the prairie interpretive foot trail, Kaercher Overlook, the dam drive, eighteen parking areas and four fishing accesses. Consumptive use programs included deer, upland game and small game hunting, fishing and trapping.

Total refuge visits decreased 7.6 percent from 1990 to 19,708 in 1991. This represents nearly a 43 percent reduction in visits from the ten year average of 34,469 visits recorded from 1979 to 1988 (Fig. 35). However activity hours decreased less than one percent from 1990 to 29,504 hours. These decreases show a continued downward trend in refuge use. Over this same ten year period, 1979 to 1988, activity hours averaged 55,800 annually (Fig. 36) maintaining a decrease of 47 percent in 1991 from that average.

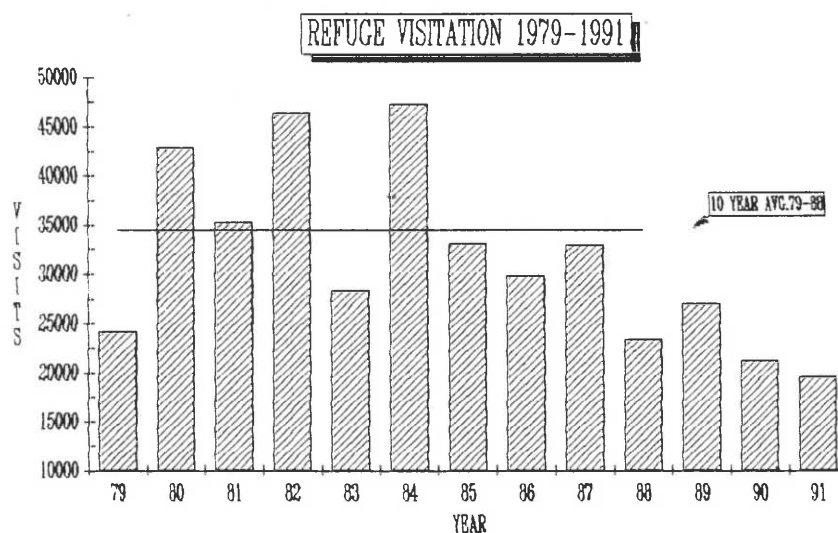


Figure 35. Refuge visitation 1979-1991

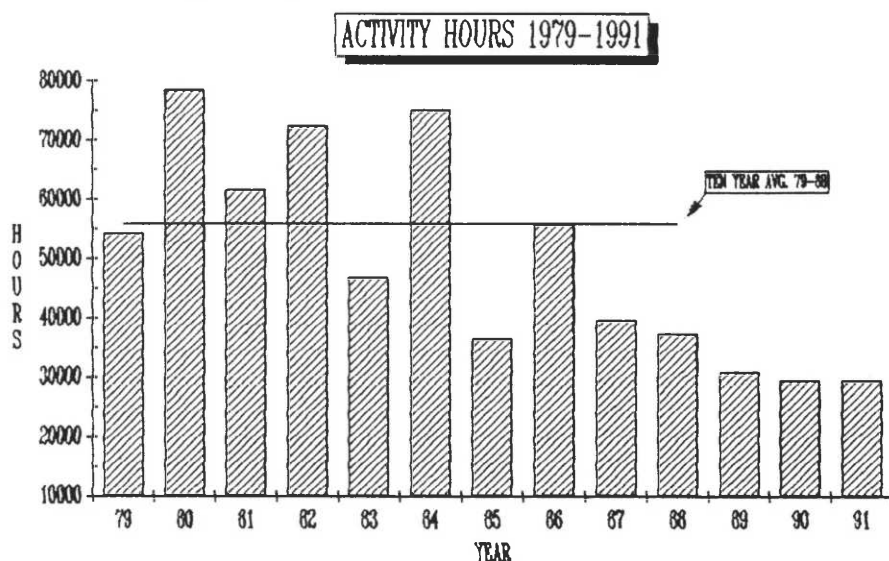


Figure 36. Activity hours 1979-1991

Public use estimates were calculated from traffic counter readings located at the low flow access, dam drive and auto tour route. Hunting and fishing use was estimated from regular weekend and periodic weekday car counts and patrol duties. A comparison of the overall public use program over the past thirteen years is shown in Table XVII.

Seven news releases were issued to the local media in 1991 and included articles on the volunteer organizational meeting, auto tour operation, including construction activities, refuge hunting zone changes and refuge trapping.

During the year, 1000 general leaflets were locally reproduced by the Ortonville Independent at a cost of \$250.50. Refuge hunting leaflets were printed by Unicor with modifications to the map showing no hunting zone boundary changes. Cost for 1500 leaflets was \$190.80 for printing and \$109.50 regional office contracted charges for layout work.

TABLE XVI - PUBLIC USE - 1979-1991

YEAR	TOTAL VISITS ^a	TOTAL ACT. HRS.	INTERPRETATION		ENV. EDUCATION		CONSUMPTIVE WILDLIFE RECREATION		NON-CONSUMPTIVE WILDLIFE RECREATION	
			VISITS	ACT. HRS.	VISITS	ACT. HRS.	VISITS	ACT. HRS.	VISITS	ACT. HRS.
1991	19,708	29,504	1,752	836	28	70	6,991	20,781	16,963	7,817
1990	21,328	29,617	1,714	875	102	256	6,825	20,625	17,480	8,212
1989	27,139	30,890	2,357	1,375	154	412	5,409	18,106	26,870	10,997
1988	23,517	37,436	2,520	1,269	199	738	5,110	19,144	24,078	15,016
1987	33,014	39,647	3,112	1,837	178	603	6,571	20,927	27,947	16,280
1986	29,898	55,872	2,002	1,691	60	120	11,893	36,334	23,200	17,727
1985	33,156	36,580	3,132	2,859	0	0	6,639	21,589	24,451	12,132
1984	47,400	75,233	10,976	12,499	40	80	9,826	29,892	39,378	32,762
1983	28,477	46,830	2,745	2,701	132	209	4,731	22,803	23,552	21,116
1982	46,500	72,570	3,198	2,809	485	1,450	13,080	29,430	37,522	38,881
1981	35,412	61,704	3,774	3,448	460	1,425	5,230	15,260	35,543	41,571
1980	43,000	78,600	2,555	1,450	630	2,080	6,910	25,085	38,650	49,985
1979	24,323	54,327	150	297	177	525	13,835	35,630	15,835	17,785

^aTotal refuge visits are less than the total of all categories since visitors will use the refuge for more than one activity per visit.



2. Outdoor Classrooms - Students

Two groups requested special use of refuge facilities for environmental education exercises. They included:

April

14 Girl Scouts from the Ortonville area

October

14 Girl Scouts from the Ortonville area

Several other school groups requested use of the tour route area but were forced to cancel due to conflicts with tour route construction work.

4. Interpretive Foot Trails

Big Stone's prairie foot trail is located adjacent to the auto tour route. Facilities include a parking lot, interpretive shelter and restrooms. The trail itself is about three quarters of a mile long. Self guided interpretive stations and an accompanying leaflet offer bluff-top views of the Minnesota River and surrounding rock outcrop and prairie and provide information on Indian and pioneer history as well as natural phenomena. Estimated trail visits were 448, down nine percent from 1990. From 1984 to 1989 average yearly use has been 778. This decline in foot trail use is directly related to a decrease in vehicle use of the tour route.

5. Interpretive Tour Routes

Big Stone's main public use facility is the five-mile self-guided auto tour route. Interpretive stations have vehicle turnouts and the accompanying leaflet describes granite outcrops, wetland impoundments, native prairie restoration and historic pioneer sites. Also available is the one and one-half mile wildlife observation drive on the Highway 75 dam and adjoining Kaercher Overlook interpretive facility. A number of changes in the theme, station location, and leaflet design are being considered. The tour route was again open to weekday use with volunteer contributions as well as weekends and holidays. This facility was open to public vehicle use beginning April 6 for 148 days compared to 162 in 1990. The route was officially closed for the season to vehicle traffic October 28.

A total of 895 interpretive visits and 262 activity hours were recorded at interpretive exhibits. This represents a modest 8.7 percent decrease over last year's visitation.

Estimated vehicle use on the auto tour route in 1991 was 3,882 which was down only 1.3 percent from 1990. Actual visits were estimated to be 8,944, down 8.6 percent from 1990.

6. Interpretive Exhibits/Demonstrations

Big Stone National Wildlife Refuge maintains two permanent exhibits, one at Kaercher Overlook on the Highway 75 dam and the interpretive shelter at the prairie foot trail. Visitation at both exhibits was estimated to be 409 in 1991 compared to 243 in 1990. Interpretive exhibit use was derived from a percentage of vehicle traffic recorded on traffic counters located at these sites. Also, an Expo-multi-screen exhibit is set up in the refuge office lobby in Ortonville.

8. Hunting

Hunting opportunities on Big Stone in 1990 included archery deer (9-14 to 11-30), shotgun slug deer (11-9 to 11-10 and 11-16 to 11-19), muzzleloader deer (11-30 to 12-15), small game (9-14 to 2-29-92) and pheasants (10-12 to 12-8).

In 1991, the "no hunting zone" was reclosed to all hunting including deer. Although the MDNR did not sanction this decision, we felt it was a positive move in an effort to increase the number of deer observations and trophy class buck opportunities within the refuge. Public support was registered from hunters and non hunters alike since deer observations and hunter opportunities have decreased substantially since the area was opened in 1985. This area has always been closed to upland hunting.

To assess the benefits of reclosing to deer hunting we began baseline data gathering. Bi-weekly surveys of deer were taken on the tour route during day time and evening while the tour route was in operation. In addition, night spot light counts were taken weekly from mid-summer through the close of the firearms season. When threshold levels of deer observations, night count populations and/or depredations and car collisions are exceeded, the closed area could be reopened to deer hunting. We feel that previously high deer numbers may not be reached for many years due to the amount of CRP acreage available off refuge and lack of severe winter conditions which force deer into their traditional wintering areas.

Summer/fall morning surveys averaged 2.8 deer per count and summer/fall evening surveys averaged 3.9 per count. Pre-hunting season night spot light surveys averaged 17.4. When post hunt surveys were included, the average was 21.69. After the first slug season, deer observed at night increased to 37. After the second season, deer observed at night increased to 67. No counts were made following the muzzleloader season.

Archery deer hunting pressure increased slightly after six consecutive seasons of decreases from the highest number of visits in 1984. In 1991 archery visits were 262, up 9.3 percent from 1990. Shotgun slug hunting decreased nearly 20 percent from 566 visits in 1990 to 455 in 1991. Muzzleloader rifle hunting which requires a state permit for this area showed an increase of 13 percent over last season with 353 visits compared to 307 in 1990. However, this is 37 percent below 567 visits in 1989. A comparison of refuge deer hunting seasons is displayed in Figure 37.

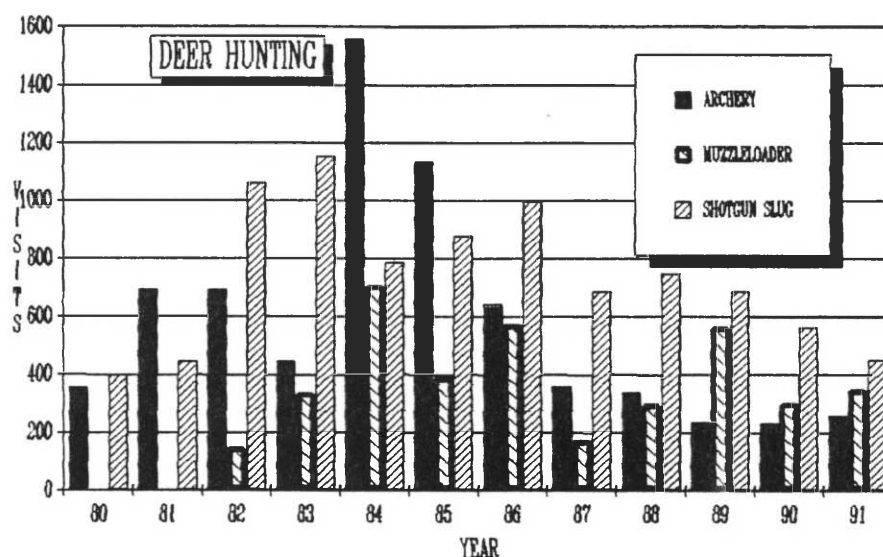


Figure 37. Comparison of visits between three deer hunts from 1980-1991.

It was very difficult to estimate the number of deer harvested because hunters are not required to register to hunt and the refuge does not have its own kill block number for harvested deer registration. However, the number of harvested deer was well below the estimated record of 480 deer taken in 1985 which was the first year the no hunting zone was open to deer hunting. From hunter contacts we estimated between 60-80 deer taken from all seasons combined. However, deer hunting outside the refuge on private lands was again considered good to excellent.

Pheasant hunting began October 12 with approximately 300 hunters on the refuge the opening weekend. Hunting was considered very good throughout most of the season. Total pheasant hunting visits increased over 12 percent from 1990. Other public hunting areas (WMAs and WPAs) showed significant hunter increases, especially opening weekend, indicating high expectations for excellent hunting.

9. Fishing

Fishing visits increased two percent from 1990 with 5,200 and was slightly higher than the five year (1984-1988) average of 5,051 visits. This stability was undoubtedly due to much improved water conditions from the past three years. Northern pike fishing in the Minnesota River did improve substantially and fall river fishing and early ice fishing at the dam and transverse channel were very good with catches of large fish being reported from anglers and spear fishermen.

10. Trapping

Again, apparently due to low pelt prices, very little interest was generated for the 1991 refuge trapping program. Only one trapper applied for a trapping permit and bid the minimum \$50.00 on two units. He took 18 mink and 10 raccoon during the 21 days he trapped, recording 840 trap nights. The season concluded on December 31.

11. Wildlife Observation

The majority of wildlife observation activities takes place on the auto tour route and to a lesser extent, on the Highway 75 dam drive. Many of the tour route users are local residents who drive the route in the evening hours to view deer. A very low number of deer in the tour route area again this year prompted a number of people to again register verbal complaints and requested that we consider having the tour route area closed to future deer hunting like "the good old days." Wildlife observation visits, decreased two percent from 1990 to 16,963. The ten year (1979-1988) average number of non-consumptive wildlife oriented visits was 29,016.

17. Law Enforcement

Spring and summer enforcement efforts centered around alternate weekend patrols and some irregular weekday evenings between two refuge officers on the auto tour route, dam and low flow areas of the refuge. Experience has shown that a certain level of presence is necessary to insure program integrity and the quality of visitor experiences.

During the major hunting seasons, (September 14 to December 15), rotating weekend duty was continued and included hunter-car counts, foot patrols and some surveillance. Some problems with bow hunters (hunting after sunset, leaving portable tree stands overnight or construction of permanent stands) persist but have lessened due to a number of cases made over the last few seasons. Four individuals were given warning citations for entering the closed area during muzzleloader deer season. No other problems were encountered with the new closed area regulation.

Assistant Papasso was detailed to the Upper Mississippi NWFR at La Crosse for canvasback duck enforcement October 25-27.

I. EQUIPMENT AND FACILITIES

1. New Construction

Construction of a new auto tour route entrance facility began in 1991. This includes a parking area, vehicle turn around, kiosk, entrance sign and gate. A site plan was developed by the facility design team (Marxen and Schaffer). Landscape Architect, Mike Marxen surveyed and staked the site and in cooperation with Big Stone County Highway Department, preliminary filling and grading was accomplished. Much of the initial fill material was obtained from County Road 17 site work immediately adjacent to our project. A considerable amount of time and effort was donated by the County Highway Department including level surveys, hauling of fill, dozer work and grading. Our only expense to date was \$1500 paid to Ortonville Stone Company for the hauling of an additional 450 tons of fill material and \$259 for a steel culvert. The project is now ready for base aggregate and curbing to be done with MMS funds in FY 92 (Fig. 38).

One-quarter mile of four strand barbed wire fence was constructed along the Schmidt tract boundary acquired in 1990.



Figure 38. Preliminary site work was completed at the auto tour route entrance with the assistance of Big Stone County Highway Department.

2. Rehabilitation

Approximately \$95,000 was available in MMS funding to rehabilitate the auto tour route road surface. Our objective was to apply an overlay coat of one and one-half inches of bituminous material over the entire five mile length in addition to blacktopping two small graveled sections. Regional engineers determined that this funding amount available wasn't adequate to complete the project as their estimates were \$104,000. Therefore a bid solicitation was let to include blacktopping of the gravel portions, overlay certain legs of the route and seal coat the remaining portions. One contractor, Bituminous Paving of Ortonville, submitted a bid of \$56,680. Modifications of the contract ensued, reducing seal coat work and adding overlay work up to the 25 percent allowed. As a result, overlay and seal coat work was accomplished for \$65,045 (Fig. 39). As a result of this over estimate by engineering, the remaining \$30,000 was lost. Completion of overlay for the remaining surface where seal coating only was done, was funded for FY 92 and scheduled for completion along with entrance area blacktop work sometime in June or July 1992.



Figure 39. Major rehab work was completed on the auto tour route including bituminous overlay and/or seal coating.

RMP 9-91

Henrich and Sons, Bellingham, MN was contracted to haul and tail gate spread granite fines over the Pool 4 dike top, providing better all weather access around this facility. Cost of this project was \$1,377.50.

Boundary posting was begun to completely standardize the existing and new acquisition boundaries. This included replacement of all boundary, public hunting, public fishing and no hunting zone signs and posts. Approximately three fifths of refuge interior and exterior boundaries were completed.

A washout on the Sellin road required the placement of a twelve inch culvert and approximately 28 tons of gravel. The culvert will allow Minnesota River flood waters to pass under the approach which goes into the tour route hunting parking lot.

3. Major Maintenance

There was no significant major maintenance undertaken this year. Minor maintenance on a multitude of facilities and equipment was accomplished. Including materials, supplies and contracted welding and repair work, nearly \$9700 was spent to keep our fleet, equipment and facilities operating. A breakdown of maintenance expenditures is as follows:

Boats/Motors/Trailers	\$ 511
Farm Tractors/Implements	2968
Vehicles	2879
Buildings	1114
Misc. Equipment Repair	1032
Misc. Maintenance Supplies	<u>1192</u>
	\$9696

4. Equipment Utilization and Replacement

A 250 gallon Wajax slip-on pump unit was purchased with fire management funds. This unit consists of a 12 HP motor, hose and reel with outrigger rollers, control panel with remote control and a foam proportioning system. Total purchase price was \$6843.50.

With \$13,000 in private lands funding a mini van was purchased. This van will replace our Ford Fairmont wagon when received in FY 92. A Dodge 3/4 ton 4WD pickup, purchased with FY 90 funds was received in July. Total cost was \$13,137.

Excess personal property was made available and included: Small lot sale - IH flail mower, Royal typewriter, Poloroid camera and scrap iron; Transfer of Property - portable high band radio to Ludington Biological Station. The small lot sale generated \$503 in revenue. Excess property received included four portable low band radios and two mobile low band radios from Sherburne NWR and an Evinrude 35 HP outboard motor from Upper Mississippi Refuge- Savanna District.

A D8 bulldozer was acquired from Mingo NWR. A local trucking firm was contracted to haul the dozer here from Desoto NWR at a cost of \$800. Nearly another \$800 was required to get the machine in running order.

A Lanier 3022E copy system was purchased at a cost of \$3952. This unit replaced a Xerox 3100LDC which was too costly to repair and no maintenance agreement was available. Also replaced by this acquisition was a 3M VQC III copier which no longer has paper available. A Xerox 7032 telecopier (fax machine) was purchased for \$2964 further automating our refuge office.

5. Communications Systems

Wind damage to our 180 foot radio tower temporarily interrupted radio communications. Milbank Communications was contracted to repair the antenna at a cost of \$965. In addition they installed one of the acquired excess mobile radios into the new Dodge pickup truck.

6. Computer Systems

Two maintenance service contracts were in effect; one with IBM for the PS/2 system and the IBM Quietwriter printer and the other with Computerland for the IBM Proprinter XL24.

A Smart Label Printer and software manufactured by Seiko Instruments was purchased and installed at a cost of \$203.50. This equipment has proven very useful by producing a mailing label directly from a document in Wordperfect, eliminating the need to insert an envelope in the typewriter or the hassle of changing to mailing labels in our continuous feed dot matrix printer. Our current computer system is comprised of the following programs in use:

Need	Software
Word processing	Wordperfect 5.1
Data base management	RBase for DOS ¹
Telecommunications	ProCom Plus
Graphics	Microrim Chart
Backup	Sy-tos

¹RBase 3.1 was purchased but not yet installed to accommodate the new RONS/MMS data base.

7. Energy Conservation

TABLE XVII - SIX YEAR ENERGY CONSUMPTION 1986-1991

	1991	1990	1989	1988	1987	1986
Electricity (KWH)	14140	14640	14360	10656	8480	9100
Propane (GAL)	1900	1950	2225	1185	1907	3350
Gasoline (GAL)	2691	2123	1666	2051	2196	2227
Diesel (GAL)	1328	1367	1037	802	568	727
Miles Driven	33144	29128	27585	31926	24577	19165

8. Other

The refuge office lease through GSA with Minnwest Bank expired in March 1991. GSA noted a number of deficiencies including handicap accessibility and a suitable fire exit which the bank would not or could not correct. As a result, GSA took a short term extension to allow time for other suitable space to be found. Several properties were inspected by the refuge staff and GSA representative, Jennifer Paton, Chicago, IL in October. As of this writing, no definite plans for a move have yet been made.

J. OTHER ITEMS

1. Cooperative Programs

A number of programs were accomplished which could be considered technical assistance and ecological monitoring. These were reported in other sections of this report. They included weekly waterfowl migration reports, mid-December goose counts, mid-winter waterfowl counts, predator scent post surveys, and weather data collection. All results were reported to appropriate Minnesota Department of Natural Resources, Corps of Engineers and/or Fish and Wildlife Service offices.

Big Stone Refuge staff cooperated with the MDNR and South Dakota Game and Fish by monitoring the avian cholera problem at Bentsen and Thielke Lakes and Big Stone Power Plant cooling ponds.

Big Stone National Wildlife Refuge again cooperated with the University of Minnesota Forest Experiment Station by setting out Gypsy moth traps during the summer. No moths of special concern were captured.

Big Stone Refuge furnished thirty three species of wildlife to the Fish and Wildlife Forensic Lab in Ashland, Oregon for their use in developing a reference collection of skins, blood, hair and feather samples. Specimens donated included waterfowl, waterbirds, raptors, song birds and small mammals.

2. Other Economic Uses

The refuge provided space to Ellingson Bees, Inc. for six bee yards for \$90.00.

Fourteen duck stamps were sold for \$210.

Cash rent farming as discussed in Section F.4 generated \$2334. Grazing as discussed in Section F.7 generated \$1000 in revenue while haying as discussed in Section F.8 generated \$706. One trapping permit as discussed in Section H.10 generated \$50. Small lot sale excess property as discussed in Section I.4 generated \$503. Total refuge revenue during 1991 was \$4,893.

3. Items of Interest

Performance awards were awarded to James Heinecke, Rich Papasso, Norman Christensen and Carole Gerber.

Manager Heinecke regularly attended Citizens for Big Stone Lake meetings concerning steps in the restoration of Big Stone Lake. This project could provide benefits to Big Stone NWR by reducing the silt load of the Minnesota River and increasing the amount of clean water available for wetland management. The project could also support the National Waterfowl Management Plan by facilities constructed in the Whetstone River watershed and the marshes at the foot of Big Stone Lake.

A special use permit was issued to the Maas family, tenants of the 1990 Lotthammer property acquisition. The permit allowed them to stay for three additional months (Jan-March, 1992) to help eliminate a mid-winter move of his family and farming operation. The Maas family had been working with the relocation assistance program (realty) since we acquired the property.

Three special use permits were issued to individuals for handicapped accessibility. One permit was issued to an instructor from St. Cloud State University for personal botanical work. Two individuals, one from Moorhead State University, Moorhead, MN and one from the Science Museum, St. Paul, MN, were issued permits to collect small mammals. Dallas Hanson Construction was issued a permit to remove granite from the Ruby Red Quarry grout pile for a local construction project.

The refuge staff became eligible for the "50 percent club" during the regional duck stamp contest. Carole Gerber, representing the station, was drawn as one of the recipients of a framed duck stamp poster, now prominently displayed in the refuge office.

4. Credits

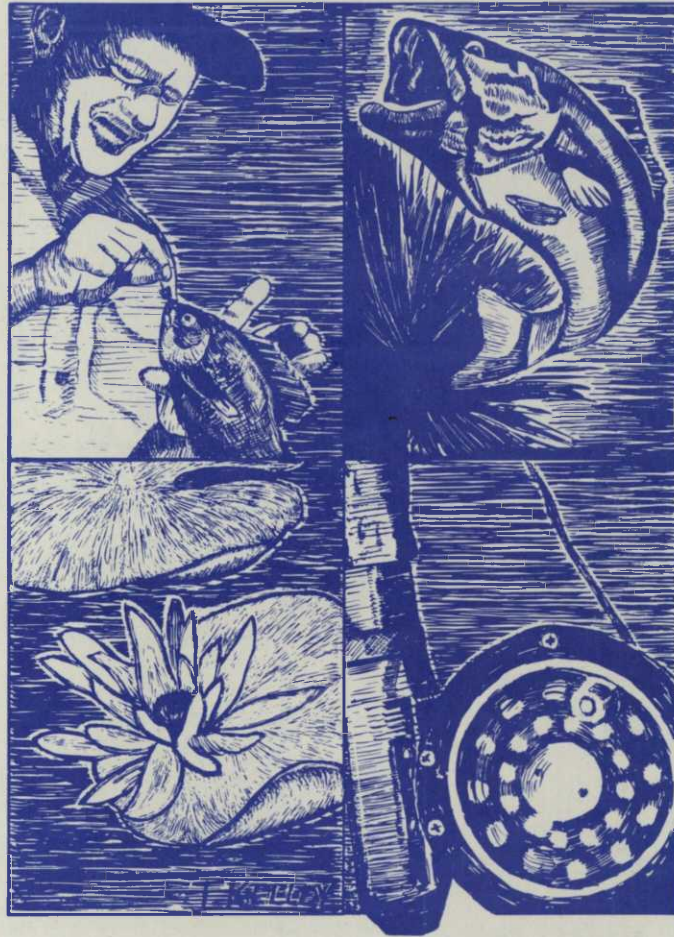
The following individuals were responsible for the preparation of this report.

Jim Heinecke	-	Sections C.4, D.1-4, F.2, 7 and 14-16 and K.
Rich Papasso	-	Sections A, C.1, D.4, E.1-3, 7 and 8, F.1, 3-6, 8-13, G, H, I, J, graphics and editing.
Carole Gerber	-	Sections B, E.1 and 2, 4-6, L, layout, word processing and assembly.
Chris Kane	-	Section D.5.

K. FEEDBACK

FISHING

MAP & REGULATIONS



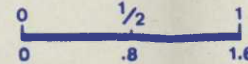
BIG STONE
National Wildlife Refuge/MN

FISHING MAP

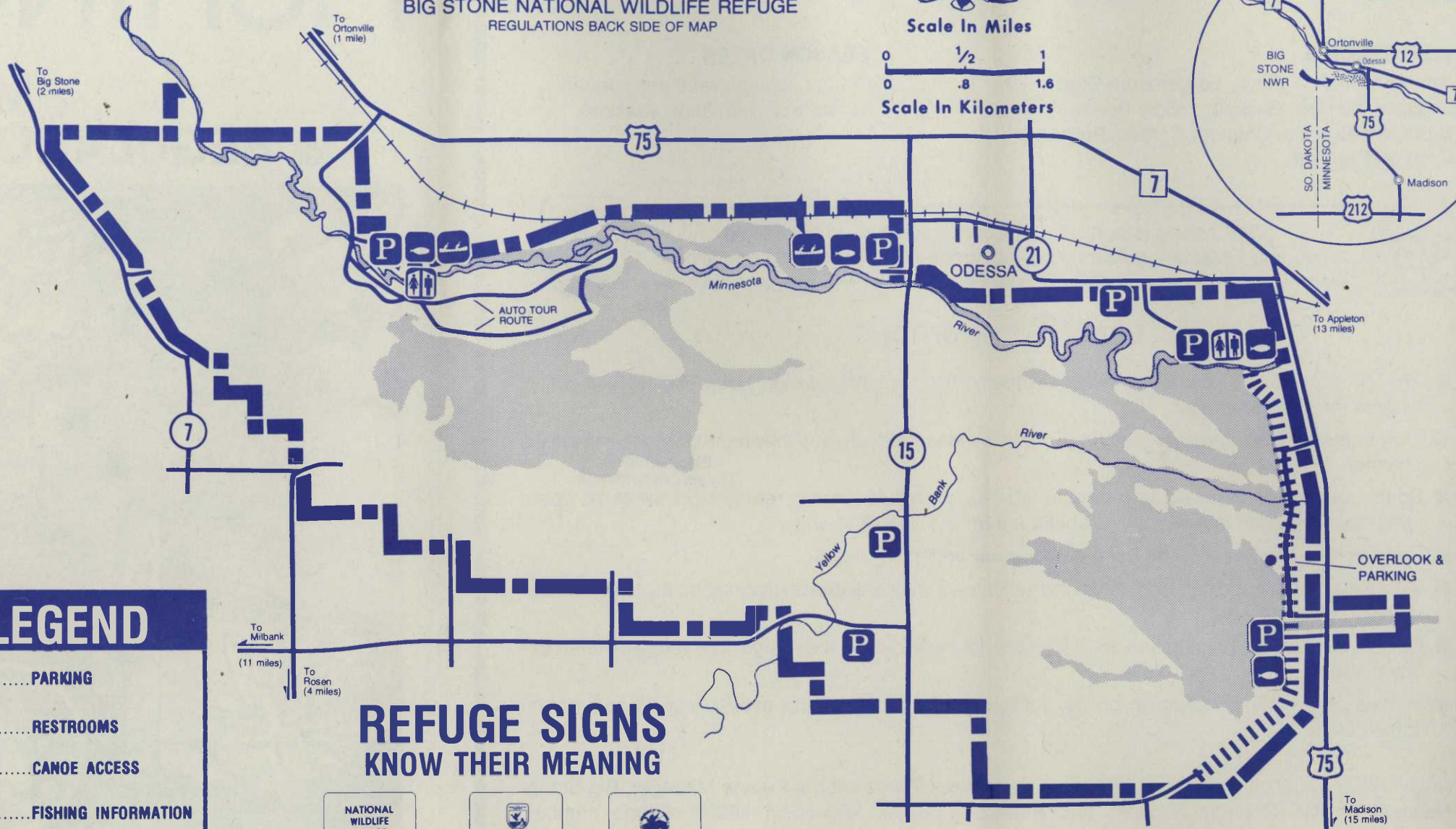
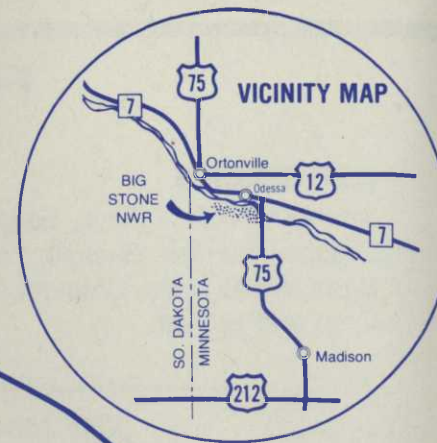
BIG STONE NATIONAL WILDLIFE REFUGE
REGULATIONS BACK SIDE OF MAP



Scale In Miles



Scale In Kilometers



LEGEND

- PARKING
- RESTROOMS
- CANOE ACCESS
- FISHING INFORMATION
- ||| DAM
- WATER
- REFUGE BOUNDARY

REFUGE SIGNS KNOW THEIR MEANING



REFUGE BOUNDARY
SIGN — ENTRY BY
PERMISSION ONLY



AREA OPEN TO
FISHING AT
SPECIFIC TIMES



SANCTUARY AREA —
OFF LIMITS TO
THE PUBLIC UNLESS
OTHERWISE SPECIFIED

FISHING REGULATIONS

FISH SPECIES

Northern Pike, Walleye, Largemouth Bass, Crappie, Sunfish, Bluegill, Yellow Perch, Rock Bass, White Bass, Channel Catfish, Bullhead, Carp and Sucker

SEASON DATES

Refuge fishing areas are open in accordance with state seasons.



Sport fishing is permitted in accordance with all applicable State and Federal regulations subject to the following special conditions:



SPECIAL CONDITIONS

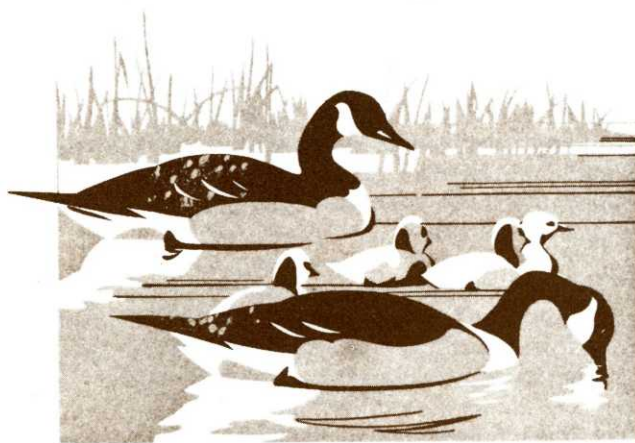
- The Minnesota and Yellow Bank Rivers are open to fishing during daylight hours only for their entire lengths through the refuge.
- Only boats without motors are permitted on the Minnesota River, and they must stay within the river channel.
Electric trolling
Motors are permitted
- Boats, canoes or other floating devices are not permitted on the refuge pool areas or open marshes. All fishing in these areas shall be from the shoreline only.
- Portable fish shelters may be used but may not be left overnight.
- Vehicles are restricted to public roads and parking areas delineated on the map on the reverse side of this leaflet.
- Camping, overnight parking and open fires are not permitted on the refuge. The refuge is open for day use only.
- Injuries or accidents occurring on the refuge must be reported to the Refuge Headquarters immediately.

Additional information concerning the refuge can be obtained from the Refuge Manager, Big Stone National Wildlife Refuge, 25 N.W. 2nd Street, Ortonville, Minnesota 56278. Phone number 612/839-3700. The Refuge Headquarters is open daily Monday through Friday from 8:00 AM to 4:30 PM.

**PLEASE KEEP YOUR REFUGE CLEAN
TAKE YOUR LITTER HOME OR DISPOSE OF PROPERLY**

Birds, Mammals, Reptiles and Amphibians

Big Stone National Wildlife Refuge



Birds of Big Stone

National Wildlife Refuge Minnesota

Big Stone National Wildlife Refuge, located two miles southeast of Ortonville, Minnesota, was established in 1975 for the protection and production of waterfowl and other wildlife. Nearly 4,000 of the refuge's 10,795 acres consist of marsh and open water created by a three-mile dam across the Minnesota River Valley.

This list contains 239 bird species which have been observed on the area since 1971.

The Art of "Birding"

A good field guide and binoculars provide the basic tools useful in the observation and identification of birds. While some species are easy to approach, others are more wary. It is best to walk slowly and quietly and to avoid sudden movements. Many kinds of birds can be found at Big Stone Refuge. Waterfowl and other water birds are plentiful during the ice-free months. The greatest numbers of waterfowl are present during early April and mid-October. A rookery of double-crested cormorants, great blue herons, common egrets, and black-crowned night herons is located within the refuge.

The field list is arranged taxonomically by order (solid line) and family (screened line). Representatives from 17 orders and 45 families can be seen on the refuge at some time during the year.

The word "family" is a classification term that places birds of similar appearance and habits into one group. Closely related families make up an order. All birds in the same order have some common characteristics. Learning to recognize families and orders can help in identifying new birds you may encounter at Big Stone Refuge.

The English, or common names of birds are in accordance with the American Ornithologists' Union's "Checklist of North American Birds".

S - Spring March-May
s - Summer June-August
F - Fall September-November
W - Winter December-February

a - abundant a species which is very numerous
c - common certain to be seen in suitable habitat
u - uncommon present, but not certain to be seen
o - occasional seen only a few times during a season
r - rare seen at intervals of 2-5 years
x - accidental seen only once or twice
* - nests locally

	S	s	F	W
— Common Loon	o	r		
— Red-necked Grebe		o		
— Horned Grebe	u		u	
— Eared Grebe*	u	u		
— Western Grebe*	c	c	c	
— Pied-billed Grebe*	c	c	c	
— American White Pelican	c	c	c	
— Double-crested Cormorant*	a	a	a	
— Great Blue Heron*	c	c	c	
— Green-backed Heron*	u	u	u	
— Little Blue Heron	u	u	u	
— Cattle Egret*		r		
— Common Egret*	c	c	c	
— Snowy Egret*	u	u	u	
— Black-crowned Night Heron*	c	c	c	
— Yellow-crowned Night Heron	u	u	u	
— Least Bittern*	u	u	u	
— American Bittern*	u	u	u	
— Tundra Swan	o		o	r
— Canada Goose*	c	c	a	o
— White-fronted Goose	o		o	
— Snow Goose	u	r	a	r
— Ross' Goose			x	
— Mallard*	c	c	a	o
— American Black Duck	o	r	o	o
— Gadwall*	c	u	c	r
— Northern Pintail*	c	c	c	r
— Green-winged Teal*	c	u	c	r

	S	s	F	W
— Blue-winged Teal*	a	a	c	r
— American Wigeon*	c	u	c	r
— Northern Shoveler*	c	c	c	r
— Wood Duck*	c	c	c	r
— Redhead*	c	u	c	r
— Ring-necked Duck*	c	r	u	r
— Canvasback*	c	u	c	r
— Greater Scaup			o	
— Lesser Scaup	c		c	o
— Common Goldeneye	c		u	u
— Barrow's Goldeneye			x	
— Bufflehead	u	o	u	r
— Oldsquaw			r	r
— Ruddy Duck*	c	c	c	r
— Hooded Merganser*	u	o	o	r
— Common Merganser	c		u	u
— Red-breasted Merganser	r			
— Turkey Vulture	r		r	
— Northern Goshawk	r		r	
— Sharp-shinned Hawk	u	r	u	o
— Cooper's Hawk	o	r	u	o
— Red-tailed Hawk*	c	c	c	r
— Red-shouldered Hawk	o	r	o	
— Broad-winged Hawk	o		u	
— Swainson's Hawk*	u	u	u	
— Rough-legged Hawk	u		u	o
— Golden Eagle	r		r	
— Bald Eagle	o		o	
— Northern Harrier*	c	c	c	r
— Osprey	r	r	r	
— Prairie Falcon	r		r	
— American Peregrine Falcon	r		r	
— Merlin	o	r	o	r
— American Kestrel*	c	c	c	o
— Northern Bobwhite*	r	r	r	r
— Ring-necked Pheasant*	c	c	c	c
— Gray Partridge*	u	u	u	u
— Wild Turkey	o	o	o	o
— King Rail	r	r	r	
— Virginia Rail*	c	c	c	
— Sora*	c	c	c	
— American Coot*	a	a	a	
— Semipalmated Plover	u		u	
— Killdeer*	c	c	c	
— Lesser Golden Plover	o		u	
— Black-bellied Plover	u		u	
— Ruddy Turnstone	o			
— American Woodcock*	c	u	u	
— Common Snipe*	c	c	c	
— Upland Sandpiper*	c	u	u	
— Spotted Sandpiper*	c	c	c	
— Solitary Sandpiper	o		o	

	S	s	F	W
— Willet	o		o	
— Greater Yellowlegs	c	u	c	
— Lesser Yellowlegs	c	c	c	
— Pectoral Sandpiper	c	c	c	
— White-rumped Sandpiper	u	o	u	
— Baird's Sandpiper	u	o	u	
— Least Sandpiper	c	u	c	
— Dunlin	u	o	u	
— Long-billed Dowitcher	o	o	o	
— Stilt Sandpiper	u	o	u	
— Semipalmated Sandpiper	c	c	c	
— Western Sandpiper	u	o	u	
— Marbled Godwit*	u	o	u	
— Hudsonian Godwit	r	r	r	
— Sanderling		o		
— American Avocet*		o	o	o
— Wilson's Phalarope	c	u		
— Glaucous Gull	r		r	
— Herring Gull	u	u	u	r
— Ring-billed Gull	c	u	c	r
— Franklin's Gull*	c	c	a	
— Bonaparte's Gull	u	o	u	
— Forster's Tern*	c	c	u	
— Common Tern*	c	c	c	
— Caspian Tern	o	o	o	
— Black Tern*	c	c	o	
— Rock Dove*	c	c	c	c
— Mourning Dove*	c	c	c	o
— Yellow-billed Cuckoo	u	u	u	
— Black-billed Cuckoo	u	c	c	
— Eastern Screech Owl*	c	c	c	c
— Great Horned Owl*	c	c	c	c
— Snowy Owl	o		o	
— Barred Owl	o	o	o	o
— Long-eared Owl			o	
— Short-eared Owl	u	u	u	u
— Northern Saw-whet Owl			r	
— Common Nighthawk*	c	c	c	
— Chimney Swift*	c	u	c	
— Ruby-throated Hummingbird*	u	u	o	
— Belted Kingfisher*	c	c	o	r
— Northern Common Flicker*	c	c	c	o
— Red-headed Woodpecker*	u	c	o	
— Red-bellied Woodpecker*	r	r	r	r
— Yellow-bellied Sapsucker*	c	c	u	
— Hairy Woodpecker*	c	c	c	c
— Downy Woodpecker*	c	c	c	c
— Pileated Woodpecker	o	o	o	o
— Eastern Kingbird*	c	c	u	
— Western Kingbird*	u	u	u	
— Great Crested Flycatcher	u	o	o	

	S	s	F	W
— Eastern Phoebe*	u	o	o	
— Willow Flycatcher	u			
— Least Flycatcher	c	o	c	
— Eastern Wood Pewee*	o	o	o	
— Horned Lark*	c	u	c	c
— Tree Swallow*	c	c	a	
— Bank Swallow*	c	c	c	
— Rough-winged Swallow*	c	u	c	
— Barn Swallow*	c	c	c	
— Cliff Swallow*	c	c	c	
— Purple Martin*	u	c	o	
— Blue Jay*	c	c	c	c
— Black-billed Magpie	o		r	o
— Common Crow*	c	c	c	u
— Black-capped Chickadee*	c	c	c	c
— White-breasted Nuthatch*	c	c	c	c
— Red-breasted Nuthatch				o
— Brown Creeper	u		c	u
— House Wren*	c	c	c	
— Winter Wren	o			r
— Long-billed Marsh Wren*	u	u	u	
— Short-billed Marsh Wren*	c	a	a	
— Gray Catbird*	c	c	c	
— Brown Thrasher*	c	c	c	
— American Robin*	c	c	c	o
— Wood Thrush	o		o	
— Hermit Thrush	u		u	
— Swainson's Thrush	u		u	
— Gray-cheeked Thrush	o		o	
— Veery	o		o	
— Eastern Bluebird*	u	o	u	
— Golden-crowned Kinglet	u		c	o
— Ruby-crowned Kinglet	c		c	
— Cedar Waxwing	u	u	u	o
— Northern Shrike	u		u	u
— Loggerhead Shrike	u			
— European Starling*	c	c	c	c
— Solitary Vireo	u			
— Red-eyed Vireo	u	o		
— Philadelphia Vireo	u			
— Warbling Vireo	c	u	u	
— Black-and-white Warbler	c	o	u	
— Golden-winged Warbler	r			
— Tennessee Warbler	u			
— Orange-crowned Warbler	u		c	
— Nashville Warbler	c		c	
— Yellow Warbler*	c	c	c	
— Magnolia Warbler	u			
— Cape May Warbler	u			

	S	s	F	W
— Black-throated Green Warbler	r		u	
— Yellow-rumped Warbler	a		c	
— Chestnut-sided Warbler				
— Blackpoll Warbler	o			
— Pine Warbler	o			
— Palm Warbler	o			
— Ovenbird	u			
— Northern Waterthrush	o		u	
— Mourning Warbler	r			
— Common Yellowthroat*	c	c	c	
— Yellow-breasted Chat	o	o	o	
— Wilson's Warbler	o	u	u	
— Canada Warbler	u		u	
— American Redstart	c	u		
— House Sparrow*	c	c	c	c
— Bobolink*	c	u	u	
— Western Meadowlark*	c	c	c	o
— Yellow-headed Blackbird*	c	c	c	r
— Red-winged Blackbird*	a	a	a	o
— Orchard Oriole*	u	o		
— Northern Oriole*	c	u	u	
— Rusty Blackbird	c		c	o
— Brewer's Blackbird	u		u	r
— Common Grackle*	c	c	c	o
— Brown-headed Cowbird*	c	c	c	o
— Cardinal*	o	o	o	o
— Rose-breasted Grosbeak*	u	u	o	
— Indigo Bunting*	o	u	o	
— Dickcissel*	u	c	u	
— Evening Grosbeak				o
— Purple Finch	o		u	u
— Pine Grosbeak				r
— Hoary Redpoll				r
— Common Redpoll	o		o	u
— Pine Siskin	o		o	o
— American Goldfinch*	c	c	c	u
— Red Crossbill	o		o	u
— White-winged Crossbill			r	r
— Rufous-sided Towhee	u	r	o	
— Savannah Sparrow*	c	u	u	
— Grasshopper Sparrow*	o	o		
— Le Conte's Sparrow	o		r	
— Henslow's Sparrow	o	o	o	
— Vesper Sparrow*	c	c	c	
— Lark Sparrow	r			
— Dark-eyed Junco	c		c	c
— Tree Sparrow	c		c	c
— Chipping Sparrow*	c	c	o	r
— Clay-colored Sparrow*	c	c	u	
— Field Sparrow*	u	u	o	
— Harris' Sparrow	u		c	r
— White-crowned Sparrow	u		c	
— White-throated Sparrow	c		c	
— Fox Sparrow	u		u	
— Lincoln's Sparrow	c		c	
— Swamp Sparrow	o		c	
— Song Sparrow*	c	c	c	o
— Lapland Longspur	o			o
— Snow Bunting	o		u	c

MAMMALS

The following mammals are year-round residents at Big Stone Refuge:

— Masked Shrew	— Thirteen-lined Ground Squirrel
— Short-tailed Shrew	— Franklin's Ground Squirrel
— Little Brown Myotis	— Eastern Chipmunk
— Silver-haired Bat	— Eastern Gray Squirrel
— Big Brown Bat	— Eastern Fox Squirrel
— Hoary Bat	— Red Squirrel
— Raccoon	— Plains Pocket Gopher
— Short-tailed Weasel	— Beaver
— Long-tailed Weasel	— Deer Mouse
— Mink	— Prairie Vole
— River Otter	— Muskrat
— Badger	— Norway Rat
— Striped Skunk	— House Mouse
— Coyote	— Meadow Jumping Mouse
— Red Fox	— White-tailed Jackrabbit
— Gray Fox	— Eastern Cottontail
— Woodchuck	— Mule Deer
— Richardson's Ground Squirrel	— White-tailed Deer

REPTILES AND AMPHIBIANS

These reptiles and amphibians may be seen on Big Stone Refuge spring through fall:

— Snapping Turtle	— Mudpuppy
— Western Painted Turtle	— Eastern Tiger Salamander
— Northern Prairie Skink	— American Toad
— Red-bellied Snake	— Dakota Toad
— Red-sided Garter Snake	— Western Chorus Frog
— Plains Garter Snake	— Northern Leopard Frog

Information

Additional information may be obtained by writing Refuge Manager, Big Stone National Wildlife Refuge, 25 Northwest Second Street, Ortonville, Minnesota 56278.

Phone: (612) 839-3700



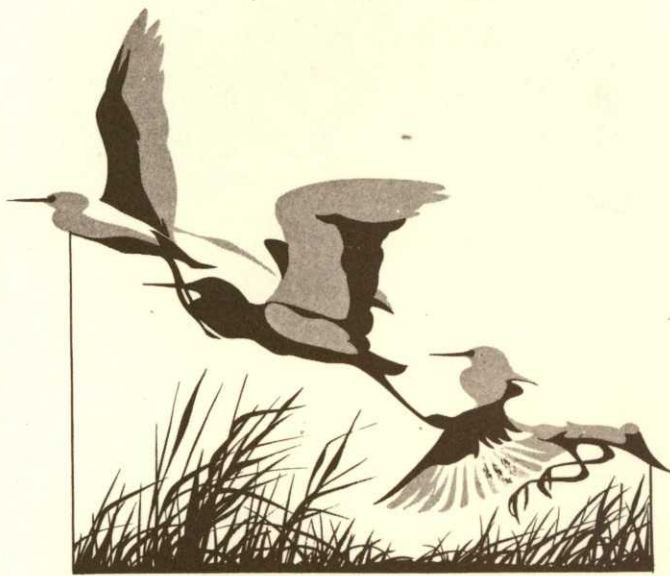
DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE

RF-3-32640-2-3/85

☆ U.S. GOVERNMENT PRINTING OFFICE: 1979-666-621

Big Stone National Wildlife Refuge

Auto Tour Route



Big Stone Auto Tour Route



Welcome to Big Stone National Wildlife Refuge's self-guided auto tour. The three-mile drive will take you through a portion of the Minnesota River Valley — rich in geologic, human and natural history.

Numbered sign posts or "stations" at vehicle turnouts refer to descriptions in this leaflet.

Big Stone National Wildlife Refuge is a valuable resource. Please leave the refuge as you found it so others may enjoy it, too.

Station 1. Granite Overlook

Try to imagine the geologic forces which shaped the land.

Granite, which underlies the region, was formed by volcanic activity over 2.6 billion years ago. These outcrops were exposed when the huge glacial River Warren flowed through the area.

Few plants can live in these hot and sterile conditions very similar to a desert. Two kinds of cactus can be found — the prickly pear cactus and the rarer ball cactus. Remnants of the tall grass prairie exist in surrounding areas where soil is adequate.

Station 2. Wildlife Needs

Just like people, wildlife have needs that must be met if they are to survive and reproduce. Food, water, shelter and living space are the most important requirements for any species.

Land must be managed to provide these requirements at optimum levels. Rotational farming is used to prepare the land for establishment of desirable vegetation such as native grass seeding and dense nesting cover.

Station 3. Prairie Restoration

Tall grass prairie once was the dominant plant community at Big Stone NWR.

Refuge personnel are restoring this important grassland type by seeding "tall grass" species: Indian grass, big bluestem, little bluestem, Canada wildrye, switch grass, side oats grama and green needle grass. Native prairie flowers will be added.

Can you tell the difference between the prairie restoration and the neighboring "dense nesting cover?" The "DNC" is a mix of sweet clover, alfalfa and domestic wheat grasses.

Together, prairie and "DNC" offer wildlife excellent living conditions. With improved habitat, grassland species will become a more stable part of Big Stone wildlife population.



Station 4. Conservation Pool

Floodwaters from the Minnesota River formerly covered these lowlands each spring, but flowed away by mid-summer. Now a dam constructed down-stream has created a 4,250 acre pool, with the depth of water averaging three feet. Although the trees and shrubs will die, their usefulness for wildlife continues.

Wood ducks and hooded mergansers nest in dead tree cavities, and hawks and eagles use them as perches. Nesting colonies of egrets, herons and cormorants can be found among the dead standing timber.

In addition, the pool attracts hundreds of migratory waterfowl from mallards to snow geese. What species can you find?

Station 5. Wetland Community

Nearly all prairie wildlife species are dependent on wetlands at some time during their life cycle. Deer use heavy cattail stands as winter cover. Marsh hawks hunt the grassy borders for small mammals. Muskrats feed on starchy cattail roots and use the stalks to build nests.

Periodic dry cycles keep prairie marshes in a productive state. Nutrients, recycled by dry conditions, are utilized by aquatic invertebrates which, in turn, provide waterfowl with protein. Concentrated protein is essential during egg laying, periods of growth, and migration.



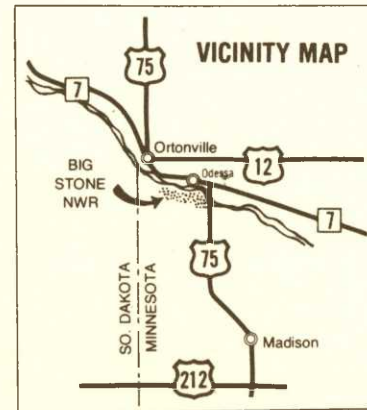
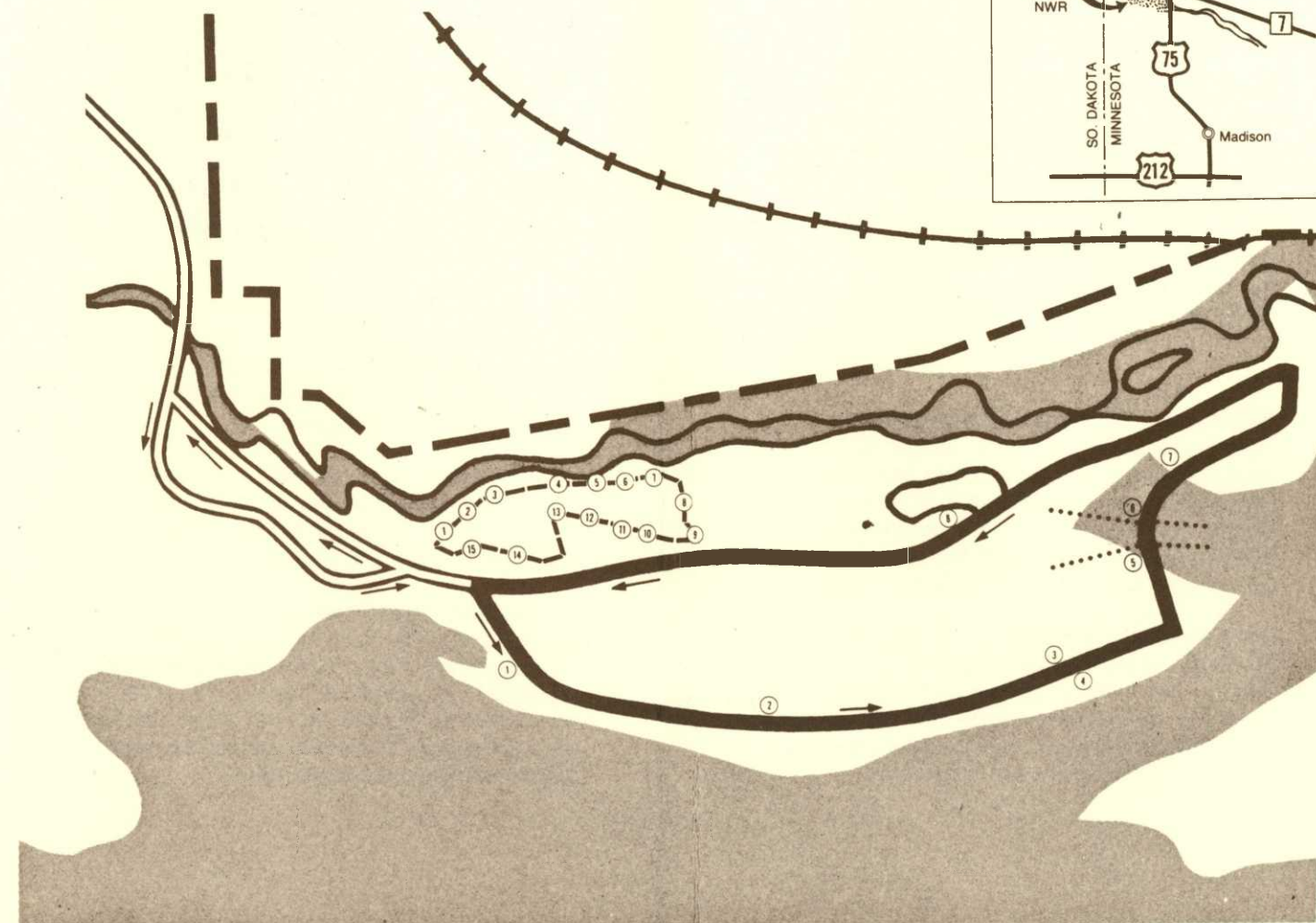
Station 6. The Water Cycle

This small pond helps support the earth's water cycle and life as we know it.

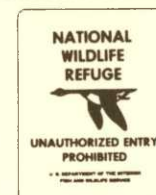
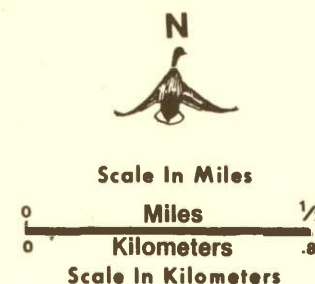
Did you know that less than 1% of the earth's water is available for living organisms? Almost all of the earth's fresh water is frozen in glaciers and ice caps or is unusable saltwater.

Much of the trillions of tons of rainwater that fall to the surface of the earth this year evaporates and eventually produces more rain clouds. Only a small portion remains in lakes and streams or filters down to become ground water. Wetlands play a vital role in storing much of this water for use by wildlife and people alike.

Auto Tour Route



LEGEND	
	REFUGE BOUNDARY
	CONSERVATION POOL
	FOOT TRAIL
	AUTO TOUR ROUTE
	POINT OF INTEREST
	MINNESOTA RIVER
	WATER AREA



REFUGE BOUNDARY SIGN — ENTRY FOR AUTHORIZED ACTIVITIES ONLY



AREA OPEN TO FISHING AT SPECIFIC TIMES

Station 7. Our Pioneer Past

Before the coming of the settlers, Indians of the Dakota nations hunted the herds of pronghorn antelope, bison, deer and elk which thrived on the Great Plains.

With the pioneers came changes. The tall grass prairie was transformed into farmland, and towns; roadways and railroads were built across the plains.

A reminder of our pioneer past is this shallow depression, the location of an original "Soddy." This was a house made from bricks of sod. The pile of rocks nearby is the remains of a "milk cellar" — a partially underground structure used as cold storage for food.

Wood Duck Woodlands

One of the most interesting inhabitants of the floodplain forest is the wood duck — considered by some to be the most beautiful of all our North American ducks.

Long ago the wood duck adapted to nesting in tree cavities instead of the ground used by many other waterfowl. The young leave their tree-top nests when they are 24 hours old. They jump to the ground or water from distances of 50 feet or more, but land unharmed.

Station 8. Forest Formation

As you view this small ice block lake, changes are occurring which you cannot see. If you returned to this spot 100 years from now, do you think it would look the same? Chances are you would come upon the beginnings of a hardwood forest instead of a marsh.

Remember the flooded lands at Station 5? In the same way, clumps of dense vegetation will gradually fill in the margins of this pond. Seeds from nearby trees will land on wet soil and send down roots. In time elm, willow and maple will form a forest which will continue to reproduce itself into the future as a "climax" plant community.

At The End of Your Auto Tour:

Did you notice as many species of wildlife outside the refuge? Probably not. On this auto tour, you have seen the reasons why. Land and water are managed at Big Stone to produce quality habitat for wildlife — and quality viewing conditions for visitors.

If you would like a closer view of Big Stone, hike on the "Prairie Past and Present" foot trail which begins at the interpretive shelter.

Information

Additional information may be obtained by writing Refuge Manager, Big Stone National Wildlife Refuge, 25 Northwest Second Street, Ortonville, Minnesota 56278. Phone: (612) 839-3700



DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE

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Big Stone

National
Wildlife Refuge



Big Stone National Wildlife Refuge



The upper reaches of the Minnesota River in west central Minnesota are a refuge for wildlife — and are fascinating to people interested in wildlife-oriented recreation.

Located two miles southeast of Ortonville near the Minnesota-South Dakota border, Big Stone National Wildlife Refuge offers recreational opportunities to visitors throughout the year.

The River Valley

The Minnesota River winds 11.5 miles through the refuge. From an airplane, the river looks like a wavy line stretching along the bottom of a much wider valley.

The wide valley was carved thousands of years ago. Melting ice from glaciers caused a huge lake to form in northwestern Minnesota. This lake, called Lake Agassiz, overflowed to the south.

In time, these torrents of water eroded a river bed named the glacial River Warren. Today, the quiet Minnesota River occupies the bottom of the old glacial river.

Look for evidence of glacial times. Try to catch a view of the high bluffs on either side of the river. The valley is 1.5 miles wide at the upper end of the refuge and four miles wide at the lower end. Imagine the time required for a river to carve a valley of this size!

Human History

Little is known about early native tribes that used the Minnesota River as their highway.

But, Dakotah Indians lived along the river banks at the time the earliest settlers arrived in Western Minnesota. Some interesting Indian and early settler sites are still visible.

A number of farms were present in the river bottomlands in 1971 when the Big Stone National Wildlife Refuge was authorized.

The U.S. Army Corps of Engineers built a dam to create a large reservoir, and then in 1975 transferred land to the U.S. Fish and Wildlife Service.

Through a cooperative agreement, the Corps still maintains the water control facilities, but the USFWS has management responsibility for all 10,795 acres of refuge lands.

Habitats for Wildlife

A wide variety of habitats exist on the refuge — from the wet world of the river and reservoir areas to the dry world of the granite rock outcrops.

The dam in the Minnesota River created an additional 4,250 acres of wetlands which provide a stopping-off place for migrating waterfowl and a home for summer residents such as: great egrets, great blue and black crowned night herons, cormorants, and many species of ducks.

Low-lying woodlands support migrating warblers and other song birds, as well as resident populations of deer and other mammals. Flooded woodlands containing American elm, ash, box elder and silver maple provide old tree trunks with hollow cavities which are good nesting sites for wood ducks and hooded mergansers. Some introduced species such as the Russian olive often are removed because of their tendency to spread into areas like "weeds." About 850 acres of refuge lands consist of low woodlands.

The refuge still contains about 1,700 acres of native prairie. This is typical tall grass prairie country, with occasional oak trees. Because many farm grasses, woody shrubs, and non-native flowers seed themselves among the native prairie species, refuge staff use controlled burns from time to time to restore and maintain a vigorous growth. A state effort to reestablish the prairie chicken in this region may be successful.

Approximately 4,000 acres of refuge lands are used to grow crops for wildlife or reestablish grassy areas which provide food, nesting areas, and cover for wildlife. Some areas have been seeded to native grass, others to mixtures of legumes and wheatgrass.

One of the most interesting habitats on the refuge is the 100 acres of granite rock outcrops. These bare rock areas support unusual species of cactus and other plants. The high outcrops provide some excellent views over the entire refuge and its wildlife populations.



Wildlife Watching

Big Stone National Wildlife Refuge offers exceptional opportunities for wildlife watching.

During spring and fall migrations, 17 species of ducks can be sighted in and around the refuge. Some of the more common species to be seen are: mallard, blue-winged teal, northern shoveler, pintail, redhead, and ruddy duck. Canada and snow geese also have been seen.

Many species become summer residents on the refuge. Western grebes, uncommon in Minnesota, are using the area to rear their young.

Other animal species to watch for include white-tailed deer, gray partridge, muskrats, beaver, and woodchucks.

Wildlife watching always is more successful if done during morning or evening when animals are most active. A bird list is available at various points on the refuge.

Auto Touring

A four-mile auto-tour route on the refuge is open to the public. Numbered stops along the way correspond to notes on a special auto tour leaflet which describes the features to watch for along the way. Pick up the leaflet at Stop #1.

The auto tour provides a view of the major habitats in the refuge. Be on the lookout for wildlife. Turnouts provide a place to park while watching.

Foot Trail

An interesting foot trail starts at the rest area near the interpretive shelter. A walk of about an hour's time will provide a close-up view of prairie plants, granite rock outcrops, river meanders and wildlife.

A special foot trail leaflet provides information keyed to numbered stops. Pick up the leaflet at the start of the trail.

Canoeing

The Minnesota River is one of the state's official canoe routes. Big Stone National Wildlife Refuge offers canoe access areas and parking.

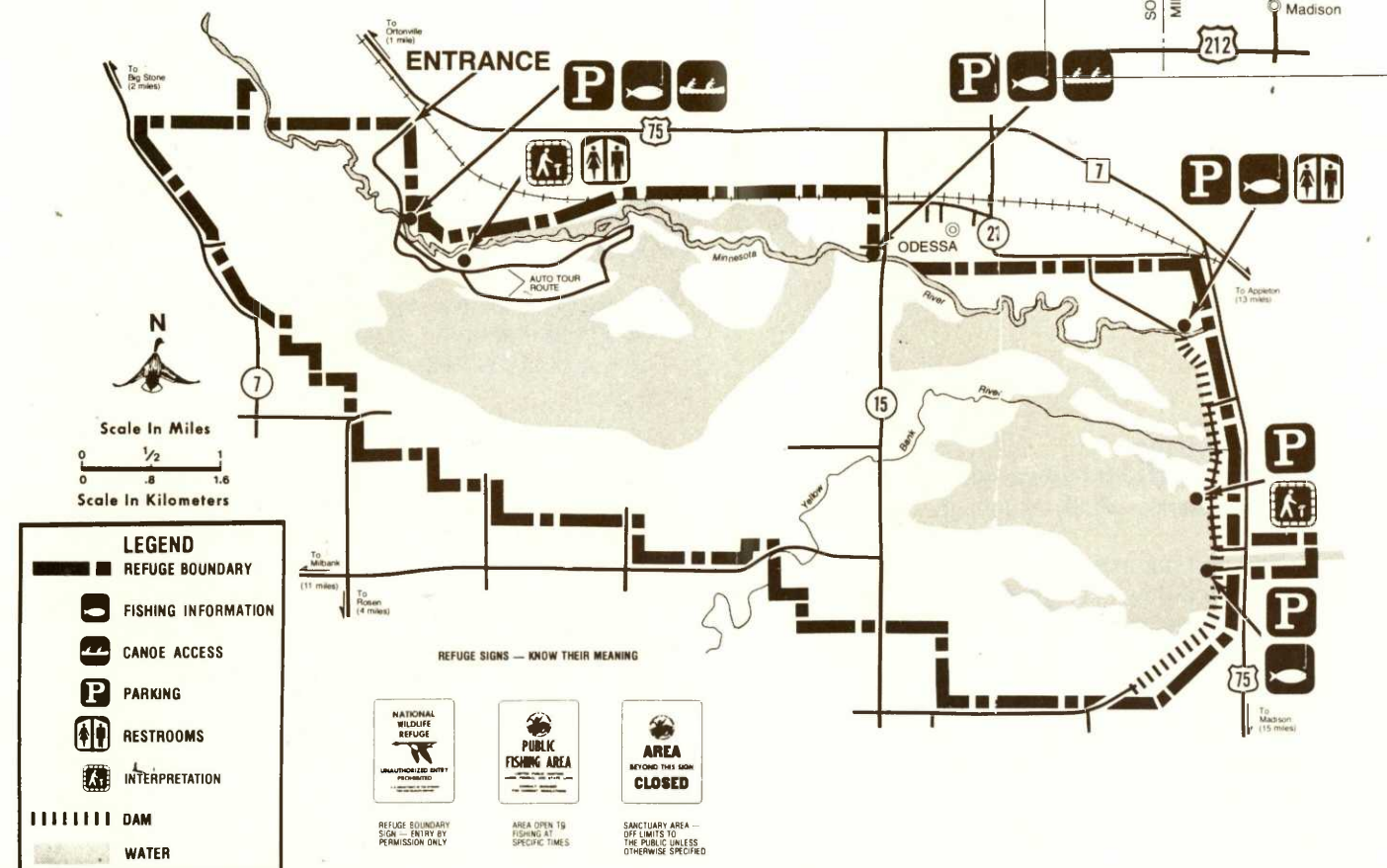
Canoeing down the refuge's section of the river will require between a half and a whole day, depending on skill and the number of fallen trees or beaver dams encountered along the way.

There are no official portages except for a 150 yard portage at the low flow water control structure.

Canoeists must stay in the main river channel on a route marked with signs. The canoe trail is open from mid-April to September 30, but canoeing is best during high water time in the Spring.

Only canoes are allowed on the refuge, so do not plan a float trip with raft, inner tube, boat, or other devices. Motors are prohibited.

Big Stone National Wildlife Refuge



Fishing

Fishing is a popular activity at the refuge. The best places are along the banks of the reservoir or the refuge's rivers — the Minnesota and the Yellowbank.

Look for fishing leaflets at the service spillway, low flow structure, and both canoe access points. The fishing season each year extends between state opening and September 30.

Hunting

Hunting areas are available during the official state hunting seasons. Species open to hunting are gray partridge, cottontail rabbit, gray and fox squirrel, pheasant, and deer.

Hunting leaflets are available in hunting area parking lots during the hunting season. All hunting ends November 30 each year.

Cross-Country Skiing and Snowshoeing

Cross-country skiers and snowshoers will find Big Stone National Wildlife Refuge an attractive place. Park outside the main entrance and ski or snowshoe wherever you would like to explore. Be careful to avoid steep drop-offs on granite rock outcrops. The easiest trail for beginners would be to follow the refuge roads.

Tips on Visiting the Refuge

Restrooms are provided on the refuge but no drinking water is available. No picnic area is available. Camping and building fires are prohibited. However, bring along a sandwich and a thermos, because there are enough areas to visit and wildlife to see to fill a whole day.

Remember to keep pets on leash. Swimming, horse-back riding, traveling by off-road vehicles or snowmobiles, or collecting of any plants, animals, and artifacts also are not permitted.

The closest lodging is at Ortonville. The nearest public and private campgrounds are along the shores of Big Stone Lake.

Information

Additional information may be obtained by writing Refuge Manager, Big Stone National Wildlife Refuge, 25 Northwest Second Street, Ortonville, Minnesota 56278.
Phone: (612) 839-3700



As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

DEPARTMENT OF THE INTERIOR U.S. FISH AND WILDLIFE SERVICE

RF-32582-1 April 1979

☆ U.S. GOVERNMENT PRINTING OFFICE: 1979-666-619

Big Stone

National Wildlife Refuge

Minnesota

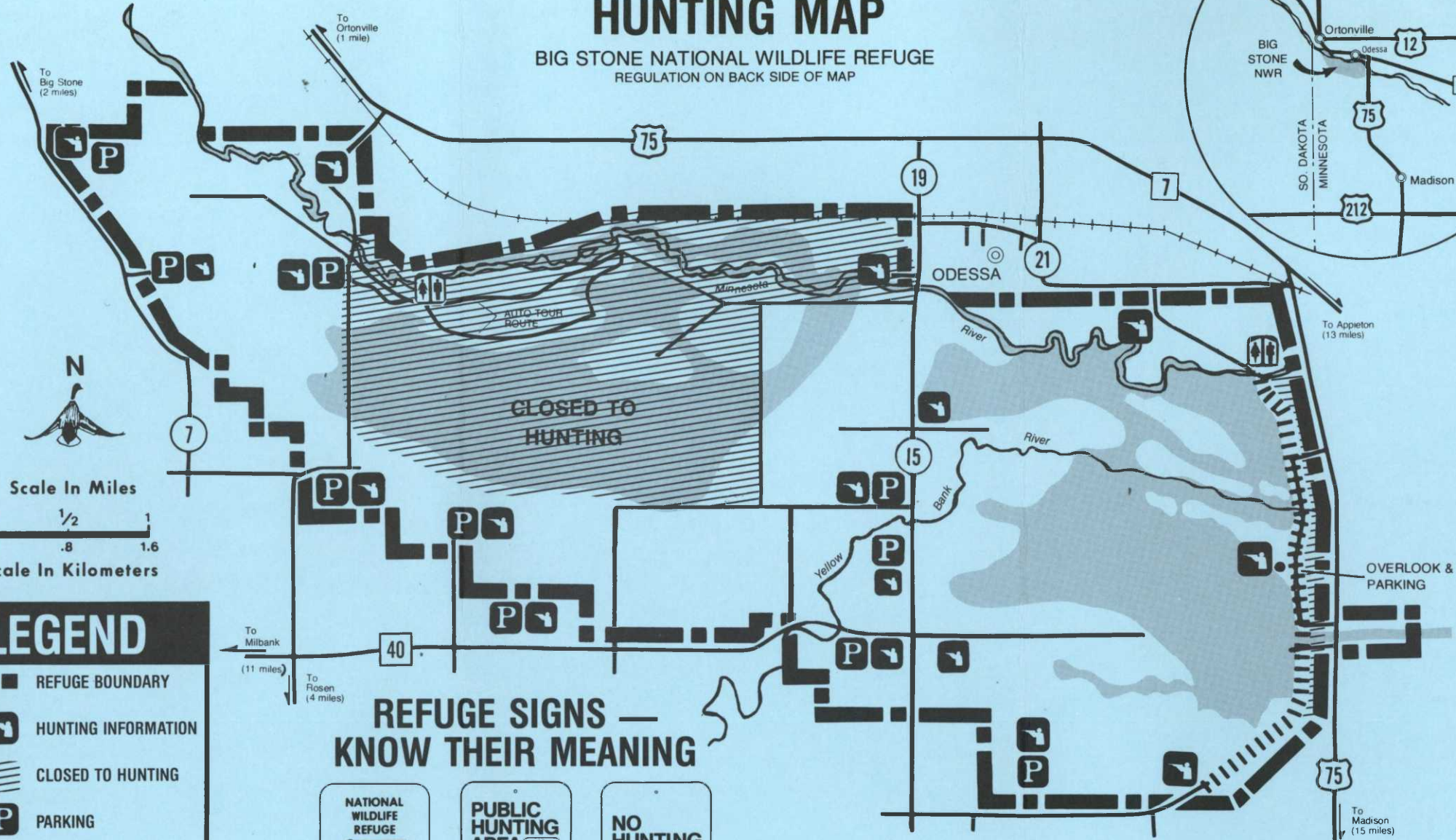
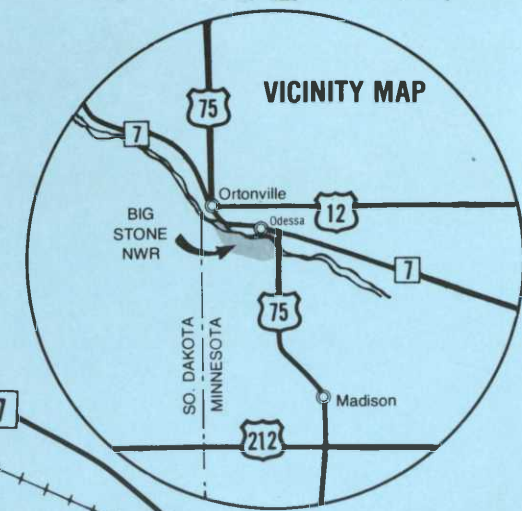
HUNTING MAP & REGULATIONS



BIG STONE
National Wildlife Refuge

HUNTING MAP

BIG STONE NATIONAL WILDLIFE REFUGE
REGULATION ON BACK SIDE OF MAP

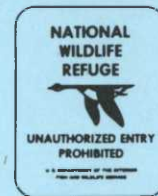


Scale In Miles
0 1/2 1
0 .8 1.6
Scale In Kilometers

LEGEND

- REFUGE BOUNDARY
- HUNTING INFORMATION
- CLOSED TO HUNTING
- PARKING
- RESTROOMS
- DAM
- WATER

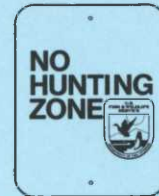
REFUGE SIGNS — KNOW THEIR MEANING



REFUGE BOUNDARY SIGN — ENTRY FOR AUTHORIZED ACTIVITIES ONLY



AREA OPEN TO HUNTING AT SPECIFIC TIMES



AREA OFF LIMITS TO ANY HUNTING RELATED ACTIVITY

Hunting Regulations

SMALL GAME

Hungarian Partridge
Cottontail Rabbit
Jack Rabbit
Gray and Fox Squirrel
Pheasant
Red and Gray Fox

BIG GAME

Deer-Archery
Deer-Firearms (shotgun-slug)
Deer-Firearms (muzzleloader)

Season Dates
are the
same as
the Minnesota
State
Regulations.
See State
Proclamation.

SPECIAL CONDITIONS

NO DUCK, GOOSE, COOT, or SNIPE HUNTING IS ALLOWED ON THE REFUGE.

Species not listed above are protected and may *NOT* be killed or possessed.

All state regulations are in effect.

All vehicle travel is prohibited except on roads and parking areas designated for such use.

Camping, overnight use and fires are prohibited.

Construction or use of permanent blinds, platforms, or scaffolds is prohibited. Portable blinds and platforms may not be left on the refuge overnight.

Wounded big game entering the No Hunting Zone may not be retrieved until first securing permission from a refuge officer.

Report all injuries and accidents to Refuge Headquarters, 25 N.W. 2nd St., Ortonville, Minnesota 56278 or Phone 612/839-3700.



**QUALITY HUNTING DEPENDS ON YOU
PLEASE RESPECT ALL REGULATIONS**



RF-3-32640-6-6/86