

RED ROCK LAKES NATIONAL WILDLIFE REFUGE

Lakeview, Montana

ANNUAL NARRATIVE REPORT

Calendar Year 1988

U.S. Department of the Interior

Fish and Wildlife Service

NATIONAL WILDLIFE REFUGE SYSTEM

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REVIEW AND APPROVALS

RED ROCK LAKES NATIONAL WILDLIFE REFUGE

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Calendar Year 1988

Nancy Gilbert 6/10/89
Acting Refuge Manager Date

Bonnie W. Schrank 6/20/89
Refuge Supervisor Review Date

Ralph F. Free
Regional Office Approval

6/20/89
Date

INTRODUCTION

"25th Travelled in the same direction 12 mls and encamped in a smooth valley about 80 miles in circumference surrounded on the North & East by a high range of mountains at the NE extremity is a marshy lake about 12 mls in circumference from this flows the head stream of the Jefferson fork of the Missouri which curves to the SW thru the valley and enters the low mountain on the west thru a narrow cut still continuing the curve encircling a large portion of country previous to its arrival at the junction 26 Crossed the valley about 16 mls and encamped on the East side. This Valley as a mountaineer would say was full of Buffaloe when we entered it and large numbers of which were killed by our hunters we repeatedly saw signs of Blackfeet about us to waylay the Trappers. 27th we stopped at this place to feast on fat Buffaloe"(sic)

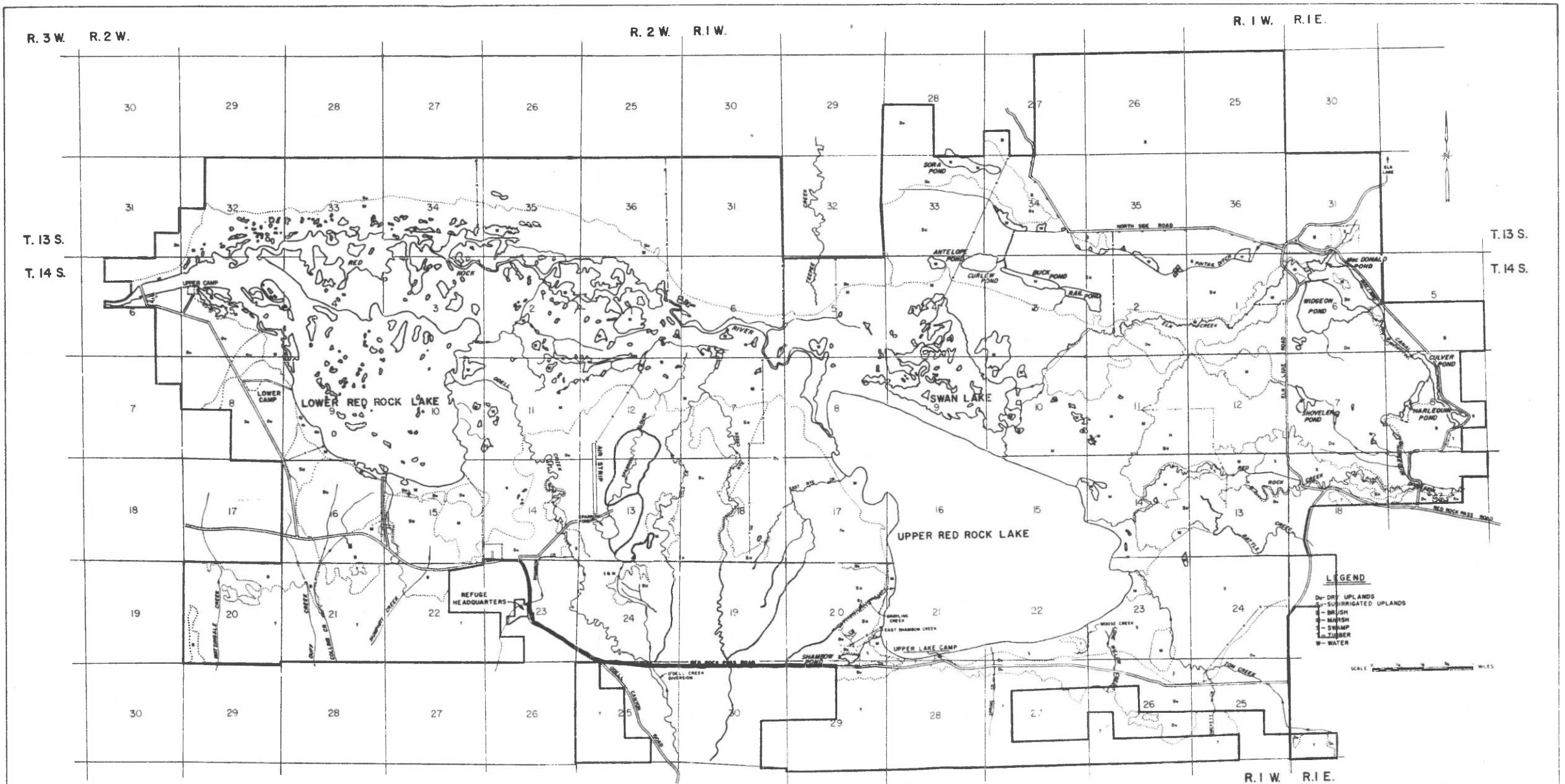
Osborne Russell, September 1835

The passage quoted above shows that mountain men and Indians alike used what is now Red Rock Lakes National Wildlife Refuge and the surrounding Centennial Valley of southwestern Montana, for obvious reasons. In addition to providing good seasonal trapping and hunting grounds, it was a favored route between the headwaters of the upper Bighole River and the Yellowstone area. White men did not settle the area until 1876. Settlement brought homesteads and herds of cattle, as well as some lumbering and market hunting. The long winters and great distances to market made subsistence difficult at best, with few surviving the "Great Depression."

In 1935 Red Rock Lakes National Wildlife Refuge was established to protect the area because it served as a nesting and wintering area for trumpeter swans. About 600 trumpeter swans are currently in the tri-state (Idaho, Montana, Wyoming) population. Over 200 species of birds have been recorded on the refuge with peregrine and prairie falcons, bald and golden eagles, burrowing owls, and sage grouse being the most notable. Common mammalian species include antelope, Shiras moose, elk, mule and white-tailed deer, badger, and red fox.

The 42,525 acre refuge sits at 6670 feet above sea level adjacent to the Continental Divide. It is composed of sub-irrigated meadows, sagebrush grasslands, coniferous forests, and two large shallow lake/marsh complexes. In 1976, 32,350 acres of the refuge were designated as Wilderness. It is also a designated Natural Heritage Landmark.

The refuge headquarters is located 28 miles from the nearest paved road and 45 miles from Yellowstone National Park. About 10,000 to 13,000 people visit the refuge annually to participate in hunting, fishing, camping and wildlife observation.



UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

RED ROCK LAKES
NATIONAL WILDLIFE REFUGE

HABITAT TYPE MAP

BEAVERHEAD COUNTY, MONTANA

INTRODUCTION

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A. HIGHLIGHTS

The refuge experienced the driest year on record (B).

The Lower Structure Project was dedicated (F2).

Two inholdings were acquired (C1).

The non-game study continued with interesting results (D5).

Trumpeter swan production was the second highest on record (G3).

The swan relocation project was successful (G3).

B. CLIMATIC CONDITIONS

Not enough can be said about the 1988 climate. New records were set across the nation as well as here. It was a year to remember. Many an old timer remarked that it was drier than the "dirty thirties" but since none of us from the refuge was here at that time we'll have to take their word for it.

The refuge has 46 years of weather records and 1988 proved to be the driest on record beating out 1979 by .17 inches. Table 1 shows the 1978-1988 precipitation records. This average was 19.46 inches, the 46 year average was 21.41 inches, and the 1988 reading was 13.11 inches.

Not only was it dry but hot too. We broke our record in June and August when temperatures hit 91°F and 90°F respectively. For another record breaker we recorded 67 days above 80°F from June 4 to September 6. This may not seem hot on the national scale but for Red Rocks it was a heatwave!

Temperatures were consistently higher than the 46-year average except in December when the thermometer plummeted (Table 2).

Snowpack was 50% or more below normal during the first part of the year, and snows quickly melted to bring spring almost 2 months early. Snows fell again in mid-November and by the end of December, snowpack on the ridge measured 29.65 inches, well above the ten-year average of 19.31 inches and over twice as much as 1987 of 11.75 inches.

A brief snow shower on September 11th broke the monotony of the long hot summer but quickly melted the same day. The first "real" snow came November 16th.

Table 1. Precipitation 1978-1988

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1978	1.53	1.67	0.18	3.21	1.10	1.26	1.87	0.93	1.95	0.17	0.67	1.13	15.67
1979	0.90	1.51	2.13	0.41	0.64	0.75	0.57	2.85	0.25	2.31	0.58	0.38	13.28
1980	0.63	1.02	1.42	0.84	6.06	3.79	1.98	2.52	3.69	0.64	0.67	1.64	24.90
1981	0.28	0.84	0.54	0.42	6.00	1.35	1.96	0.28	1.79	2.54	1.72	1.13	18.85
1982	1.08	0.36	3.94	1.94	1.18	2.01	2.30	0.56	3.10	2.48	2.08	2.46	23.49
1983	0.35	1.19	4.31	0.29	0.71	2.91	2.93	2.75	2.71	2.03	2.45	0.87	23.50
1984	0.35	0.44	0.94	2.91	3.07	4.22	4.67	2.02	5.49	1.80	1.40	0.85	25.16
1985	0.35	0.94	1.58	0.71	1.79	0.76	1.47	0.61	3.14	1.17	1.95	0.51	14.98
1986	0.32	0.97	1.93	3.56	3.90	2.59	1.54	3.04	2.27	0.56	0.91	0.00	21.59
1987	0.86	0.73	1.82	0.85	3.56	1.88	6.63	1.36	0.00	0.03	0.94	0.00	19.55
1988	<u>1.11</u>	<u>0.25</u>	<u>0.38</u>	<u>2.86</u>	<u>2.48</u>	<u>0.94</u>	<u>0.67</u>	<u>0.24</u>	<u>0.50</u>	<u>0.05</u>	<u>2.39</u>	<u>1.54</u>	<u>13.11</u>
X =	0.71	1.61	1.74	1.64	2.74	2.04	2.42	1.56	1.99	1.25	1.43	1.04	19.46

Table 2. Mean monthly average temperatures 1988 and 46 year average

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1988	10.70	16.60	25.00	39.00	46.30	57.20	62.40	59.50	49.50	45.00	24.00	8.20
46 yr	10.25	14.20	23.25	35.90	45.80	53.10	58.70	57.20	47.60	38.80	22.38	10.80

C. LAND ACQUISITION

1. Fee Title

Final purchases were completed on two inholdings on the refuge during the year (Figure 1).

The Saier tract (431 acres) was acquired at a cost of \$237,000. This tract came with a 5 year grazing reservation attached, as well as use of corrals as long as Saier retains a grazing permit on the refuge or grazes his property immediately adjacent to the tract we acquired.

The Kinard tract (120 acres) was acquired at a cost of \$102,000. This tract came free of encumbrances except for a right-of-way across the tract to get to a portion of the property which was not sold to the Fish and Wildlife Service.

Negotiations continued on the remaining 351.8 acres of the Saier tract. An offer was made to the Saier family in August. However, in the meantime, Saier sold the timber on the property to the Brand S sawmill in Livingston. Saier also filed for bankruptcy at this time. The Service reviewed its offer based on the value of the property minus the timber and made a counter offer to Saier's attorney handling the bankruptcy. The offer was refused and the attorney threatened to sue the Service for changing its offer. At year's end the issue remains unresolved.

Some logging has occurred on the tract which greatly diminishes some of the values which we are trying to protect by purchase.

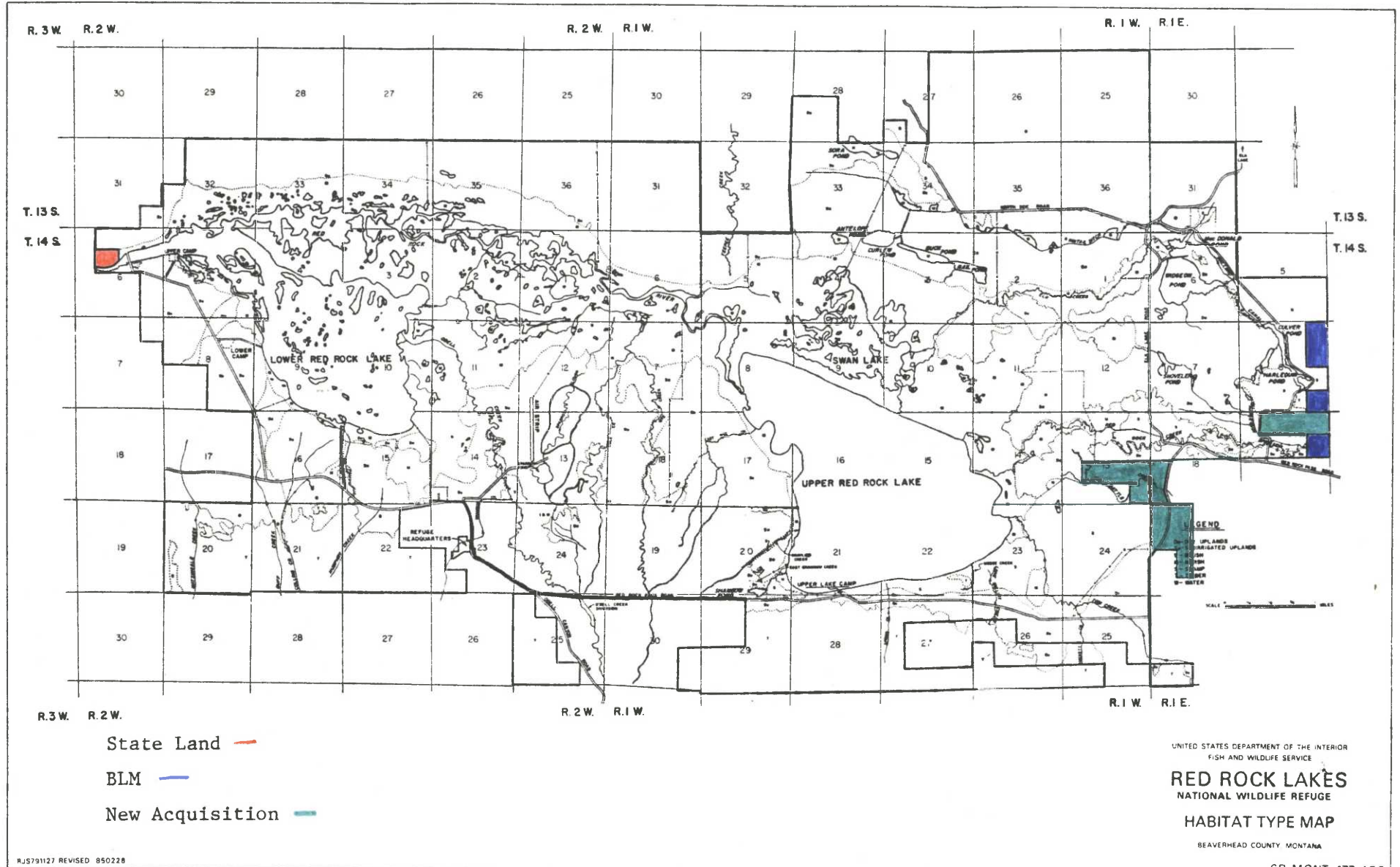
Efforts continued to acquire the Walsh tract; however, Walsh stated he wasn't interested in selling this tract at any price. A private third party has acquired a ranch at the west end of the Centennial Valley and will attempt to work out a trade with Walsh for the tract the Service wants. He will then sell this tract to us. This appears to be our last chance to secure this property in the foreseeable future.

2. Easement

At year's end a conservation easement was being negotiated with FmHA on the Nyquist Ranch, approximately 18 miles north of Dillon on Highway 41, (T4S, R7W, Madison County, Montana, S25: a portion of the SW $\frac{1}{4}$).

The easement would give the Service control of grazing and wetlands on a 54 acre tract immediately east of the highway,

Figure 1. New additions to Red Rock Lakes NWR



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HABITAT TYPE MAP

BEAVERHEAD COUNTY MONTANA

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and would provide basic floodplain protection to a riparian area west of the highway.

The property contains some shallow wetlands which had been excavated years ago for gravel, and uplands with stands of buffaloberry and grassland.

3. Other

The Refuge assumed management control of a 26 acre tract at the west end of the refuge which is owned by the Montana Department of Fish, Wildlife, and Parks (Figure 1). The tract was fenced into the refuge during the winter and will be managed a part of the refuge.

The Refuge continued contact with the BLM in order to secure a trade of management on several isolated Federal tracts in the area (Figure 1) The refuge would assume management of three BLM tracts totaling 160 acres which are adjacent to the refuge, and BLM would assume management control of 4 Service tracts totaling 440 acres. These tracts would be managed as part of an Area of Critical Environmental Concern which seeks to protect the unique sand dunes on the north side of the Centennial Valley.

An agreement was developed and is awaiting final action by the BLM which is supposed to be completed by the spring of 1989.

The Service has requested the BLM tracts adjoining the refuge be withdrawn from the BLM and transferred to the FWS. This process will likely take several years.

D. PLANNING

4. Compliance with Environmental and Cultural Resource Mandates

Section 7 consultations were prepared for the refuge hunting programs and for the Tucks Slough project.

An environmental assessment was prepared for the Tucks Slough project.

5. Research and Investigations

Tom Creek Watershed Review - On January 26, Refuge Manager Reiswig and Assistant Refuge Manager Kurtenbach met with Director Glimp and his staff of the U.S. Sheep Experiment

Station, Dubios, Idaho, concerning the continuing erosion on the Tom Creek watershed. The watershed area is managed by the Agricultural Research Service, USDA.

The refuge called the meeting to express its concerns about the poor and eroding condition of the Tom Creek area. Glimp stated he didn't think sheep grazing on the area was the cause of the problem. We agreed to meet on the site during the summer with experts in the soils and erosion area.

Refuge Manager Reiswig, Assistant Refuge Manager Gilbertson, and Dr. Clifford Montagne, Soils Professor from Montana State University met with Sheep Station personnel and a large group of soils personnel from the Soil Conservation Service.



Sediment Gauge on Tom Creek. (NG)

The soils and geology of the area were reviewed. It was determined that the area of about 350 acres was probably scorched by a severe forest fire in the 1930's which removed the litter and top soil horizon.

Because of the particular geology of the site and the accompanying poor soils there has been relatively little vegetative regeneration. The annual movement of sheep across the area has not helped the situation.

The Sheep Station and the Refuge agreed to install several grazing enclosures to observe the impact of sheep on the site over a several year period. These were installed in August.

The refuge and the U.S.G.S. installed a sediment monitoring station on the flats below the watershed area and began monitoring the sediment flow out of the area. The dry year coupled with illegal upstream diversions dried the creek up for most of the year so little data was gathered. The situation is further complicated by the addition of silt loads from several other feeder creeks to Tom Creek. Several of these have slumping activity on them.

The refuge will intensively monitor the situation for a few years to get a better handle on the amount of silt being dumped into the Upper Red Rock Lake by the Tom Creek watershed.

Effects of Grassland Management Practices on Non-game Wildlife Species Use--Janissa Balcomb and Brian Stephenson

The purpose of this study is to look at the relationship between the refuge's grassland management practices, including grazing, prescribed burning, and rest, and non-game wildlife use of the refuge. Information provided by this project will be used in evaluating and revising the refuge's grassland management plan.

It was a very successful year with some interesting results. In terms of diversity, grazed areas have lower small mammal diversity while burned areas and control areas have higher small mammal diversity. The relationship between bird diversity and treatment type is less clear. Bird diversity appears similar between all treatments, though burning may reduce it slightly more. Bird diversity increases in burned areas as the length of time since burning increases, up to two years.

The effects of each treatment on bird and mammal densities vary with the species and length of time since treatment. Areas grazed more recently have lower vole densities while areas grazed longer ago, including non-use areas, have higher vole densities. Burned areas have lower vole densities following the burn.

Some bird species appeared to be affected specifically by grazing, burning or non-use. Burn areas attracted horned larks one year after burning but the horned larks did not use burned areas otherwise. Canada geese and long-billed curlews avoided burned areas. This seems to be contrary to results of other studies and needs to be looked at further. Sandhill

cranes may prefer burned over grazed areas. Short-eared owls preferred areas grazed three or more years ago. Meadowlarks had higher densities in grazed areas and little to no use of burned areas. Lark buntings occurred only in grazed areas, restricted to sagebrush. Most other species showed no preference for one treatment or another.

Savannah sparrows have higher densities the longer the time since treatment up to four years, with the exception that areas grazed two years previous have lower densities than all other grazed areas. Four or more years after treatment, the density drops off. There seem to be no differences in densities in grazed or burned areas overall. Areas grazed three years ago have the highest densities while areas grazed two years ago and areas burned this year had the lowest densities. More nests were found in grazed areas than in control areas or in burned areas. Densities were highest in dry upland grasslands interspersed with sub-irrigated and/or sparse brushy areas. Similar upland areas but with more saline/sodic soils had slightly lower densities. Densities were lowest in sandy, sagebrush areas. The second lowest densities were in areas of predominantly sub-irrigated grassland.

Because of differences in vegetation, soil types and soil moisture, some sections of the refuge are better or worse for wildlife regardless of treatment. Irrespective of treatment, the north-northeast section has the highest small mammal diversity and the highest vole densities. The west-southwest section has the lowest vole densities and low diversity. For birds, the northeast and west-southwest sections of the refuge have the highest diversity and number of species present. The northeast section also provides a unique habitat for several bird species not normally found elsewhere on the refuge, including sage thrasher, lark bunting, vesper sparrow, grasshopper sparrow, and Brewer's sparrow. The predominantly sub-irrigated areas of the south-southwest, north-northeast, and east have fewer bird species present.

Work will continue on this project next year.

E. ADMINISTRATION

1. Personnel



7. 5. 3. 4. 8.

- 1. Barry, Reiswig, GS-11 (PFT) Refuge Manager
- 2. Bill Kurtenbach, GS-9 (PFT) transfered 3/88 Asst. Manager
- 3. Nancy Gilbertson, GS-9 (PFT) EOD 6/88 . . Asst. Manager
- 4. Carl Mitchell, GS-7 (PFT) Asst. Manager
- 5. Charlie Young, WG-10 (PFT). Heavy Equip. Mechanic
- 6. John O'Connor, WG-6 (Career Seasonal) . Maintenance Helper
- 7. Jackie Vann, GS-5 (Temp Intermittent) . . Refuge Assistant
- 8. Janissa Balcomb, GS-6 (TFT). Biological Technician
- 9. Kent Luttschwager, GS-5 (TFT). Biological Technician
- 10. Brian Stephenson Volunteer
- 11. Harry Young Volunteer

Several personnel changes occurred during the year. Assistant Manager Bill Kurtenbach transferred to the Waubay Refuge in South Dakota on the 27th of March.

After more than three years of service at Red Rock Lakes, Bill left an impressive record of accomplishment especially in the areas of water and predator management.

Assistant Manager Nancy Gilbertson arrived on the 17th of June to replace Kurtenbach. Nancy's prior duty station was Rio Grande Valley NWR in Texas, and represents a change from one of the hottest to one of the coldest refuges in the Continental U.S. One of the warmest summers on record eased Nancy's transition to the snow belt.

Refuge Clerk Teri Kurtenbach also departed Red Rock Lakes with her husband Bill in March. Teri did an outstanding job and her departure left the station staff fumbling around attempting to do payrolls and pay bills.

Jackie Vann replaced Teri starting on the 9th of May and has effectively filled the Clerk position since that time.

Staffing patterns are shown on Table 3.

Table 3. Staffing patterns during last five years

STAFFING PATTERN				
Year	Full Time	Career Seasonal	Temporary	Volunteers
	(FTE)	(FTE)	(FTE)	
1988	4 (4)	1 (.58)	2 (1.06)	2
1987	4 (4)	1 (.50)	4 (1.33)	1
1986	4 (4)	1 (.50)	2 (.63)	4
1985	4 (4)	----	1 (.50)	5
1984	4 (4)	----	2 (.67)	3

4. Volunteers Program

Three volunteers contributed nearly 850 hours of service to the refuge this past year. Janissa Balcomb spent about 151 hours doing trumpeter swan observations at the wintering ponds to evaluate the effectiveness of the winter feeding program.

Brian Stephenson contributed 480 hours of effort to the grassland management monitoring project being headed up by Biological Technician Balcomb. This was Brian's second summer

as a volunteer on the refuge and he did an excellent job. Brian was paid \$1,001 in per diem during his twelve weeks here.

Harry Young contributed about 200 hours in station yard and airstrip maintenance during the early part of the summer.

Our volunteer program is greatly hampered by a lack of suitable housing on the refuge. Efforts will be made to upgrade the Compañeros Cattle Company bunkhouse by the summer of 1989 to provide more housing for future Volunteers.

5. Funding

Table 4 shows Red Rock Lakes funding (in thousands) by subactivity.

Table 4. Red Rock Lakes NWR funding (in thousands) during last four years.

FY	85	86	87	88
1260	196	262.5		
1261			179	181
BASE				
1262				79
MAIN				
1262				
SM ARMMS			31	
1262				
LG ARMMS			20	
1230				
MIGRATORY NON-GAME PROBLEMS				20
6860	7	5	5	5
8610	9.6	6.5	7.7	4.5
PERMITTEE				
REHAB		29.4	24.5	27.7
CONTAMINANTS			37.5	
TOTAL	212.6	303.4*	304.7*	317.2
DU PROJECT FUNDS	60	45	255	

* FY 86-87 L.W.C.F. Acquisition Funding 2,000,000

6. Safety

Red Rock Lakes broke a long-standing run of work days without a lost-time accident this year. Fortunately, our one lost-

time accident this year was not too serious. On 30 June, while working on a fence line in a wetland area, Heavy Equipment Mechanic Young removed his shoes and socks, anticipating shallow water. The water turned out to be about 3 feet deep. While Young was in the water, three leeches attached themselves to his leg and ankle. The leeches were not observed and removed until 4pm. On 5 July, Young noticed considerable swelling and discoloration around the bites. He visited his personal physician and was treated for the infection. The medication he received required bedrest for three days.

7. Technical Assistance

The refuge provided technical assistance, concerning the management of trumpeter swans, to a number of federal and state agencies, an Indian reservation, and a private landowner during the year.

Assistant Manager Mitchell worked closely with the Call of the Wild Ranch in the Paradise Valley near Livingston to aid in removing their free-flying flock of mute swans. The flock which once numbered more than a hundred individuals has been plaguing the Paradise Valley for years.

An agreement was developed with the ranch that the mutes would be removed from the ranch alive except for one pair which would remain and be used for cross-fostering trumpeters. Once the trumpeters are established the remaining pair would also be removed.

Most of the refuge staff spent a day on the ranch and captured 13 mutes. These birds were sold and shipped to new owners in other parts of the U.S. Bob Elgas, an aviculturist from Big Timber, provided invaluable assistance in holding the captured birds in his facility until they could be shipped. He also found new owners for a number of the birds.

From 15-20 mutes still fly free in the Paradise Valley. A big push will be mounted in 1989 to capture the remaining birds.

Considerable assistance was also provided to the Fort Hall Indian Reservation prior to and during the transplant of trumpeters to the reservation. Refuge staff worked with Reservation biologists in finding release locations. Biological Technician Kent Luttschwager spent much of the summer and fall on the reservation tracking the progress of the released swans.

Assistant Manager Mitchell developed an in-depth article for the Teton Science School in Jackson, Wyoming during the year.

This was printed in a School periodical devoted to trumpeter swan management. The document was very well done and gives an excellent overview of trumpeter swans in the Greater Yellowstone Ecosystem.

The refuge also worked with the Beaverhead National Forest, the Dillon Resource Area of the BLM and Harriman State Park on swan management during the year.

8. Other Items

Beaverhead County received \$22,110 this year for in-lieu-of payment. This again was well short of the amount the county should have received if payments were up to appraised levels.

Refuge personnel attended the following meetings during the year.

Reiswig	Jan. 5-12	LE Training, Marana, AZ
Reiswig, Kurtenbach	Jan. 26	U.S. Sheep Experiment Station Mtg., Dubois, ID
Mitchell	Jan. 28	Peregrine Falcon Coordination Meeting, Bozeman, MT
Reiswig, Mitchell	Feb. 2-7	Trumpeter Swan Society Convention Everett, WA
Reiswig, Kurtenbach	Feb. 9-12	Project Leader & Wildlife Society Meeting, Lewistown, MT
Kurtenbach	Feb. 16-20	LE Training, Marana, AZ
Reiswig	Feb. 18-20	Swan Briefing, RO
Reiswig, Mitchell, Balcomb	Feb. 22-26	Computer Training, Jackson, WY
Reiswig	Mar. 8-11	Pacific Flyway Technical Committee Mtg., Reno, NV
Mitchell	Mar. 15-17	Bald Eagle Working Group Jackson, WY
Reiswig, Mitchell	Mar. 22-23	SE Idaho Refuge Complex, Swan Habitat Review Pocatello, ID

Reiswig	Mar. 25	Nature Conservancy Natural Areas Meeting Butte, MT
Balcomb	Apr. 21	FWS Water Quality Training Stevensville, MT
Balcomb	May 2-7	S-190 Fire Training, Jackson, WY
Reiswig	May 20	Water Users Irrigation Co. Meeting, Lima, MT
Reiswig, Mitchell	May 23	Mute Swan Project, Call of the Wild Ranch, Livingston, MT
Reiswig	May 24-26	Montana Waterfowl Tour Great Falls, MT
Reiswig	Jun. 3-4	Greater Yellowstone Coalition Convention, Yellowstone N.P.
O'Connor	Jun. 6-10	S-390 Fire Training Boise, ID
Gilbertson	Jun. 28-30	BLM Riparian Training, Dillon, MT
Reiswig, Mitchell Gilbertson	Jul. 11	Tri-State Swan Sub- Committee Meeting, Harriman State Park, ID
All staff	Aug. 24	DU Lower Structure Dedication RRLNWR
Reiswig, Gilbertson	Aug. 30- Sept. 2	Project Leaders Meeting West Yellowstone, MT
Reiswig	Sep. 17	Robb Creek Game Range Dedication, Sheridan, MT
Reiswig	Oct. 6	Water Users Irrigation Co. Meeting RRLNWR
Reiswig, Gilbertson Mitchell	Oct. 7	National Wildlife Federation Riparian Coordination Meeting

Reiswig, Gilbertson	Oct. 17-18	Tucks Slough Water Rights Hearing Dillon, MT
Reiswig, Mitchell	Oct. 20	Swan Hazing Meeting, Harriman State Park, ID
Gilbertson	Nov. 15-17	Water Law Short Course, Denver, CO
Reiswig	Nov. 17	West Fork Planning Meeting Beaverhead National Forest Ennis, MT
Reiswig	Nov. 29	Recreation Land Agencies Coordination Meeting, Dillon, MT
Reiswig	Dec. 1	Western Montana College Wyoming Wildlife Society Meeting Casper, WY
Reiswig	Dec. 2-3	Montana Wilderness Association Convention, Kalsipell, MT

F. HABITAT MANAGEMENT

1. General habitat

Drought conditions affected every area of the refuge.

The most noticeable changes occurred in the wetlands, especially the wet, boggy, sedge meadows which became cracked and dry. Marsh, lakes, and streams were too low to even float a canoe. Hip boots were cast aside. Grasslands became dry and brown and brittle to the touch. Forest habitats even felt the effects as aspen leaves turned autumn colors almost 6 weeks early.

It was a dramatic and remarkable year for Red Rock Lakes.

2. Wetlands

Very little snow pack and extremely low precipitation this summer resulted in low water levels throughout the refuge wetlands. By June, no measurable water was flowing through the Lower Structure and by August, the water had ceased to flow at all.



River Marsh 1988 (CM)



River Marsh 1975



Lower Structure 1988 (CM)



Lower Structure 1966

This was also true for Sparrow Pond and Sparrow Slough which are fed from a diversion on O'dell Creek. Off-refuge water users diverted water from O'dell which left no water for these wetlands. This will no longer be a problem since the refuge has secured water rights from O'dell by buying the Campaños Tract.

The River Marsh, Upper and Lower Red Rock Lakes, Swan Lake, and surrounding subirrigated meadows were noticeably lower. Most of the "wet" meadows were dry.

Tom Creek and other small tributaries and drainages went dry by early summer.

Culver Pond dike (Figure 2) blew out in March, and although it was repaired in June, much of the aquatic vegetation on the south end died. For some unknown reason it did not revive itself by the end of the year. In 1989 we may have to do some supplemental plantings.



Culver Pond after dike blowout. (CM)

West Pintail ditch (Figure 2) did not receive any water until June because it receives its water via the Mallard Canal which receives its water from Culver Pond which had no water. However, West Pintail ditch proved to be highly productive in spite of the late filling.

Shoveler Pond (Figure 2) did not receive water until July because the diversion feeding it had been shut off in preparation for the construction of Tucks Slough. Tucks Slough, a 70 acre Ducks Unlimited wetland project, was postponed until 1989 because of a water rights disagreement, so water was again diverted to Shoveler Pond. This tiny pond was used by a pied-billed grebe family and blue-winged teal family of 5.

The new "Lower Structure" was completed in 1987 and discussed in the '87 narrative; however, it was not dedicated until 1988. Ducks Unlimited, with the support of Adolph Coors Company, Winchester Group/Olin Corporation, and GMC Truck Division played a vital role in making the project a reality.



Lower Structure dedication (MG)

5. Grasslands

A total of 15,786 acres of native grasslands occur on the refuge. Of this acreage, 10,245 acres are either sub-irrigated or saline sub-irrigated grasslands with varying degrees of productivity, depending of site-specific soil chemistry. These acreages do not include recent acquisition purchases.

Under the current grassland management plan, native grasslands combined with substantial areas of marsh, timber, and willow

bottom riparian habitat are managed in 22 units containing 25,106 acres, excluding recent acquisitions. Grazing is the primary management tool, although the use of prescribed fire has been integrated into the management process.

During the year, a total of 5 units, G-16A, G-12, G-5E, G-6, and G-3/4 containing 6,771 acres (4,269 grassland acres) was grazed and one unit, G-1S containing 448 acres was prescribed burned in the spring.

In 1988, Robel transects were read in 7 units, G-2, G-5E, G-6, G-8, G-12, G-15C, G-16A, and a Daubenmire transect was read in unit G-5E. Robel readings were generally static or declined slightly over readings taken 3 years ago. In the past Robel and Daubenmire readings were read each year on one-third of the units. However, this was changed last year so that readings are taken on a particular unit once every 5 years. This is based on recommendations from our range consultant.

Photo-points have been established in most of the units and are read annually to develop a visual record of grassland changes. Each of the grazed and burned units is reviewed on the ground at least annually to give the staff a better understanding of grazing patterns, response to fire and vegetative changes. Reports of the reviews are developed and filed with other grassland management data.

The extremely dry conditions of 1988 greatly reduced vegetative growth and nearly eliminated the extensive displays of grassland flowers which are generally so common in the Centennial Valley.

Biological Technician Janissa Balcomb continued and expanded her evaluation of grazing and burning management on grassland birds and small mammals. The results of her work when complete should provide excellent information on the impacts of these treatments of wildlife species and will lay out a blueprint for future management options which benefit wildlife species.

7. Grazing

Livestock grazing is the primary tool used at the present time to manage grasslands for mulch reduction, plant vigor, and species diversity. In 1988, 5 permittees used 5,036 AUM's (Table 5) on 4,269 grassland acres of the refuge. This use was equivalent to 1.18 AUM's/grassland acre. Grazing intensity varied greatly on the various units depending on outlined goals. A total of \$35,252 was generated at the rate of \$7.00/AUM.

Table 5. Grazing use

UNIT	GRASSLAND ACRES		AUM		DATES	GRASSLAND ACRES		DATES	1987		DATES	1988			
	TOTAL ACRES		FWS BASE	SCS RATING		TOTAL ACRES			AUM	AUM/ACRE		AUM	AUM/ACRE	AUM	AUM/ACRE
	ACRES	PERMITTEE	AS OF 1982	AUM		AUM	AUM/ACRE		AUM	AUM/ACRE		AUM	AUM/ACRE	AUM	AUM/ACRE
1N	<u>887</u> 1077	Wolfe	472	439	--	Rest	- / -	4-23	Burned	- / -	--	Rest	- / -		
2	<u>281</u> 494	Wolfe	572	511	5-18	Burned	- / -	--	Rest	- / -	--	Rest	- / -		
16A	<u>1055</u> 1065	Wolfe	972	915	--	Rest	- / -	--	Rest	- / -	8-9 10-14	932	0.88 0.87		
16B	<u>718</u> 1001	Wolfe	400	381	7-16 9-13	1045	1.46 1.04	--	Rest	- / -	7-14 8-9	357	0.50 0.36		
17	<u>1004</u> 1408	Wolfe	500	525	--	Rest	- / -	7-16 10-31	975	0.97 0.69	--	Rest	- / -		
3/4	<u>921</u> 1980	Matador	250	288	7-10 10-10	315	0.34 0.16	--	Rest	- / -	7-10 10-9	818	0.89 0.41		
1S	<u>370</u> 484	Matador	296	253	--	Rest	- / -	--	Rest	- / -	5-11	Burned	- / -		
5E	<u>1107</u> 1790	Saier Huntsman	533 500	--	7-10 10-12	1053 983 2036	1.84 1.14	--	Rest	- / -	7-11 10-10	869 856 1725	1.57 0.97		
5C	<u>885</u> 1223	Saier Huntsman	533 500	--	--	Rest	- / -	--	Rest	- / -	--	Rest	- / -		
5W	<u>680</u> 1465	Saier Huntsman	533 500	--	--	Rest	- / -	7-13 10-11	883	1.30 0.60	--	Rest	- / -		
11	<u>631</u> 940	Raffety Huntsman	620 176	729	--	Rest	- / -	7-10 10-18	923	1.46 0.98	--	Rest	- / -		

Table 5. Grazing use (cont'd)

12	<u>965</u> 1687	Raffety Huntsman	620 176	735	--	Rest	- / -	--	Rest	- / -	7-13 10-11	954	0.99 0.57
13	<u>1930</u> 1985	Raffety Huntsman	620 176	735	7-11 10-25	1285 369 1654	0.86 0.88	--	Rest	- / -	--	Rest	- / -
15A	<u>756</u> 856	---	798	793	5-19	Portion Burned	- / -	4-12	Burned	- / -	--	Rest	- / -
15B	<u>951</u> 1132	---	798	742	--	Rest	- / -	4-12	Burned	- / -	--	Rest	- / -
15C	<u>956</u> 1137	---	798	877	--	Rest	- / -	7-23 10-16	1442	1.52 1.27	--	Rest	- / -
6	<u>221</u> 249	Huntsman	--	192	--	Rest	- / -	--	Rest	- / -	7-10 7-31	251	1.14 1.00
14	<u>2723</u> 2723	---	168	838	9-14 10-31	853	0.31 0.31	--	Rest	- / -	--	Rest	- / -
7	<u>120</u> 361	---	--	264	--	Rest	- / -	--	Rest	- / -	--	Rest	- / -
8	<u>276</u> 276	---	--	93	--	Rest	- / -	--	Rest	- / -	--	Rest	- / -
9	<u>357</u> 357	---	--	71	--	Rest	- / -	--	Rest	- / -	--	Rest	- / -
10	<u>82</u> 1071	---	--	692	--	Rest	- / -	--	Rest	- / -	--	Rest	- / -
10E	<u>246</u> 259	---	--	126	--	Rest	- / -	--	Rest	- / -	--	Rest	- / -

One permittee, Volker Saier, filed for protection under Federal bankruptcy laws and did not pay his 1987 grazing bill. Not only were we not able to collect the 1987 bill, we could not refuse grazing to Saier in 1988 because of non-payment of the 1987 bill under the legal protection afforded him. Saier was required to pay his total 1988 bill in advance of turn-in.

The experimental range improvements program which utilizes grazing fees for range improvements continued into its third year. Three projects valued at \$21,720 were completed, and an additional project valued at \$5,985 was approximately half done when winter snows halted work. The start of the project was delayed because of high summer fire danger. This will be finished during early summer in 1989. These projects included the reconstruction of 2.4 miles of boundary fence, the rehab of 3.3 miles of boundary fence to wildlife standards, the removal of 3.2 miles of standard interior fence and the installation of 5 miles of electric fence for unit divisions and to protect riparian habitats.

In addition, a local 4-H club was paid \$800 to remove larkspur from an area in G-16A by hand. The presence of the larkspur prevents an adequate grazing treatment on the unit. The 4-H group did a good job of removing the larkspur from flagged areas. However several other areas with larkspur were discovered later in the summer, so the treatment did not completely eliminate the plant from the unit.

The permittee rehab program has been extremely useful in improving fencing on the refuge and in protecting riparian areas on the refuge with electric fencing without straining our already tight resource management budget.

During the year G-16A was grazed at the rate of 0.88 AUM/grassland acre. Because of the larkspur in this unit, cattle were not turned on until August 9. Cattle were held in unit G-16B from July 14 when they entered the refuge. Because of the extremely dry conditions, the division fence between G-16A and G-16B was not functional and cattle freely moved between the two units. Most of the grazing pressure was confined to the heavy stands of sedge which was available because of the low water conditions in the marsh. It is safe to say that little constructive was accomplished by grazing on this unit during this treatment. Most of the uplands on the north half of the unit which needed treatment were not even touched by livestock.

This unit should be prescribed burned but this will be difficult to accomplish because of its location in relation to prevailing winds and its Wilderness status.

G-12 was grazed at the rate of .99 AUM/grassland acre from July 13 to October 11. The unit was divided into two halves by a three-wire electric fence. In addition an electric fence was located to prevent cattle use of the riparian habitat along Red Rock Creek. The west half of the unit received a good treatment, the east half received a somewhat spotty treatment. Water was diverted from Red Rock Creek through Shoveler Pond and into the east half of the unit to provide stock water away from the riparian zones. This was successful in drawing cattle away from the south end of the east half. The electric fence set up to keep cattle off Red Rock Creek did not work well although with heavy maintenance little impact occurred to the Creek's riparian zones. Rebar was used for posts on the electric fence and these caused considerable difficulty in keeping the fence working.

G-6 and G-5E were grazed in conjunction with each other. Huntsman put stock on G-6 on July 10 and moved them to G-5E on July 21. A total of 251 AUM's were used for a rate of 1.14 AUM/grassland acre. The unit received a good treatment although impact to Grayling Creek was heavy. In the future the south boundary fence should be moved north to exclude the creek from the grazing program.

Saier went on G-5E July 11 and used 869 AUM's before removal on October 10th. Huntsman joined him with the stock from G-6 on August 1 and used 856 AUM's. A total of 1725 AUM's were used on G-5E at a rate of 1.57 AUM/grassland acre.

The unit was split in half with the south half being grazed from July 10 to September 1, and the north half from then to October 10. The cattle concentrated on the southwest corner of the south half and much of the rest of the unit did not receive an adequate treatment because of a lack of stock water. When the stock was moved to the north half of the unit they stayed west of Nye Creek for several weeks until they were forced across the creek to the east side. The east side of the north half also received inadequate treatment.

G-3/4 received a total of 818 AUM's at a rate of 0.89 AUM/grassland acre. This is more than twice the pressure the unit has received in the past. Adequate treatment was received on most of the grassland areas of the unit. The riparian areas of the unit took a considerable beating though because of the concentration of stock in these areas.

Overall the grazing program is providing a diversity of habitats for wildlife species, however a much more sophisticated approach is needed to properly manage the refuge's grasslands in the future. The evaluation of the grazing program's impacts on wildlife should give management an excellent basis for further refining the program to make it

more responsive to the needs of a host of wildlife species dependent on the grasslands and associated habitats for survival.

9. Fire Management

A prescribed burn was carried out in G-1S in May. A total of 448 acres was burned to rejuvenate western wheatgrass and basin wildrye and reduce thatch and mulch accumulation. Although winds changed to the opposite direction, the burn was accomplished in a satisfactory manner.



Prescribed Burn (CM)

Wildfires could have been a very serious problem diuring the summer but landowners as well as the refuge exercised caution by closing lands late in the summer to public access until moisture fell in September.

Refuge staff fought 2 off-refuge fires as part of cooperative agreements with federal and local agencies. One was a lightning caused fire on a BLM grassland which burned approximately 1500 acres. The other was a lightning caused fire on a neighboring ranch which burned approximately 200 acres.



Yellowstone Fire from Red Rock Pass (CM)



North Fork Yellowstone Fire (CM)



"Yep, it works." Fire Engine Refresher Course (CM)

11. Water Rights

An application for a Change of Appropriation Water Right for Tucks Slough was protested by the Water Users Irrigation Company (local landowners and water rights holders) in June. This held up the Tucks Slough project, a Ducks Unlimited venture. A hearing was held in October with the objectors and the Montana Department of Natural Resources. A decision will be made in 1989 but it looks favorable for the refuge.

12. Wilderness and Special Areas

Since the majority of the refuge is in Wilderness designation, we continue to strive to work within the special bounds of the Wilderness Act. That includes fence maintenance. Several miles of fence were repaired this past year with the aid of a trusty steed and a good pack saddle.



Packing fencing materials in wilderness area (JO)

G. WILDLIFE

1. Wildlife Diversity

Varied habitats on the refuge support a diverse fauna. Some 258 bird species have been recorded on the refuge. Forty-two species of mammals, 10 species of fish and at least 5 species of reptiles and amphibians also inhabit refuge lands. Species range in size from shrews to moose, and from hummingbirds to trumpeter swans. Rare species like Peregrine falcons are present with abundant species such as savannah sparrows. The abundant, high quality habitat on, and adjacent to, the refuge, and the relative remoteness of the region contribute to the variety and abundance of wildlife populations.

2. Endangered and/or Threatened Species

A pair of bald eagles has nested by Culver Pond for about 16 years. (Apparently they nested for some years before they were found by refuge personnel.) They are consistent producers and fledged 1 eyes this year. They nested again in the nest

built by refuge staff after the original nest tree blew down in 1986.

The adults spend all year on or near the refuge. They forage on fish and waterfowl, primarily on Culver and MacDonald Ponds. Immature bald eagles are also observed regularly. We are not certain, but we suspect some of these are previous years young from Culver. Others are dispersing from nest sites in Yellowstone National Park, and other areas. Eagle numbers increase during spring and fall migrations. No regular census efforts (except the national Mid-winter Bald Eagle Survey) have been initiated. In 1988, the Survey revealed 2 adult and 1 immature bald eagles.

Peregrine falcons were observed regularly during spring and summer months. A pair bred, and fledged 3 young off an eyrie on the refuge. Both of these birds were hacked out as eyases by the Peregrine Fund. Another pair of banded sub-adults defended an unused hack tower and displayed courtship behavior. We expect them back in 1989, and hope they produce young.

We had only one whooping crane sighting this year. On 25 August, Assistant Refuge Manager Gilbertson observed a banded (yellow-left, blue-right) whooper feeding near Pintail Ditch.

3. Waterfowl

TRUMPETER SWANS

Our annual Mid-winter trumpeter swan survey was conducted between 14-17 February. This survey is designed to provide as nearly a complete count as possible of the entire Rocky Mountain Population. The Rocky Mountain Population is comprised of the Interior Canada sub-population, and the Tri-state sub-population. Red Rocks Lake swans are one flock in the Tri-state sub-population. The 1988 Mid-winter total was 1710 trumpeters. This was the highest number of trumpeters recorded during a Mid-winter survey. "White birds" totaled 1308, and cygnets totaled 402. Some 21.6% (370) swans were counted on the refuge. This was the largest single concentration in the Tri-state area. A procedural protocol covering the purpose, planning and conduct of the area surveys was completed at RO request.



Trumpeters on wintering pond (CM)

Winter feeding ended on 15 April. Most of the swans were utilizing available aquatics elsewhere, but a few birds still used the feeding ponds regularly. Both feed storage bins were emptied (2000 bushels), following a data analysis showing a strong, positive correlation between the amount of wheat provided over-winter and the subsequent summers reproductive output (i.e. mean clutch size, % hatching rate, mean brood size), and computations that provided a basic formula for providing a specific amount of wheat per bird per day. The formula worked reasonably well, with small amounts of wheat left at nest feeding days. Most of the wheat provided was distributed in scattered, small piles, based on studies showing that this was the most efficient method as determined by total swan use. On some days it was too windy to safely use the boats, and wheat was distributed via a spout directly from the bin to the water. Dike failure on Culver (see F2) also lowered water so that no broadcasting of wheat was possible from late March. We noticed no detrimental effects on the swans.

We began feeding for the winter of 1988-89 on 2 December.

Our production this year began very well, but severe cygnet losses occurred during the prolonged drought. Although open water, and presumably invertebrates and aquatic vegetation was

available, much of what is normally brood water dried up, and many family groups had to move considerable distances through unproductive habitats while cygnets were still quite young. Most of the cygnet mortality occurred after the first week or so in July. Until that point we were looking at another potential record production year. Our final production was 54 cygnets to fledging, around the long term average, but well above recent years, in spite of the drought. Table 6. documents appropriate production data for the last ten years.

Table 6. Comparative trumpeter swan production data at Red Rock Lakes NWR, MT, 1987-1988.

Year	Number of Nesting Pairs	Mean Clutch Size	% Eggs Hatching	Maximum Number Cygnets Observed	Maximum Number Cygnets fledged	Percent mortality (hatch-fledge)
1979	47	5.00	65	116	54	54
1980	41	4.80	21	18	6	66
1981	44	5.33	58	90	37	59
1982	24	4.07	29	17	4	77
1983	29	4.60	50	46	19	59
1984	31	4.75	20	30	4	87
1985	24	5.00	67	63	42	34
1986	25	4.25	53	26	15	43
1987	34	5.70	86	127	96	25
1988	34	7.30	91	113	54	53

We were able to take advantage of 1987's excellent production and implement the first phase of a relocation effort outlined by the North American Management Plan for Trumpeter Swans.

Twenty eight molting yearling swans were captured on Upper Red Rock Lake on 9 July 1988. We had two airboats and 18 people from the refuge, Wyoming Game and Fish, Idaho Fish and Game, and the Fort Hall Indian Reservation on hand. Capture, processing, transport and release went very smoothly. Fifteen swans (8F, 7M) all marked with patagial tags were released at Fort Hall Indian Reservation in southeast ID, less than 7 hours after capture. Fort Hall contains abundant, high quality, year-round trumpeter swan habitat. The other 13 swans (9F, 4M), also marked with patagial tags, were released at Grays Lake NWR, southeast Idaho, about 6 hours after capture. Grays Lake normally contains very high quality summer and breeding habitat, with excellent winter habitat just "over the hill" (circa 30 miles) on the Salt River in Wyoming.



Ruth Gale, Idaho Game & Fish drawing blood during swan transplant (BR)



Swan in onion bag straight jacket awaiting new home. (BR)

Bio-technician Luttschwager kept track of both release flocks as well as logistics and time allowed. No money was available for radio-telemetry equipment, so all data on movements and activity patterns was collected by visual observation or, after swans regained flight and dispersed, interview. Details are available in a filed report, but essentially the swans adapted well to their new homes. About one-half of each flock dispersed after regaining flight. Some left the area entirely, others made short forays afield and returned at intervals. As of this writing; 7 swans from Fort Hall are still there; 2 more were shot during the hunting season, but are recovering under veterinary care, 3 are known dead, and 3 are unaccounted for. Seven swans from Grays Lake are wintering on the Salt River in Wyoming; 2 are known to be, and another is suspected dead; and 3 are unaccounted for. Relocation efforts at these and other sites will continue as production at Red Rock Lakes permits. (We calculate expected over winter survival of known fledged cygnets, and will not remove yearlings unless at least 35 will be left at the refuge. In this way we will not deplete any one cohort, and our base breeding population will remain strong.)

We should note that the communications, planning and co-operation between two FWS regions, 2 refuges, 2 federal agencies, 3 state agencies, and any number of interested private individuals was nothing less than outstanding.

On yet another front, different efforts were being made to restore trumpeters to historic breeding and wintering habitat in Montana, by removing mute swans from the area.

In April, a private ranch manager contacted us about such a project. Refuge Manager Reiswig and Assistant Refuge Manager Mitchell visited the ranch, and found abundant high quality year-round habitat. In order to meet both the ranch's (capture for sale, no killing) and the Refuges (removal of mutes and replacement with trumpeters any way possible) objectives, we agreed to live-capture resident mute swans (for eventual sale out-of-state) and replace mutes with trumpeters by natural re-colonization, cross-fostering, direct relocation, or a combination of techniques.

On two subsequent visits refuge and ranch personnel caught 14 molting mute swans. About 14 others are still at large, and will be captured during their 1989 molt. Some trumpeters are using the ranch as a wintering site already, and once all of the more aggressive mutes are gone we expect a rapid re-colonization by the trumpeters. A few other mute swans are known to be in the area, but we do not anticipate a rapid population increase, based on the recent mute swan populations dynamics (i.e. a general decline from about 100 mutes in the late 60's to about 30 in 1988). We will remove all mutes if

possible. This project has been "on the back burner" for many years, and it is gratifying to have had the right person on the ranch at the right time. In addition to providing additional wintering habitat for perhaps 50 or so trumpeters, we hope that 3 to 5 breeding pairs will become established.

Our annual Tri-state survey, which records numbers of adult swans and fledged cygnets, was flown 19-23 September. Six hundred and one trumpeters (464 adults and 137 cygnets) were counted. This is the highest total since 1964. Two hundred and nineteen adults (47%) and 54 cygnets (39%) were counted on the refuge.

In response to predictions that the Henrys Fork of the Snake River in Idaho would freeze this winter due to low water, Biotechnician Luttschwager and Assistant Refuge Manager Mitchell spent 4 weeks attempting to haze trumpeters off of this important winter habitat, before the swans became too attached to it. Propane powered Zon guns and "banger" and "screamers" shot from clow pistols were used. Initial efforts were encouraging, but a constant influx of trumpeters from other areas kept us from clearing all the swans out. Since water remained open and vegetation available, we opted to leave the swans alone until it became absolutely vital to move them, i.e. when the river freezes over completely. Perhaps we should have taken this approach from the start, but it was worthwhile to try, and hindsight is after all, much clearer.

TUNDRA SWANS

Tundra swans were not present very long this year, nor were they present in large numbers. About 1000 arrived on 26 October, and left 7 November.

CANADA GEESE

No formal surveys were conducted for Canada geese. Some data were obtained during other surveys. Goose production appeared to decline, with an estimated 30 goslings hatched.

About 3-500 Canada geese molted on the refuge this summer.

No geese were counted during the 1988 Mid-winter waterfowl count, and none were present at years end.

DUCKS

A total of 1054 ducks was present during the 1988 Mid-winter waterfowl survey. Mallards and Common goldeneyes comprised the majority, with a few Wigeon, Redheads, Barrows goldeneye, Bufflehead and a pair of Hooded Mergansers present as well.

Our aerial survey resulted in an estimate of 4809 pairs of ducks and only 429 pairs of coots on 14 June. Only one flight was made this year, the other being used to test an adaptation of line-transect sampling.

Waterfowl breeding pair counts since 1980 are summarized below.

Table 7. Estimated waterfowl breeding pair counts at Red Rock Lakes NWR, MT, 1980-1988.

Year	Ducks	Coots
1988	4809	429
1987	8721	2316
1986	4950	1041
1985	5247	1431
1984	4965	1788
1983	4275	1437
1982	4239	1560
1981	4628	1016
<u>1980</u>	4264	578
x	5122	1288

The duck breeding pair count was a bit below average this year. Pair behavior was noticeably different however, with hen observed with drakes throughout the day. This implied a lack of nesting activity, which subsequent production surveys confirmed. The technical literature contains several reports on waterfowl behavior during drought conditions, and our observations essentially paralleled descriptions in those reports. We had water present all summer, but there obviously wasn't enough of the right wetland types at the right time. There wasn't enough water present for us to manage. The result was that several thousand ducks concentrated on the lakes all summer.

Waterfowl production was correspondingly poor, with an estimated 1576 ducks and only 54 coots produced. The table below shows prior years survey data for comparison.

Table 8. Estimated waterfowl production estimates for Red Rock Lakes NWR, MT, 1980-1988.

Year	No. ducks	(dabbling - divers)	No. coots
1988	1576	(1027- 549)	54
1987	7060	(3770-3290)	1781
1986	4414	(3147-1267)	2038
1985	7603	(4078-3525)	2063
1984	7703	(3108-4595)	3100
1983	7495	(4386-3109)	3306
1982	6748	(4215-2533)	3383
1981	7958	(4011-3947)	3880
<u>1980</u>	4044	(2038-2006)	1888
x	6066	(3308-2758)	2388

4. Marsh and Water Birds

An aerial survey of sandhill cranes found only 23 pairs, 7 singles and 8 in groups, for a total of 61. Few nests were found, and only 1 colt was observed all summer. Again, the severe drought reduced available nesting and foraging areas, especially impacting young.

A new great blue/black-crowned night heron rookery was begun in Lower Red Rock Lake this summer, on hummocks exposed by low water levels. We estimate a total of 85 great blue heron nests on the refuge. With an average brood size of 3.5 (range 2-4, N=11), production is estimated at 297. This is well above average. No estimates of production are available for the other thirteen species of marsh and water birds present. Plans to census a gull colony were postponed because the colony was abandoned due to drought conditions.

About 300 white pelicans used the refuge (primarily Upper Red Rock Lake near the mouth of Red Rock Creek) during the summer. These birds were likely foraging here from some unknown distant nesting colony. They generally arrived between 8 and 9 am, and left in early to mid-afternoon.

White-faced ibis were abundant again. We suspect, but were unable to confirm nesting.



Great blue heron young. (CM)

8. Game Mammals

Moose, elk, white-tailed and mule deer, and pronghorn all occur on the refuge. Elk and pronghorn use is usually seasonal, although a few elk apparently got trapped by heavy snows and wintered in timber and willow habitats on the east end of the refuge this year. No data are available on densities or production for elk or deer.

Three moose surveys were conducted in 1988. Two were completed by the Montana Department of Fish, Wildlife and Parks. (Since the state surveys large geographic areas for moose, we can often obtain the necessary data from them, saving our limited funds). The January count tallied only 18 adults and 6 calves. We assume that a light snowpack allowed many moose to continue using forested habitats. A March flight tallied 38 adults and 20 "short-yearlings". In May we found 37 adults, 13 yearlings and 1 newborn calf. Although we missed the main calving period (or else many cows calve in timbered habitat) we were not able to fly any more moose surveys. The refuge moose population is apparently stable at 50-60. As usual, moose from the Centennial, Snowcrest and Gravelly Mountains migrated to the extensive willow habitat on the refuge to winter.

We completed two aerial surveys for pronghorn. A 7 June survey tallied 51 bucks, 115 does, 3 fawns (early) and 1 unclassified antelope for a total of 170. The buck:doe ratio was 45.4:100. Table 9 shows results for the last five years early survey.

Table 9. Antelope survey 1984-1988

Year	Date	# bucks	# does
1988	7 June	51	115
1987	3 June	44	226
1986	6 June	43	182
1985	7 June	35	115
1984	22 June	23	134
mean	---	39	154

Pronghorn production was surveyed on 18 July. We found 25 bucks, 127 does, and 59 fawns, totaling 211 animals. The buck:doe ratio decreased to 19.6:100. Fawn:doe ratio was 46.4:100. A survey by the state on 21 July resulted in a buck:doe ratio of 43.3:100, and a fawn:doe ratio of 100:100. The state biologist noticed conspicuous herd movements to the few areas with green forage. We may have had some movement off-refuge by lactating does. Since the refuge is only a small area surrounded by contiguous pronghorn range, we expect considerable short-, and long-term variation in numbers, sex, and age ratios due to normal herd movement, and variations in forage production, water availability, predation (including fall hunting) and weather.



Where the deer and the antelope play

10. Other Resident Wildlife

We discontinued our muskrat house count in 1988. Counts over the years have indicated an abundance of rat houses, at least as far as potential swan nest sites are concerned. This was a difficult flight to plan and conduct from a logistical standpoint, and we opted to use the flight time to gather other, more useful data.

On 20 September, Assistant Refuge Manager Gilbertson and Biological Technician Balcomb observed a tiger salamander in Pintail Ditch. This is a new addition to our list of reptiles and amphibians.

11. Fisheries Resource

Looking over the files for the past 50+ years, we have asked and answered the same questions over and over again about our fisheries resources and this past summer was no exception. To get some answers the Creston Hatchery and Bozeman Fish Tech Center were brought in to assess the situation. Several important questions were posed:

1. What is happening to the grayling population, especially in O'dell Creek?
2. What can be done about the siltation problem in O'dell? Besides the erosion problem on the refuge, are off-refuge sites involved?
3. Do beaver dams block the upstream migration of grayling and do the dams hold back silt which covers the spawning gravel?

Besides these questions, other interesting observations were made including the great numbers of fish (grayling, cutthroat, brook and rainbow trout) trapped in diversion canals. Sometimes the number of fish in the canals were greater than the creek itself. This was true in both Red Rock and O'dell Creeks. O'dell will get a rest from diversion for a while but the diversion from Red Rock Creek, which feeds several wetlands on the refuge will need to be dealt with in the way of a fish screen. Art Viola, of the Bozeman Fish Tech Center has sent in a proposal for a grant to the Trout Unlimited to help fund, among other things, the purchase of a fish screen. The next year hopefully will tell the tale.

Other habitat improvements include replacing two small culverts on the County Road by O'dell Creek with a bridge. This of course takes money too and we can only hope that things will look better in 1989 or 1990.

The refuge will continue its efforts to fence out all riparian areas to cattle.

At the request of the Fish hatchery all the beaver dams were pulled prior to freeze-up on O'dell Creek. This is still a questionable practice. Since the lower lake is so shallow, there may not be enough oxygen to sustain grayling in the winter and they may actually be using the ponds behind the beaver dams for wintering habitat. In a good spring run-off, most beaver dams are naturally breached and washed away anyway. However, they definitely do hold back silt from being washed away into the lake.

So many questions have been left unanswered for 1989.

Biologists from the Creston Fish Hatchery successfully collected over 150,000 arctic grayling eggs which were hatched at the Bozeman Fish Technology Center. Grayling fry were stocked at Blackfeet Indian Reservation (30,000 fish) and Gibbon River, Yellowstone Park (24,400 fish). Although this was only a 32% survivability, this is considered very good for grayling.

At MacDonald Pond, 600 seven inch rainbow trout were stocked, and Culver Pond received 2000 three inch brook trout.



Electroshocking O'dell Creek for grayling count.



Art Viola and Ron Skates removing grayling eggs

12. Wildlife Propagation and Stocking

In response to last year's makeshift propagation of cygnets, Assistant Refuge Manager Mitchell prepared a rationale and plans for a regular propagation facility at the refuge. In addition to salvaging eggs from nests in jeopardy, we could use the facility to produce extra cygnets most years by double-clutching perennially productive pairs. Those "extra" cygnets could be used to augment cohorts and allow range expansion projects to continue on a regular basis. As part of a mitigation package for Jackson Lake Dam in Wyoming, the Bureau of Reclamation has allegedly approved funding for building, maintaining and staffing a propagation facility here. We are awaiting details.

15. Animal Control

In late summer, a family of beavers took over the culverts under the county road on Elk Springs Creek. After spending a total of about 10 staff days trying to keep the culverts open, we decided to trap the beavers. Three young and one adult were trapped and the problem was solved.

17. Disease Prevention and Control

Nine trumpeter swan carcasses were collected this year. Six of these were on the refuge, and three swans were found near release sites in Idaho. Four of the swans collected on the refuge, and two from Idaho, were forwarded to the National Wildlife Health Laboratory. No reports are available at this time. Three of the carcasses were so decomposed and/or scavenged that there was nothing to gain by sending them to NWHL.

Of the carcasses sent in 1987, two had elevated levels of lead in tissues, one was predated and the remaining had no obvious cause of death or disease symptoms.

H. PUBLIC USE

1. General

The refuge receives 10,000 to 13,000 visits annually. The majority of this number is from sightseers and nature lovers driving through the refuge on the county road. The rest is made up of hunters, fishers, campers, and a few school groups. Wildlife observers comprise about 85% of the refuge's visitors.

7. Other Interpretive Programs

Refuge staff was asked by the Teton Science School to contribute to an educational publication on trumpeter swans. The publication, Biologue, is a quarterly product of the Science School, and regularly highlights a particular species or concept in every issue (past issues included articles on elk, raptors, and winter). Assistant Refuge Manager Mitchell composed a short article for the Fall 1988 issue on trumpeters. A copy of this Biologue is Appended to this narrative. Copies are available from the refuge or the Teton Science School.

8. Hunting

Waterfowl hunters contributed approximately 125 visits which was down from an estimated 200 last year but above the average of 100 visits. Hunters did well in shooting their limit despite the drought conditions. Water levels were so bad (how bad were they?) that when birds were shot, they would pop onto the mud where men and dogs alike would wade half buried into the ooze to retrieve their prize. Canoes had to be

pulled through the mud to reach the water 20 feet from shore. It was a messy job, but there were a few die-hards that stuck it out for more than one weekend.



Two gates at Lower Structure open, but no water going through (NG)

Moose season opened on the 15th of September and ran through the end of November. As with last year, 5 bull and 2 antlerless tags were issued. All hunters were successful in filling their tags - most within the first 2 weeks.

Portions of the refuge are included in Montana Department of Fish, Wildlife, and Parks hunting units for white-tailed deer, mule deer, antelope, and elk. Heavy snows the second week in November trapped the elk on the valley floor. Refuge staff patrolled the road heavily to insure that no "road hunters" would harass the animals to move or shoot the elk from the road. This was a problem off-refuge where 17 elk out of a herd of 25 including cows were killed or wounded trying to cross the road. This sort of massacre was common this year due to the unexpected snowfall.

9. Fishing

Fishing of refuge streams opened the third Saturday in May except for that portion of the refuge lying east of Elk Lake road which opened July 15th. Angling pressure was even lower

than last year as water levels decreased. The blowout of the dike at Culver Pond did not help matters any where brook trout enthusiasts were concerned. Most of the fish at Culver escaped downstream and fishing remained poor even after the dike repair.

10. Trapping

One special use permit was issued to remove beavers from O'dell Creek but the early snow put a quietus on the trapper's efforts. So no beavers were taken by the trapper. However, four beavers were trapped by refuge personnel (see section G.15).

13. Camping

Two campgrounds are available to the public, one at the Upper Lake and the other at the River Marsh by the Lower Lake. The latter is used primarily by waterfowl hunters.

16. Other Non-Wildlife Oriented Recreation

Canoeing is probably the only other non-wildlife oriented recreation on the refuge. This has decreased in the past few years because of low water conditions, however, visitors continue to inquire about canoeing opportunities.



Happy campers--er canoers (NG)

17. Law Enforcement

No citations were issued this year. This does not mean that the refuge is without law enforcement problems, however. A dead moose was found illegally shot. Also, snowmobile trespass was evident in several places this winter when the drifts on the county road became very rough. Snowmobilers preferred driving on the refuge lands adjacent to the road. A few more signs tacked up at trespass points curtailed, but did not completely halt, the entry.

I. EQUIPMENT AND FACILITIES

1. New Construction

This summer, an arctic entry way was replaced on quarters #94. The new entry way allows for storage of winter gear outside of the main house.

New windows were installed in quarters #1. This is a major energy saving project for the 50 year old log cabin. Both quarters #1 and #90 had their logs chinked with a Butyl-rubber based sealant. The new chinking and windows have greatly improved the winter fuel consumption in these log houses.

2. Rehabilitation

The dike at Culver Pond blew out in early spring from what was believed to be river otters burrowing into the dike. Heavy Equipment Mechanic Young repaired the structure. A new culvert was installed with wing walls on the upstream side. An anti-seepage diaphragm was placed in the middle of the dike. Materials were hand tamped around the culvert and around the gate pipe. Approximately 100 cubic yards of fill were used to rip-rap the uphill slope.



Revamped dike at Culver Pond

Quarters #94 was repainted on the inside from top to bottom (the basement included) in anticipation of the new tenant, Assistant Refuge Manager Gilbertson.

4. Equipment Utilization and Replacement

A new Four-trax arrived to replace the 3-wheel ATV. We will all miss the versatility of "Big Red", the 3-wheeler, but realize the necessity to replace it.

A new John Deere rotary tiller was purchased to aid in planting cover around wetlands and on islands.

A new mower attachment for the John Deere 750 tractor replaced the old riding lawn tractor.

J. OTHER ITEMS

1. Cooperative Programs

Heavy Equipment Mechanic Young maintained the weather station for the National Weather Service, and conducted the snow course survey during the winter months for the Soil Conservation Service.

The refuge has cooperative agreements with the Lima Volunteer Fire Department and BLM to assist in fires in the local vicinity. Members of the staff assisted on 2 grass fires during the summer and fall.

The refuge worked with the Idaho Department of Fish and Game and the Wyoming Department of Game and Fish to produce posters which will be posted in areas where the swans may be in danger of getting shot. The first batch (Figure 3) didn't turn out quite right but the second batch (Figure 4) was on the mark.

4. Credits

Balcomb: D5, J4

Gilbertson: A, B, F1, F2, F9, F10, F11, F12, F13, G15, H1, H8, H9, H10, H13, H17, I1, I2, I4, J1, J4, K and edit.

Mitchell: E6, G1, G2, G3, G4, G8, G10, G12, G17

Reiswig: C1, C2, D5, E1, E4, E5, E7, E8, F5, F7,

Vann: Typing and construction

Young: I1, I2, I4

Photo Credits

CM= Carl Mitchell
 NG= Nancy Gilbertson
 BR= Barry Reiswig
 BK= Bill Kurtenbach
 MG= Mike Gurnett (D.U.)
 JO= John O'Connor

COMPUTER USE

In February, three members of the staff, Refuge Manager Reiswig, ARM Mitchell, and Bio-tech Balcomb, attended one week of computer training in Jackson, Wyoming, put on by the Regional Office. The training emphasis was on the use of dBASE III, with a smattering of DOS and WordPerfect. The staff left training with mixed emotions about computers and just enough knowledge to be dangerous. All the staff is now at least minimally competent on WordPerfect, and all reports are produced on WordPerfect. The learning hasn't been without pain though. The computer has nearly made it through the office window several times.

Figure 3 Pelican Poster

DON'T SHOOT!

Help Protect Our Trumpeter Swans

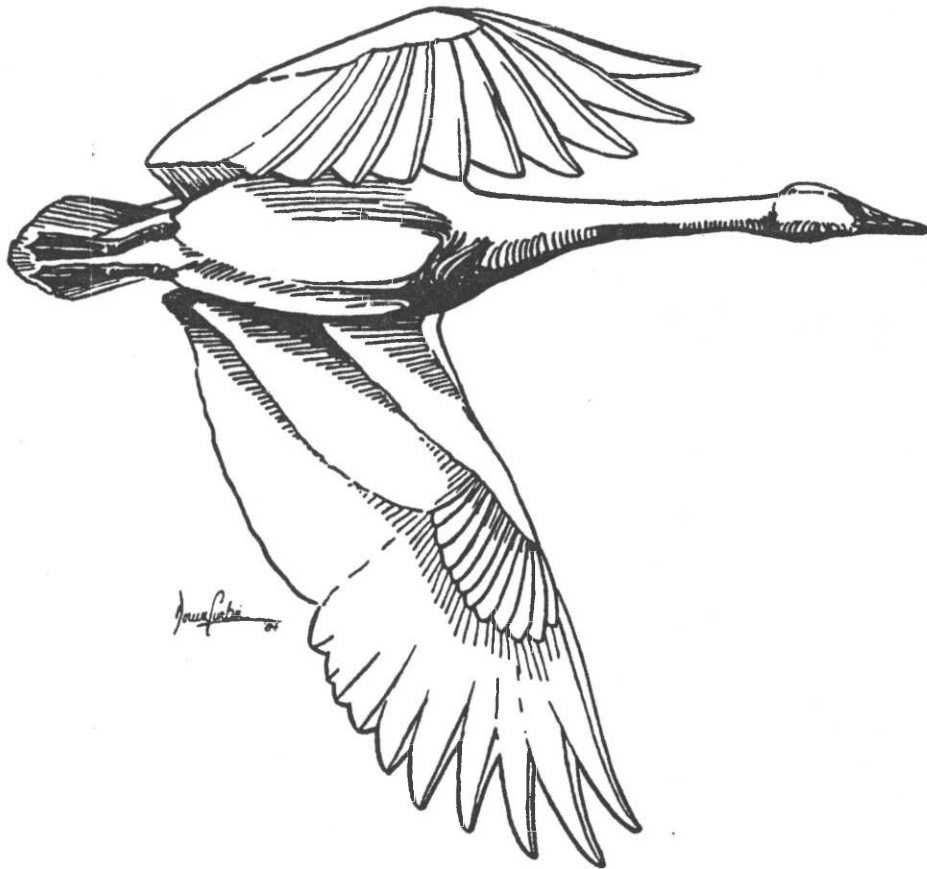


Trumpeter swans are being restored
to this area and we need your help
for this effort to succeed.



DON'T SHOOT!

Help Protect Our Trumpeter Swans



Trumpeter swans are being restored to this area and we need your help for this effort to succeed.



dBase III remains an enigma to most of the staff. Bio-tech Balcomb has adapted a dBase III program received from Montana Fish, Wildlife, and Parks Department originally designed for use with Bald Eagle nests. It has been adapted for use with Trumpeter Swan nest surveys. The program is now completely menu-driven and requires only minimal computer skills and no knowledge of dBase whatsoever to use.

Clerk Vann taught herself WordPerfect and Lotus 1-2-3 and has designed a Lotus spreadsheet to keep track of procurement records and to help with reports. Otherwise, Lotus remains an untapped resource.

The software program, TRANSECT, which does line transect analyses has received a lot of use and been extremely helpful analyzing data from the grassland management study being done by Bio-tech Balcomb.

K. FEEDBACK

The office computer sits on the desk just gleaming with potential. It has earned our respect...Yes, it is helpful...Yes, it saves us time. But this is a double-edged sword. It has also earned our frustrated animosity...it consumes so much time...it can be so hard to use and understand!

Last year, our computer, since nicknamed "Our Brain", was dumped in our lap unceremoniously. After we had had it for months, we were given a bit of training. Then we were commanded to use it. This was about the equivalent of handing car keys to someone who had never seen a car before, let alone driven one, showing them how to start it and then pointing them toward the road. Drivers Beware!...there's a novice computer user on the loose.

Fortunately for us, one of our "passengers" knew how to drive, a little. She drove for a while, which showed us that it could be done. Then she closed her eyes while we practiced. We are now driving, with both hands clenched on the wheel, knuckles white with dread. There have been a few fender benders, but miraculously both the computer and drivers are intact.

But what if we hadn't had someone here with a little knowledge? Would big brother with the keys have let us crash and burn? Was there a less painful, faster way for us to have learned?

But that's past history now. To mix metaphors, we are ready to take off the training wheels and let 'er rip. We've seen

the potential of our machine and we want to tap into it. But we still need help and guidance. Where we stand now, our computer is mostly just a fancy typewriter.

Instead of having each refuge floundering and trying to design programs to help themselves and instead of expecting all the staff to become computer whizzes, one wonders why some higher authority with more skill isn't designing programs that will be user-friendly, flexible and standardized throughout the region.

If our big brother doesn't have the expertise to write the programs needed to help make the system run smoother and more efficiently, why not contract out to a specialist to spend a little time writing programs (especially for frequently used forms) for us? It doesn't take long for people who know what they're doing. We at the refuge level are not here to be computer programmers. We're here to manage the resource with the help of computer programs.

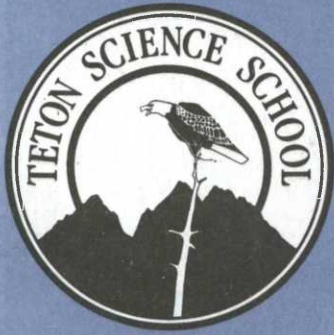
*

*

*

We need another and a wiser and perhaps a more mystical concept of animals. Remote from universal nature, and living by complicated artifice, man in civilization surveys the creature through the glass of his knowledge and sees thereby a feather magnified and the whole image in distortion. We patronize them for their incompleteness, for their tragic fate of having taken form so far below ourselves. And therein we err, and greatly err. For the animal shall not be measured by man. In a world older and more complete than ours they move finished and complete, gifted with extensions of the senses we have lost or never attained, living by voices we shall never hear. They are not brethren, they are not underlings; they are other nations, caught with ourselves in the net of life and time, fellow prisoners of the splendor and travail of the earth.

Henry Beston.
The Outermost House



Biologist

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Discovery in the Life Sciences

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THE TRUMPETER SWAN





BIOLOGUE

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In and around the Greater Yellowstone Ecosystem, the trumpet of the swan can still be heard. Trumpeter swans nest on lakes and ponds in the area and winter on available waters.

Seventy years ago, the trumpeter was thought to be gone from the lower forty-eight states, their numbers decimated by hunting and loss of habitat. The discovery of a few remaining pairs in Yellowstone and Montana initiated the effort to revive the population in hopes that the trumpeter would once again be present in large numbers.

Recovery of the swans has been an arduous task. Biologists dedicated to bringing back the swan have spent years correlating historical data, making field observations, improving available habitat, and studying the life cycles, habits, and needs of the swan. The articles in this issue tell the stories of their efforts and of the current status of the Tristate trumpeters.

Summer is a busy time in the trumpeters' world. For swans, it is the time to nest and raise their cygnets. For the biologists, there is field work, office work, and a myriad of tasks to be done in the brief mountain summer. And yet, when I called with my request for articles, no one turned me down.

Dave Lockman, Carl Mitchell, and Ruth Gale are biologists working with trumpeters. Since Ruth was swamped with too many prior commitments for writing, Becky Griffin, former Public Affairs Specialist for Grand Teton National Park (GTNP), agreed to write about Ruth and her work. She attended Ruth's seminar on the trumpeters at Teton Science School, and Ruth took time to be interviewed and to review the article. Katy Duffy, a ranger naturalist at GTNP, and a licensed bird bander, helped Dave Lockman band trumpeters several years ago. Dusty Zaunbrecher is an environmental consultant and has participated in artificial nest construction projects. Bert Raynes is a writer and the head bird-watcher of Jackson Hole, Wyoming. Their willingness to take time to share their knowledge and information on current projects is evidence of their dedication to the trumpeter.

David Weaver, Executive Secretary/Treasurer of The Trumpeter Swan Society offered his services as reader, reviewing facts and figures, and was an invaluable resource. For those of you who would like to keep up with the current happenings involving trumpeters, The Trumpeter Swan Society is described on the back page. They welcome members.

In 1978, for the first time in my life, I observed a pair of adult trumpeters with downy cygnets in Yellowstone. Every year since, I have returned to check on the swans. And each year, when I see them, I feel reassured just to know they are there. May it always be so.

Jackie Gilmore
Editor

COVER: Trumpeter swan adults and cygnets.
Photograph courtesy Jackie Gilmore.



Illustration by Denise Casey.

Trumpeting filled the cool air of an April morning as two of the five great birds lifted off the river. The flying swans' trumpeting was answered by hoarse calls from the three yearling swans that remained behind. After circling over the river, the airborne swans rose over a ridge where snow still cloaked the north-facing side. Below the ridge lay a partially melted pond. Snow draped the swans' nest of the previous year and the sedge tussocks at the shallow end of the pond, giving them the look of giant marshmallows. Snow also clung to the conical mass of the beaver lodge. As the swans glided towards the open water at the other end of the pond, a moose looked up from the leafless willow it had been munching on. The swans landed with a graceful swoosh and immediately began nodding and bobbing their heads in a display of courtship.

Every day for nearly a month, the adult swans had been checking their "territory," the pond they had nested on during each of the past five years. Now for the first time since the preceding November, a large patch of open water awaited them. Between bouts of feeding on plants under the surface of the water, the cob (male) and pen (female) courted. Although this pair had been together

since they reached maturity, annual spring displays of courtship behavior served to strengthen their bond to each other and to their nest site. The yearling swans, their offspring from the year before, were now officially on their own as another cycle of nesting began.

Cygnets (swans in their first year) remain with their parents from the time

"Ideal ponds for swan nesting are about 20 acres in size and support a lush growth of underwater plants. Aquatic plants preferred by swans include sago pondweed, water milfoil and duckweed."

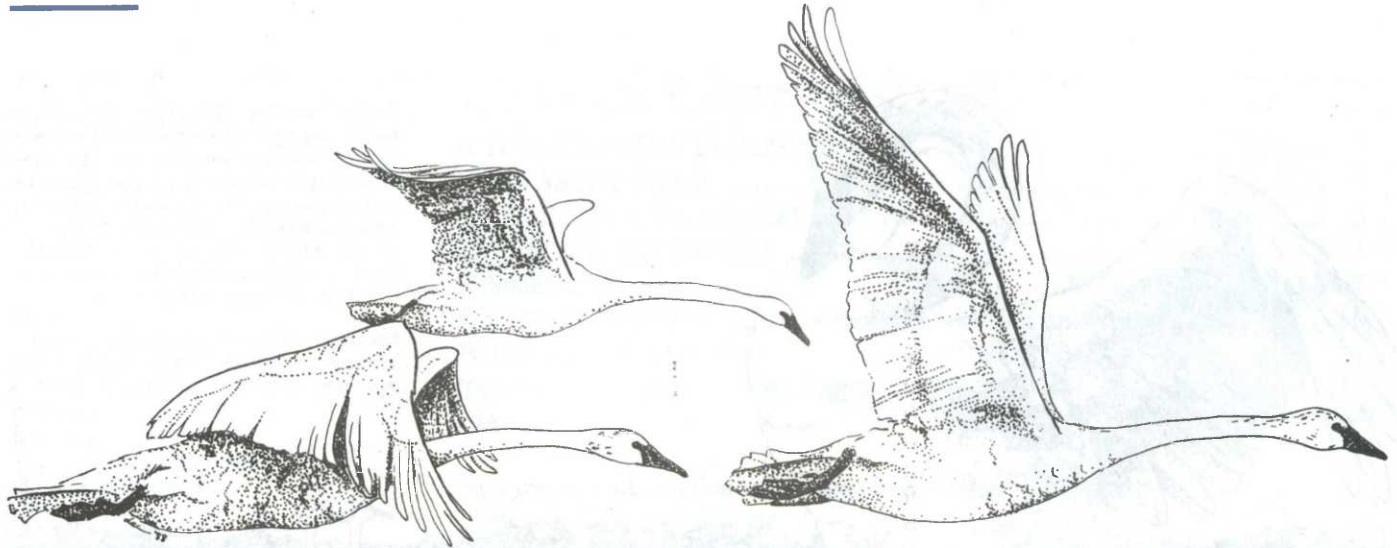
of hatching until the parents are ready to nest again nearly a year later. Yearling swans often stay together as a group for another year or two, until they reach maturity and find mates of their own. When swans are about two to three years old, pair formation begins. Sibling associations break down as first pair bonds are formed during the swans' second or third winter. The new mates

seek a pond of their own where they can establish a territory, a pond where they will not tolerate intruding swans. While pairs usually meet on wintering areas, the pond chosen for nesting is often located near where the female was hatched. The pen selects the territory, and the cob defends the space around the female.

Trumpeter swans mate for life and can live 20 to 30 years. When one member of the pair dies, it is replaced. When a female remates, the pair occupies the female's old territory. When a male replaces his lost mate, it is usually with a young female, so the male takes his new mate to his old territory. Once a pair spends at least two summer seasons on a pond, they are nearly as bound to the pond as they are to each other.

Ideal ponds for swan nesting are about 20 acres in size and support a lush growth of underwater plants. Aquatic plants preferred by swans include sago pondweed, water milfoil and duckweed. Trumpeter swans can tip-up and use their long necks to reach plants growing far below the water's surface. Because cygnets feed in shallow water, extensive areas less than 18 inches deep must occur within the nest area.

continued on page 4



In flight, swans are recognized by their long, straight necks, all-white feathers, and trumpet-like call. *Illustration by Denise Casey.*

The pond must also contain suitable nest sites, such as tussocks of grasses and sedges surrounded by water, and sufficient insects and other invertebrates for the cygnets to feed on during their first few weeks of life. In addition to safe nest sites and food, ponds must provide plants growing above the water where swans can hide.

Ponds as small as five acres may be adequate, as long as there is enough vegetation where the swans can escape when people approach too closely. Even a very large pond with no emergent vegetation provides security for swans, because they can move to a distant part of the pond during disturbance. Large water-covered marshes also serve as safe nesting areas.

Often a pair builds no nest during the first spring and summer they occupy a new pond. The mated pair winters together and usually attempts next building the next spring. Eggs laid in this first nest frequently do not hatch, but the following year the nest effort often results in viable eggs, eggs that hatch out living cygnets. A pen's first clutch of eggs is usually small, containing only three eggs. Thereafter, the average clutch is five.

Nest structures are frequently used year after year. Pairs return to their territory as soon as the ponds begin to open up in the spring and begin reconstruction of the nest once the snow melts. The cob assists the pen in nest building. Egg laying follows, and incubation of the eggs, performed solely by the pen, lasts about 35 days. Throughout incubation, the cob defends the nest territory against all trespassers.

Intruding swans are quickly chased from the pond.

By late June the eggs have hatched. Both pen and cob assist in the feeding of the cygnets for about four weeks, until the cygnets have learned how to feed by themselves. Both adults remain nearby, defending their offspring for almost four months, until the cygnets have acquired the ability to fly (fledged). After ridding their territory of trespassing swans, adults frequently display to each other, trumpeting loudly and quivering their wings. When predators such as coyotes lurk nearby, the cob and pen become very alert, ready to charge the coyote with a threat display to protect their young.

While the cygnets are growing rapidly, the adult swans undergo the annual molt of their flight feathers. During replacement of the wing feathers, swans are incapable of flight for a period of about 30 days. The pen usually molts first. Once her new flight feathers have grown and hardened, the cob begins his molt. Thus one adult is usually able to fly at all times. Since they are more vulnerable to predators during the molting period, swans protect themselves by hiding among tall plants growing out of the pond.

By the time the cygnets have developed their flight muscles, the long, warm days of summer have vanished, and autumn has descended upon the trumpeters' pond. Willows and aspens surrounding the pond have been gold for nearly a month. Overnight temperatures in the teens threaten to lock the pond in ice. Learning to fly in the nick of time, the cygnets finally leave the pond

and head to nearby ice-free waters in the company of the cob and pen.

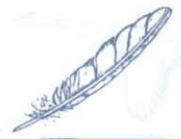
On the winter waters, sibling groups and unmated adults mingle, feeding on whatever underwater plants remain. Family groups and mated pairs keep themselves separate from other swans. Pairs with cygnets tend to use the same winter feeding sites year after year. The quality of winter food is very important, as it determines the swans' productivity during the following nesting period.

When exceptionally frigid conditions crowd swans into small patches of open water, swans repeatedly trumpet to each other, filling the rising mist with their resounding calls. Head bobbing and other displays of recognition between mates keep pair bonds strong during this time of communal living.

At last, the days begin to lengthen, more water opens up, and swans start dispersing to creeks and rivers near still-frozen nest ponds. Families of adults and cygnets usually travel together to these transition areas, but adults often leave the cygnets behind when they survey their nest ponds for signs of melting. Finally the day arrives when the adults do not return from their reconnaissance trip to the nest pond. At nearly a year of age, the cygnets have been granted their independence. □

—Katy Duffy has worked as a seasonal ranger naturalist at Grand Teton National Park since 1983. For the last 10 years, she has been a licensed bird bander specializing in raptors (birds of prey). Katy developed a special concern for trumpeter swans five years ago, after spending a day helping capture and band several trumpeter swans, assisting Dave Lockman, dedicated and knowledgeable waterfowl biologist.

MORE ABOUT SWANS



Swan. Family Anatidae. Order Anseriformes. Three swans are regularly found in North America: the tundra swan (formerly whistling swan) and the trumpeter swan are native; the mute swan was introduced from Europe. A small number, perhaps a few dozen, of a fourth swan species, the whooper swan, winter in the western and central Aleutian Islands. These birds likely summer somewhere in Siberia.

Swans are among the largest living birds. The male trumpeter swan may in fact be the largest native North American bird; an exceptionally large male may weigh 35 pounds or more, be 6 feet in length and have a wingspan of up to 8 feet. Swans, simply, are great white birds.

These waterfowl have broad, flat bills with lamellae, or tooth-like serrations, along the edges of both mandibles. These serrations fit together to form a strainer which allows food to be held in the mouth while the water runs out. The bill has a hard "nail" at the tip of the upper mandible, and the tongue is fleshy.

Swans' feet have four toes; the front three are joined by webs, and the small hind toe is free. Legs are relatively short, placed far apart and somewhat behind the center of the body. As a result, swans have a waddling walk and avoid attempt-

ing to go up steep inclines. They can run very fast on hard ground, almost outrunning a human.

Swans' long necks are adapted for feeding on aquatic, bottom-rooted vegetation found in creeks, lake edges, ponds and estuaries, and they use a variety of neck postures for communicating with others.

Someone determined that tundra swans have over 25,000 feathers covering their bodies. Contour feathers (exposed feathers on body, wings, and tail) provide a waterproof covering, are necessary for flight, and take part in forming the outline or contour of the bird. Smaller feathers under the contour feathers provide buoyancy (semiplumes) and insulation (semiplumes and down feathers). Feathers must have frequent care, and swans may spend up to 60% of all daylight hours preening. As do most birds, swans have an oil gland located dorsally at the base of their tails which secretes a greasy fluid. (The location of this gland can be seen sometimes in the field; swans erect the feathers immediately around it when preening.) During preening, the birds press out the secretion with their bills and dress their feathers with the oil. Preening removes parasites and dirt from the feathers and restores the integrity of the contour

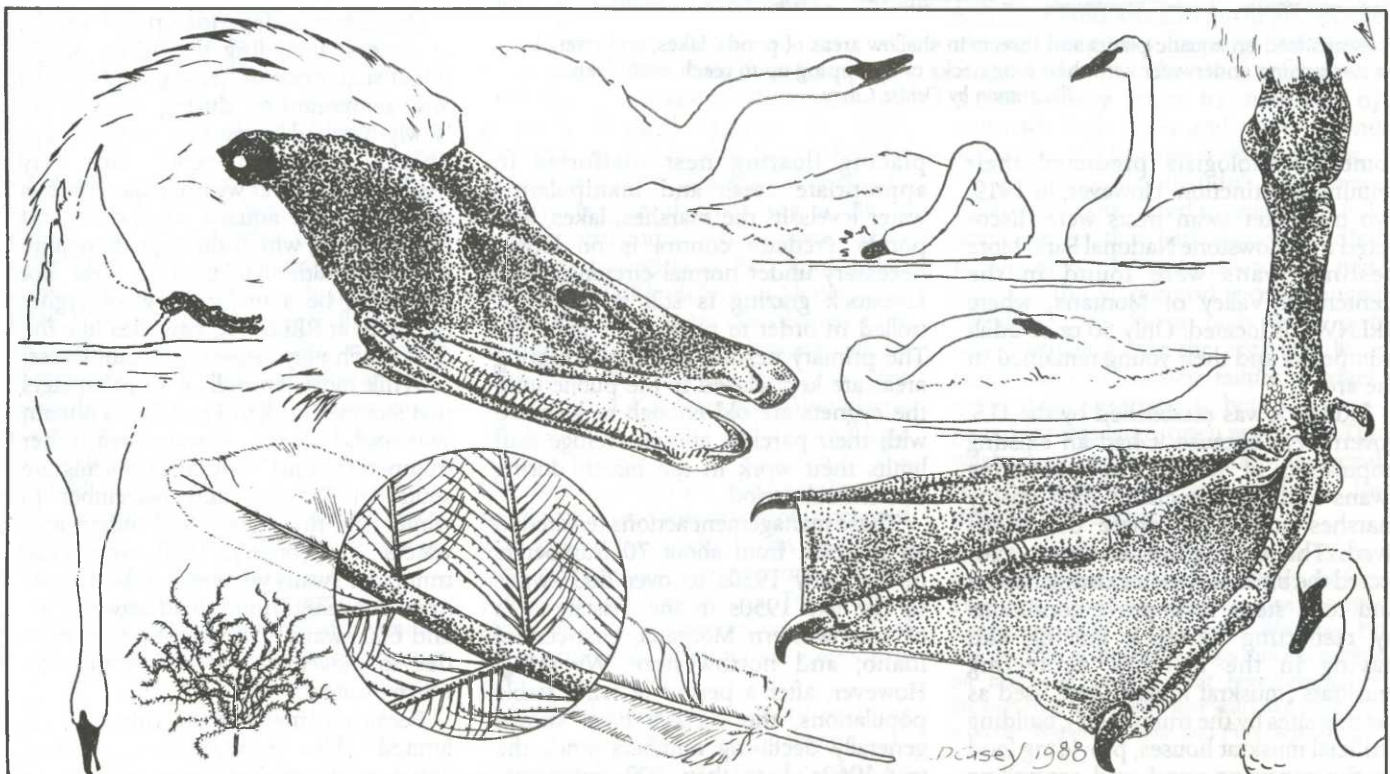
feathers by realigning the barbs, or branches, and barbules in the feathers.

Body feathers are molted and replaced continually during lifetime so that the birds are always protected against temperature change and water, but all the flight feathers, on wings and tail, are shed at once in summer.

Swans feed mostly in shallow waters upon aquatic vegetation, but are entirely capable of grazing upon grains or sedges and the like. Trumpeter and mute swans seem to prefer aquatic plants, while tundra swans graze more. Trumpeter and tundra swans especially use their strong legs and large webbed feet to dislodge submerged aquatics and invertebrates clinging to underwater vegetation. Trumpeters can be seen skimming or seining the water surface during insect hatches. High protein foods are very important to newly hatched cygnets and to their mothers, who may have lost up to 25% of their body weight in egg-laying and incubation. □

—Bert Raynes writes a weekly newspaper column on natural history subjects and is the author of "Birds of Grand Teton National Park and Surrounding Areas". More importantly, he greatly admires great, white birds.

Illustration by Denise Casey





Red Rock Lakes National Wildlife Refuge (RRLNWR) sits in a high mountain valley in southwestern Montana, about 40 miles west of Yellowstone National Park. Elevation at the valley floor is approximately 6670 feet. This area has long, cold winters and short, cool summers. The refuge was established in 1935 as a "sanctuary and breeding ground" for wildlife, especially trumpeter swans.

Because of over-hunting and the destruction of habitat during the 1800s, trumpeters declined in number until

predators. They also experimented with expanding the trumpeters' range by moving four cygnets to the National Elk Refuge in Jackson, Wyoming.

Many of these same techniques are still being used at the refuge to benefit the trumpeters. As the population has increased, winter feeding has become more important. The swans are still protected from hunting, and the use of lead shot and lead fishing sinkers on the refuge is prohibited to protect the swans from lead poisoning. Some nest sites are protected from flooding by

were counted in September, 1986.

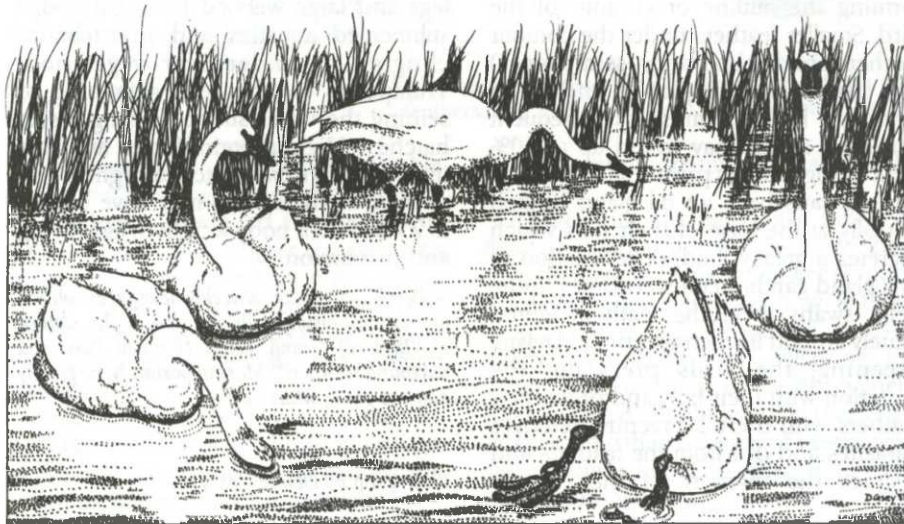
A number of factors are thought to have contributed to this decline. These include: weather-related impacts on reproduction; stable high water levels, which resulted in nest flooding during years with increased run-off from snow-melt and rain; and decreasing production of aquatic plants and invertebrates in the marsh, both important food sources for swans. In 1987 and 1988, the trumpeter production on RRLNWR has been exceptional, in part due to good weather, early spring weather and low water, and because recently completed research has provided some new guidelines for managing the winter feeding program and water levels in the breeding marshes.

Trumpeters begin to defend their territories in February, when the marshes are still iced over. Territories at RRLNWR range in size from about 5 to 100 acres, and average about 32 acres. Breeding pairs spend much of their time sitting on the ice in the spot they have chosen to nest. Some confrontations occur between swans competing for the same territory, but by April or May, most of the swans have begun to build their nests, and eggs are laid, generally in May. In years when spring comes early, as in 1987 and 1988, the entire process is early.

Nest success depends upon a variety of factors, including the adults' nutritional state prior to nesting, and rainfall and temperatures during incubation. Newly-hatched cygnets are very susceptible to chilling in cold and rainy weather. Cold, wet weather also inhibits the growth of aquatic vegetation and invertebrates, which the cygnets require for food. Although predators do not appear to be a major cause of cygnet mortality at RRLNWR, parasites like the duck leech may cause significant losses.

While most, if not all, of the trumpeters that summer on Red Rock Lakes remain year-round in the Tristate Area, other trumpeters from Canadian flocks migrate south in October and November to winter on the refuge and other area waters. In February, 1988, over 1700 trumpeter swans wintered in the Tristate Area. The refuge ponds held between 200 and 600 swans. (The numbers fluctuate due to movements to and from other nearby waters.)

Because so many swans winter in such limited habitat, managers are concerned about potential losses to disease or



Swans feed on aquatic plants and insects in shallow areas of ponds, lakes, and rivers by reaching underwater with their long necks or by tipping up to reach even deeper.

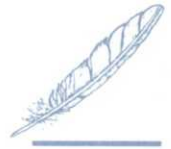
Illustration by Denise Casey.

some ornithologists predicted their imminent extinction. However, in 1919, two trumpeter swan nests were discovered in Yellowstone National Park. More nesting swans were found in the Centennial Valley of Montana, where RRLNWR is located. Only 50 or so adult trumpeters and their young remained in the area.

RRLNWR was established by the U.S. government because it had an existing population of nesting and wintering swans and the associated high quality marshes and lakes where the swans lived. The first refuge managers protected the birds and their existing habitat and took steps to improve conditions by restricting livestock grazing and haying in the marshes, protecting muskrats (muskrat houses were used as nesting sites by the trumpeters), building artificial muskrat houses, providing food on the wintering pond, and controlling

placing floating nest platforms in appropriate areas and manipulating water levels in the marshes, lakes, and ponds. Predator control is no longer necessary under normal circumstances. Livestock grazing is still strictly controlled in order to protect the marshes. The primary nesting and brood rearing areas are kept closed to the public until the cygnets are old enough to keep up with their parents, and the refuge staff limits their work in the marsh during this critical period.

These management actions resulted in an increase from about 70 trumpeters in the early 1930s to over 600 swans by the late 1950s in the Tristate Area of southwestern Montana, east-central Idaho, and northwestern Wyoming. However, after a period of fairly stable populations, the surveys have shown generally declining numbers since the mid-1960s. Less than 400 trumpeters



pollution. Biologists from several states and agencies in this region have begun experiments to increase the range of wintering swans by relocating birds into suitable habitats.

The swans wintering at Red Rock Lakes are fed wheat twice weekly because so many swans on such small bodies of water soon eat all of the available aquatic vegetation. Swans on other area waters rely on natural vegetation for the entire winter.

Temperatures during the winter often reach -20°F to -30°F , and, depending on water flows, winter habitat in some areas can freeze, preventing swans from

feeding. At least some water on the refuge ponds always remains open. When the temperatures are very low or when high winds cause extreme cold, trumpeters conserve energy by sitting on the ice, tucking their heads under their wings, and remaining inactive.

Some winter mortality occurs when swans cannot obtain enough food and starve or become so weak that disease or predators can take their toll, but most survive until spring. Trumpeters may lose 20% of their body weight during the winter.

Many problems face the trumpeter swans at Red Rock Lakes, and we do

not yet have all the answers. We are working with the information we have and using our management skills to provide a better winter feeding program, more and better nesting and brood rearing habitat, and an expanded winter range. By more closely examining these factors and other aspects of swan biology at RRLNWR, we can continue to provide the trumpeters what they need both now and in the future. □

—Carl D. Mitchell is Assistant Refuge Manager at Red Rock Lakes National Wildlife Refuge. In addition to his current work with trumpeters, he has worked with coyotes, bald and golden eagles, peregrine falcons, and elk.

ENHANCING THE HABITAT

Research strongly suggests there is a short supply of areas within Wyoming that meet the trumpeter swan's total habitat requirements. Other than the availability of food supplies during crucial periods of the swan's life cycle (especially the pre-nesting period), habitat features important to the reproductive success of this "wilderness species" include safety and security from humans. Two habitat improvement methods in Jackson Hole have been tried to partially compensate for human-caused disruptions and to improve habitat effectiveness: artificial nest sites and power line and fence marking.

Fences and power lines close to wetland habitats create flight path barriers and result in collisions, which are a leading cause of death among subadult swans. Removal or marking of fences and other obstacles to flight reduces the incidences of death by collision and is a simple habitat improvement measure used effectively in Jackson Hole. Documenting hazards to flight and obtaining the cooperation of land owners and the power company serving Jackson Hole has proved relatively easy. Livestock fences across creeks and wetlands are temporarily removed or marked with brightly colored tennis balls, and power lines are strewn with large, orange plastic spheres to make swan navigation less hazardous.

A more complex habitat improvement problem is increasing nest site availability for trumpeters. A choice of nesting sites remote or hidden from human activity has been shown to have a crucial effect on nesting success and brood survival. Of 14 areas used by nesting-

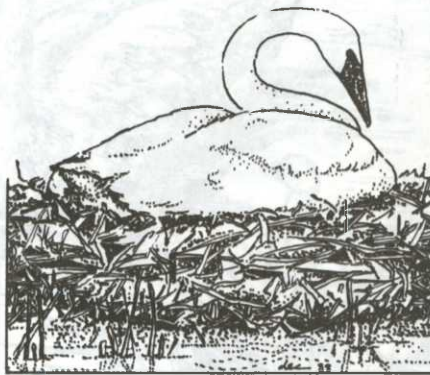


Illustration by Denise Casey

pairs since 1981, only four have been relatively consistent producers of successfully fledged cygnets. In 1988, attempts were made to boost the rate of nesting and rearing success by constructing and installing artificial nesting structures, which were developed by biologists at Red Rock Lakes National Wildlife Refuge in Montana.

Floating islands are constructed from four sections of 6-inch diameter plastic pipe filled with buoyant foam. The pipe is joined in a 4' x 4' square, using plastic elbows at the corners and a center pipe with a plastic "T" at each end. The intersecting joints are reinforced with a special glue, and the structure is covered with coated wire, which can be woven with wet emergent vegetation and wet soil for natural appearance. Ten Jackson Hole Alliance volunteers created 10 of these structures in about six hours this fall.

Artificial nests were placed at three locations chosen by the Wyoming Game and Fish Department on the basis of

their past use by swans that attempted to nest but failed due to marginal habitat conditions; lack of potential nesting island; no nest sites secure from human activity; or lack of nest material immediately adjacent to nest sites. The nests were anchored to the bottom with heavy, woven nylon rope in places near food, cover, and previous nest sites.

One of the islands was immediately accepted by an experienced, but as yet unsuccessful, breeding pair, which hatched three cygnets (as of this writing, apparently healthy and growing strong). Another island was also put to immediate use, resulting in a four-egg clutch that failed to hatch. The third island was washed away from its mooring by unusually high water and currents, and was never used by the resident swans.

The four eggs that didn't hatch were collected and analyzed to reveal four full-term cygnets that had apparently died within days of hatching—a very near miss for the young and inexperienced breeding pair. Since high wind and waves washing over the eggs may have contributed to the nest failure, a larger, more stable structure is being contemplated for this large, open water site. The washed-out structure at the other pond will be reanchored and available for nesting next spring. □

—Dusty Zaunbrecher is Consultant for Ecological Planning and Environmental Policy and Vice President, Northern Rockies Conservation Cooperative (NRCC) in Jackson, Wyoming. He is a specialist in wetlands ecology and has worked on trumpeter swan habitat improvements in Jackson Hole for the past four years as a volunteer with the Wyoming Game and Fish Department.

SUMMER CYGNETS



A trumpeter swan pair occupies the same nest area every summer, arriving soon after the ice melts. For a few weeks they alternate feeding with courtship displays, such as wing-quivering and head bobbing. By early May, swans begin building their nests, taking as long as two weeks to finish structures as large as seven feet in diameter.

Successful trumpeters build their nests high enough above the surrounding pond to prevent flooding by fluctuating water levels. Secure sites include the tops of muskrat and beaver lodges and tall clumps of sedges and cattails.

Swans often reuse old nest sites, refurbishing them each year. Both cob and pen construct the nest. The cob uses

his powerful bill to rip out hunks of vegetation which he passes to the pen. She piles up the vegetation, then uses her body to form a cup for the eggs in the center of the nest mound. Because the cob and pen usually choose a site surrounded by water, it is difficult for predators to sneak up on the nest.

Starting about mid-May, the pen lays one large white egg every other day until her clutch (usually four to six eggs) is complete. Incubation of the eggs, performed solely by the pen, begins once all the eggs have been laid and lasts about 35 days. Throughout incubation, the pen leaves the nest only to feed herself and preen her feathers, after carefully covering

the eggs with nest material. Although the cob rarely incubates the eggs, he stands guard nearby and chases away any trespassing swans, predators and other intruders. Sometimes the pen joins the cob in defending their territory, especially when other swans dare to land on the pond. No swans will be tolerated on the nest pond except perhaps the trumpeter pair's offspring from previous years.

At the time of hatching, the fuzzy cygnets weigh a mere 7 ounces. Within a day or two, the cygnets have left the safety of the nest mound and entered the pond. Bobbing along between the watchful cob and pen, the cygnets learn to feed, quickly darting to pluck insects

from the surface of the water. Adult swans paddle vigorously to churn up the water so that the cygnets may feed on tasty morsels that rise to the surface. A plentiful supply of insects and other aquatic invertebrates is essential for the survival of the cygnets during their first few weeks of life. If the nest area does not provide a sufficient amount of aquatic invertebrates, the adults will move the whole family to another pond, if one is nearby, within a few days of the cygnets' hatching.

Cygnets develop at an amazing pace. Within four to six weeks, they have switched to a diet consisting of more plants than insects. Cygnets quickly learn how to use their bills to yank out rooted plants just as the adults do.

Smoky immature feathers gradually replace the cygnets' soft gray down. By the time the cygnets are about 10 weeks old, they weigh almost 15 pounds, and their grayish wing feathers have grown in. Although the cygnets practice flapping their wings daily to exercise their developing flight muscles, they will not be able to lift themselves off the water until they are about 110 days old.

By late October, the cygnets have finally gained the strength to fly. Although their first flight is usually short, within a few days they are capable of flying as far as a half-mile. Daily practice flights continue for a few weeks until

the day the swan family fails to return to their nest pond. Leaving just prior to freeze-up of their pond, the adults and cygnets head to traditional wintering areas, ice-free streams and ponds. In less than four months, the cygnets have grown from 7 ounces to nearly 20 pounds, from little balls of fluff to the "ugly duckling" stage of fairy tale fame, before becoming long-necked, long-winged, beautiful trumpeter swans. □

—Katy Duffy (see page 4)

—Nancy Wiley is a freelance artist in Ft. Collins, Colorado.



FLUCTUATING POPULATIONS: A Biologist Looks for Answers

Trumpeter swans once ranged from coast to coast on North American wetlands, but they were ruthlessly eliminated during 125 years of commercial harvest. By 1900, trumpeter swans were thought to be extinct. In 1919, two nesting pairs were discovered in Yellowstone National Park, and other swans were located in the surrounding areas. A 1932 survey counted 70 swans—the only trumpeters then thought to be left in the world. We now know there were also trumpeters, perhaps several thousand, in Alaska and Canada.

Today the largest population of trumpeter swans in the lower 48 is found in parts of Idaho, Montana, and Wyoming, a region known as the Tristate Area. Within the area there are two groups of swans. Swans which winter there, disperse to summer nesting territories within the vicinity, and are essentially non-migratory, make up the Tristate Subpopulation. Swans which winter there and migrate to Canada to nest are called the Interior Canadian Subpopulation. The Tristate Area is the only known wintering area for Canada's trumpeters.

Only the swans of this remote region, which was somewhat free from hunting and had open water in winter due to the area's geothermal features, survived the slaughter. Thus, trumpeter swans were left in the most remote and harshest part of their former range, with marginal conditions for existence. The establishment of Red Rock Lakes National Wildlife Refuge in 1935 provided some protection for swans. In the early years many trumpeters were illegally shot as they left the refuge, so management efforts were aimed at keeping the birds on the refuge year-round, and a winter feeding program was implemented.

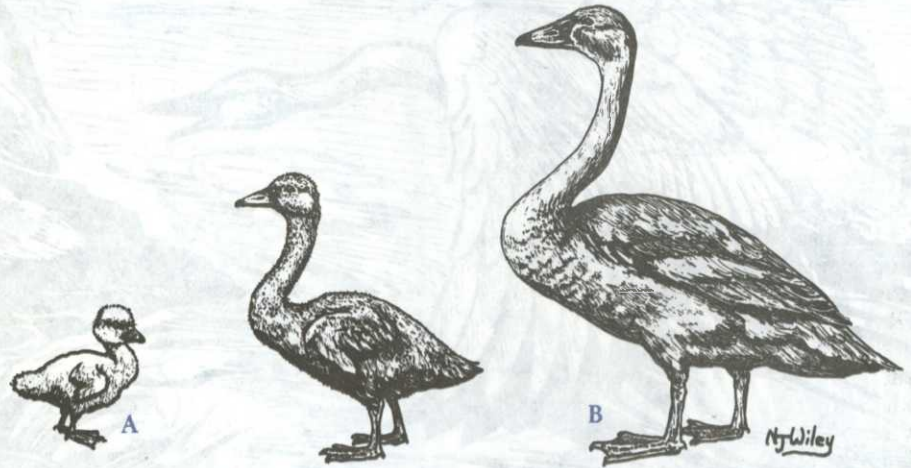
By the 1950s, the number of Tristate swans had increased to 640. Cygnet productivity showed some inconsistencies, and it was thought that perhaps the available habitat was saturated, which limited the numbers of swans. The annual census figures remained fairly stable. Suddenly in the late 1970s, the number of Tristate swans took a plunge. For three years in the early 1980s, less than six cygnets per year were produced from about 30 nesting pairs at Red Rock Lakes. With continued low cygnet production and fewer nesting pairs, the population would soon be unable to sustain itself. "It was frighteningly clear that the Tristate trumpeters were in

serious decline. The 1986 figure was 392, the fewest swans since 1950. During this same time, cygnet production in the Canadian flock was good. Why was the Tristate Subpopulation in peril? Had they saturated their range? Was the gene pool too small for a healthy population? Was disease or lead poisoning from consuming lead shot the critical factor?

To answer these and other questions, Ruth Gale undertook a comprehensive study to compile and examine all the

understood years ago, and there are still unanswered questions.

Gale's study revealed some basic reasons for the Tristate Subpopulation decline. When 50 years of population data was correlated with data from the supplemental feeding program at Red Rock Lakes National Wildlife Refuge, there was a significant relationship between the amount of grain fed per bird and the annual mortality rate. High winter losses occurred in years when



A newly-hatched, down-covered cygnet (A) weighs only about 7 ounces. At 10 weeks, the cygnet, fully feathered, (B) has grown to about 19 pounds. Illustration by Nancy Wiley.

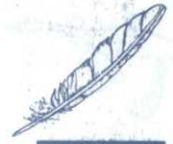
available information on trumpeter swans. Already an authority on swans, Gale had researched trumpeter swans in Yellowstone National Park for her master's degree. The study was funded by the U.S. Fish and Wildlife Service, the states of Wyoming, Montana, and Idaho, and The Trumpeter Swan Society, and was made possible by the help of virtually every trumpeter swan researcher and manager in the United States and Canada. After three years of research, "The History, Ecology and Management of the Rocky Mountain Population of Trumpeter Swans" by R.S. Gale, E.O. Garton and I.J. Ball was completed in August, 1987.

Even though efforts to save swans from extinction had been going on for decades, no one had really looked at the total picture. An understanding of swan behavior and movement patterns before and after their numbers declined was needed to help explain their present successes and failures in reproduction and survival. Some of the conclusions of the study are encouraging, others seem so obvious it is frustrating they weren't

smaller amounts of grain were provided. During the early 1980s, the refuge was feeding the lowest amount of grain per bird in its history. Productivity was also diminished by inadequate natural winter and spring food sources and other factors resulting from exceptionally harsh winters.

The key period in the swans' yearly cycle is the six to eight weeks before nesting when the birds must store the energy necessary for egg production and incubation. Traditional migratory routes that provide favorable winter and spring habitat are essential for long-term welfare of the population. While the Canadian trumpeters migrate farther north to lower elevations and less severe weather where more food is available, the Tristate Subpopulation is left to contend with a longer winter and scarce spring food supply. The Tristate trumpeters, having lost their migratory traditions, are forced to winter in a marginal habitat and are vulnerable to harsh weather conditions.

In 1987 and 1988, favorable spring and summer weather, coupled with substantial increases in the feeding program

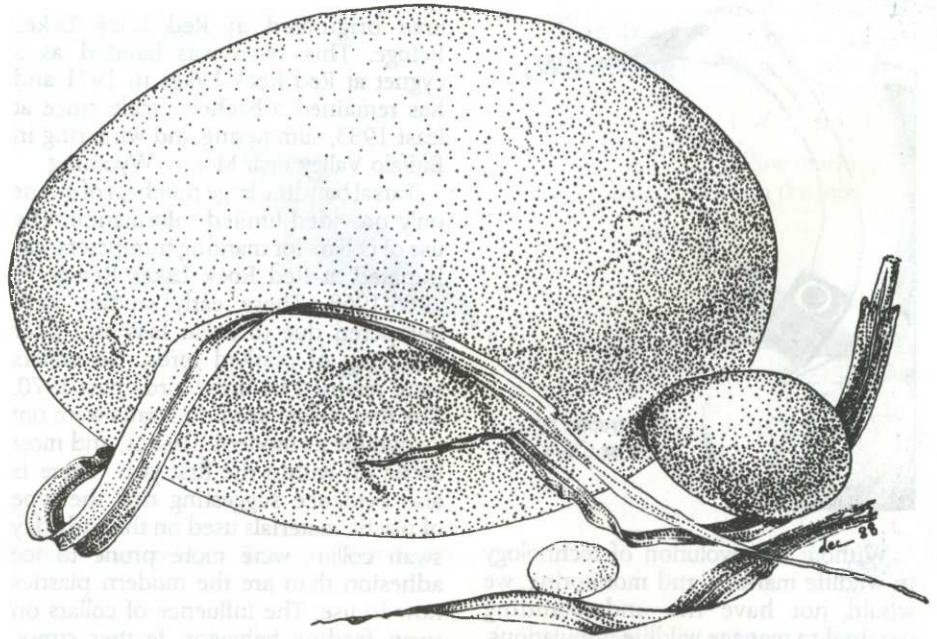


resulted in soaring productivity. Clutch size, percent hatch, and cygnet survival increased. In 1987, 133 cygnets were fledged, and in 1988, the number of cygnets hatched was up to 160 in the area in and around Red Rock Lakes. This is a remarkable turnaround.

Trumpeter swans need open water in winter. The swans wintering on the Henry's Fork in Idaho are dependent upon water levels controlled by the Island Park Dam. The Henry's Fork is the most heavily used wintering area in the Tristate Area. Generally, very little water is released from the dam in winter. When the shallow river waters below the dam freeze, the swans can't obtain adequate food, and deaths from starvation increase. Gale's study showed a strong correlation between the low water flow from the dam, the severity of the winter, and the annual mortality rate. Steps are being taken to provide adequate flows to keep open water. However, the Bureau of Reclamation, which manages the dam for irrigation purposes, has objectives which are sometimes in conflict with actions that would be most beneficial to swans.

Traditional movement patterns passed from one generation of swans to their offspring have kept swans from expanding their winter range to more favorable areas, even after they were protected from hunting. Swans are long-lived birds which form strong family bonds. The cygnets stay with the parents through their first winter. In the spring, the yearlings are driven off the nesting territory by the parents but stay in the same vicinity, often in a sibling group. This extended family may return to exactly the same place it was the previous winter. Even two-and-a-half-year-old swans may be allowed on the parents' territory. During this time, the juveniles are learning where to spend winters and summers and where to find food. These learned behaviors keep swans returning to the same places season after season.

The management plan for the Tristate Subpopulation, based upon the recommendations of Gale's study, has several objectives. One goal is to have a stable wintering population of at least 1100 swans in the Tristate Area. The 1987 count was 1710. Both Tristate and Canadian Trumpeters are limited by the food resources of their winter range and vulnerable to starvation or disease during a severe winter. Adequate spring food sources are critical to their nesting



Actual-size comparison of a trumpeter swan egg, a robin egg, and a hummingbird egg. Illustration by Denise Casey.

success. The management goal is to expand the distribution of swans wintering and nesting in the Tristate Area by establishing at least four new wintering sites, each capable of wintering between 50 and 150 birds by the year 2000. Such a dispersal of the wintering swans will reduce their vulnerability to any single crisis and provide the birds with access to more favorable spring habitats.

How can swans be encouraged to move into new areas, given their traditional learned behavior patterns? In the past, efforts to relocate swans failed because they were moved to new nesting habitats. When winter came and waters froze, the swans didn't survive unless they were fed. A better approach is to put the swans on good winter habitat and let them disperse into good summer areas.

With the population of the Tristate Area expanding again (the September, 1987 count was 540), relocation efforts are already underway. Some birds were moved in summer, 1988 to parts of Idaho and Wyoming where good wintering conditions exist. These birds will be watched closely to see how they do. The long-term goal is to get half of the Tristate swans wintering farther south.

Swans can ingest lead shot as they feed, and toxic levels of lead have been found in swans which died of starvation. Lead shot for waterfowl hunting has been

banned already from some wintering areas and is to be banned nationwide by 1991. Although death by winter starvation is a far greater concern than the effects of lead poisoning, the ban on lead shot is another positive change for swans.

What is the outlook now for the Tristate trumpeter swans? We can manage this subpopulation so that it produces cygnets and stays year-round in protected areas with feeding programs. In a sense, that is swan farming. According to Gale, the dilemma of the trumpeter swan is a man-made situation with man-made problems which require man's intervention to correct. She believes reestablishment of migration routes in the Tristate Subpopulation is essential for the long-term survival of trumpeter swans as a successful, independent species.

We have come perilously close to losing our swan population a second time. The recovery of an endangered species requires much more than merely restoring its numbers. The future of these magnificent birds in the Tristate Area is looking brighter, but the rebuilding of broken migratory traditions will be a long and difficult process.

—Rebecca R. Griffin worked for the National Park Service for 11 years and was Public Affairs Specialist in Grand Teton National Park from 1978-1984.



FOLLOWING TRUMPETERS

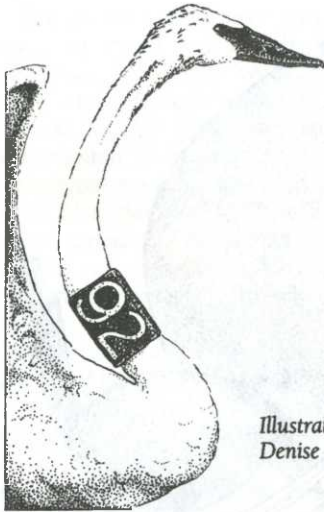


Illustration by
Denise Casey

Without the evolution of technology in wildlife marking and monitoring, we would not have the understanding required to manage wildlife populations. With an expanding human population and an environment being taxed more by human demands on the resources, habitats for many wildlife species are in very short supply. In order that we may perpetuate many species of wildlife, it is imperative that we understand their needs and modify our land-use practices to create an earthly environment of mutual species habitation rather than mutual exclusion.

The Rocky Mountain Population of trumpeter swans is not classified as a threatened or endangered population today; however, the population and its habitats are insecure enough that "special management attention" is required. The trumpeter is protected and not hunted within any of its current North American range. Winter and summer habitats for the Tristate Subpopulation is limited, and unless the winter and summer range is expanded, the long-term welfare of the population will be in jeopardy.

Banding and marking of trumpeter swans has been conducted since 1945 within the range of the Rocky Mountain Population in Canada and the Tristate Area. Between 1945 and 1984, 1050 swans were leg-banded (tarsal-banded) on or near Red Rock Lakes National Wildlife Refuge, Montana. Tarsal banding has provided evidence that Centennial Valley (Red Rock Lakes) trumpeters occasionally disperse into Yellowstone and the lower elevations of Wyoming. At least one of the adult males currently summering in the Jackson, Wyoming,

area originated at Red Rock Lakes Refuge. This swan was banded as a cygnet at Red Rock Lakes in 1971 and has remained a bachelor male since at least 1983, summering and wintering in Buffalo Valley near Moran, Wyoming.

Tarsal banding large numbers of swans only provided limited information. The use of collars for marking trumpeters was initiated at Red Rock Lakes Refuge in 1966-1968. These early studies were hampered due to collar loss and poor reporting of marked birds. No collars were retained by these birds past 1970. The first collars used on swans were not as durable as modern plastics, and most broke off within the first year. There is also evidence suggesting that the type of plastic materials used on the early day swan collars were more prone to ice adhesion than are the modern plastics now in use. The influence of collars on swan feeding behavior, feather stress, and survival were investigated during the first year of collar use in Wyoming in 1983.

In Wyoming, only swans one-year-old and older were marked with collars. Wyoming studies found that the collars did not appear to restrict the mobility or use of any seasonal feeding postures or activities. Nor did the collars, when applied with sufficient space for movement, cause significant feather stress or restrict movement of large food boluses down the esophageal tract. Ice build-up on collars has been a concern on first-year swans (cygnets); therefore, cygnets are not collared in the Tristate Subpopulation.

To date, marked Wyoming swans appear to be as productive as are unmarked swans and also appear to have a high survival rate. We have seen no evidence that collars are influencing the mate-selection process or markedly altering behavior. Modern plastics provide material that is lightweight, durable and slick-sided (which minimizes the opportunity for ice adhesion and feather stress). The collars being used today that have the greatest longevity (78% with a retention span of 4.5+ years) weigh about 84 grams, or 3 ounces.

Using collars, colored tarsal bands and metal tarsal bands, Wyoming biologists have intensively monitored 13 identifiable swan pairs since 1983. We have also tracked individuals, representing four sibling groups from parental origin to first nesting. Our studies are relatively

long-term and are providing some of the first insights into variations in trumpeter swan life-cycle chronology. Dispersal movements out of their natal range have been observed in both yearling sibling groups, prior to their first adult molt, and in males, at time of first pair formation following their second or third winter. Movements of known individuals between and within seasonal ranges and habitats used by productive and non-productive pairs have been well-documented.

A current research project is measuring the attributes of seasonal feeding sites being used by marked pairs and their young. These pairs have been marked since 1982-1984 and have a known history of production and seasonal habitats used. Based on our growing knowledge, made possible by being able to track specific individuals through time and space, we are testing methods of habitat modification which have enabled us to increase productivity and decrease adult mortality. We are accumulating more case histories on the responses of individuals to habitat modification, which will enable managers to predict outcome and prescribe management actions.

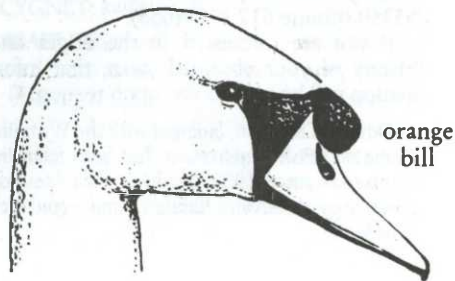
The Canadian Wildlife Service has used neck-marking extensively since 1973 to study winter movements of trumpeters from western Alberta and the Yukon. Their studies have contributed greatly to our understanding of northern population expansion, techniques for range expansion, migration and movements, and breeding habitat use. Current marking studies in Canada demonstrate the importance of Tristate swan wintering areas to trumpeters breeding throughout interior Canada. Most of the Canadian migrants winter in the Henry's Fork area of the Tristate. In recent years, Canadian trumpeters have been observed in more southerly wintering areas, including Utah, Colorado, and Nevada. In 1987-1988, 10 marked trumpeters out of the southern Yukon wintered in the Snake River drainage in Wyoming. About 65% of the swans wintering in the Jackson area summer in Canada and other parts of the Tristate Area. For the first time, at least five birds marked in Canada are summering in the Tristate Area. Eyes are on these swans. If a trumpeter of Canadian origin pair-bonds with a Tristate trumpeter, the first demonstrable interchange will have

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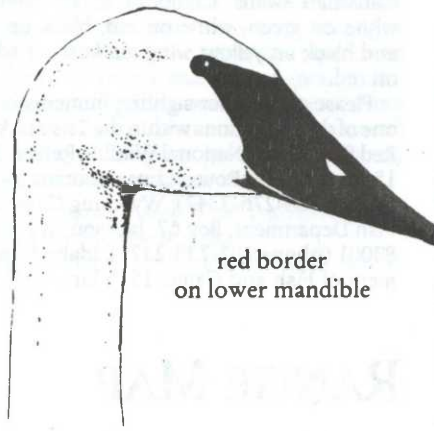
IDENTIFYING SWANS IN THE FIELD



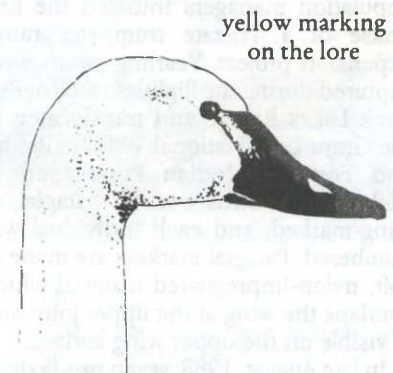
Mute



Trumpeter



Tundra (Whistling)



Head Profiles

Illustration courtesy of The Trumpeter Swan Society.

Adult swans are very large, all-white birds with long necks and wing spans of 6 to 8 feet. All swans fly with necks outstretched, and tundra swans (*Cygnus columbianus*) tend to fly in groups or V's. Swans feed mostly on aquatic plants that they reach with their long necks, often "tipping up" as do dabbling ducks. (The reddish-brown color frequently seen on their heads and necks is stain from iron salts in the water.)

The three species of swans regularly found in North America are the mute swan (*Cygnus olor*), the trumpeter swan (*Cygnus buccinator*), and the tundra swan. The tundra swan, formerly known as the whistling swan, was renamed by the American Ornithologists' Union in 1983.

Mute swans, most associated with estates and parks, were introduced from Europe for ornamental purposes. Over the years, they have established feral colonies and are expanding their range along the east coast and elsewhere in North America. The tundra swan population is significantly larger than the populations of the other two species. The tundra swan is still present in some places in such concentrations that it can be hunted. The trumpeter swan was almost extirpated in the lower 48 states and persists there in low numbers in essentially isolated, non-migratory populations.

When mute swans are seen at close range, the orangish bill and the black knob on the forehead are distinctive. Mute swans hold their necks in a sweeping arc and hold their bills with a downward tilt. They habitually bring

their secondary wing feathers up over their backs, whereas the two other species are not prone to doing this.

Mute swans are usually silent, although they hiss when angered and call their young with a short note. In flight, however, mute swans' wings make a quite loud, musical sound.

Tundra swans' bills are black and usually (but not always) have a yellow spot in front of the eye. Their bills also are in proportion with the round head, and usually slightly dish-shaped or concave, when viewed in profile. At close range, the tundra swan's eye can usually be seen as distinct from the bill.

Tundra swans hold their long necks erect and relatively straight, with bills in a horizontal position, and do not bob their heads repeatedly, even when preparing to take off in flight.

The tundra swan's call is high-pitched and quavering, a kind of oo-oo-oo, resembling that of a Canada goose. A wedge of migrating tundra swans high in the sky sometimes sounds like a pack of hounds baying in the distance.

In the trumpeter swan's profile, the heavy bill, somewhat wedge-shaped, seems to emphasize the large, angular head. The bill is black, the black extending to and masking the eye, with a red border on the lower mandible. Caution: this red border or line may be present on some tundra swans and should not be solely depended upon as a definitive field mark. The certain field mark is the trumpet-like call, deep and loud.

Trumpeter swans hold their necks

erect with bills horizontal and, while on the water, frequently bob their heads and necks up and down and up, whether vocalizing or not. In this species, some head bobbing almost always precedes a take-off run and flight. Experienced wildlife biologists find that when trumpeter and tundra swans are intermingled (as in migration periods), tundras tend to take off first.

When the two native swans are observed in mixed groups on water or land, trumpeters have a longer neck in proportion to their body length than tundras do; this characteristic is not reliable when the birds are flying. Trumpeter swans floating at ease customarily hold their necks kinked back at their bases so that they seem to rise from the forepart of the back; tundra swans' necks appear to rise from the very front part of their bodies. Mute swan necks are almost always held in a graceful arc.

On land, standing tundra swans hold their bodies in a horizontal position when in a state of alertness, whereas trumpeter swans hold their bodies at an angle to the ground.

Cygnets (swans in their first year) are grayish, (although a white phase can occur) and do not become all white until their first molt in their second year. A cygnet's bill is black only at the tip at first, but becomes all black in the bird's first winter.

Whatever species it is, it's a magnificent white bird. Enjoy being in its presence. □

—By Bert Raynes



continued from page 12

occurred between the Canadian and Tristate breeding populations.

In summer, 1988, Rocky Mountain Population managers initiated the first phase of a Tristate trumpeter range expansion project. Yearling swans were captured during the flightless molt at Red Rock Lakes Refuge and translocated to the Grays Lake National Wildlife Refuge and Fort Hall Indian Reservation in Idaho. These birds were all patagial, or wing-marked, and each individual was numbered. Patagial markers are made of soft, nylon-impregnated material which overlaps the wing at the upper joint and is visible on the upper wing surface.

In late August, 1988, seven pre-fledged cygnets, with an adult female as a foster parent, were released on the Salt River, Wyoming. These swans will be intensively monitored from the ground and air to determine if they will remain in the Fort Hall and Salt River winter habitats and if they will effectively decoy migrating swans to these new wintering areas.

The use of ultra-light radio transmitters on trumpeters is currently being tested by the Canadian Wildlife Service. Tristate swan managers will await results of their initial tests before using them.

Similar studies and range expansion efforts for trumpeters are going on in Ontario, Minnesota, Wisconsin, Michigan, Lacreek National Wildlife Refuge (South Dakota), Missouri, Elk Island National Park (Alberta), Alaska, British Columbia, Washington, and Malheur National Wildlife Refuge (Oregon).

Through the interaction of the Rocky Mountain Trumpeter Swan Population Subcommittee representatives with The Trumpeter Swan Society, state and federal wildlife and land management agencies, interested citizens and special-interest groups, there are more people observing swans than ever before. It is only through everyone's keen interest in "keeping them around" and "enjoying their majesty" that we have the observers necessary to milk all of the information possible from our current marking studies.

If you observe a marked trumpeter, or even a tundra swan, we are interested in the following information: name, address and phone number of the observer; date, specific location, marker color, marker number or symbol and color; and any other information pertinent to the sighting.

Collars and wing markers are currently being used on Rocky Mountain Tristate and Canadian swans. Colors of collars include: white on green, white on red, black on red and black on yellow; wing markers are white on red.

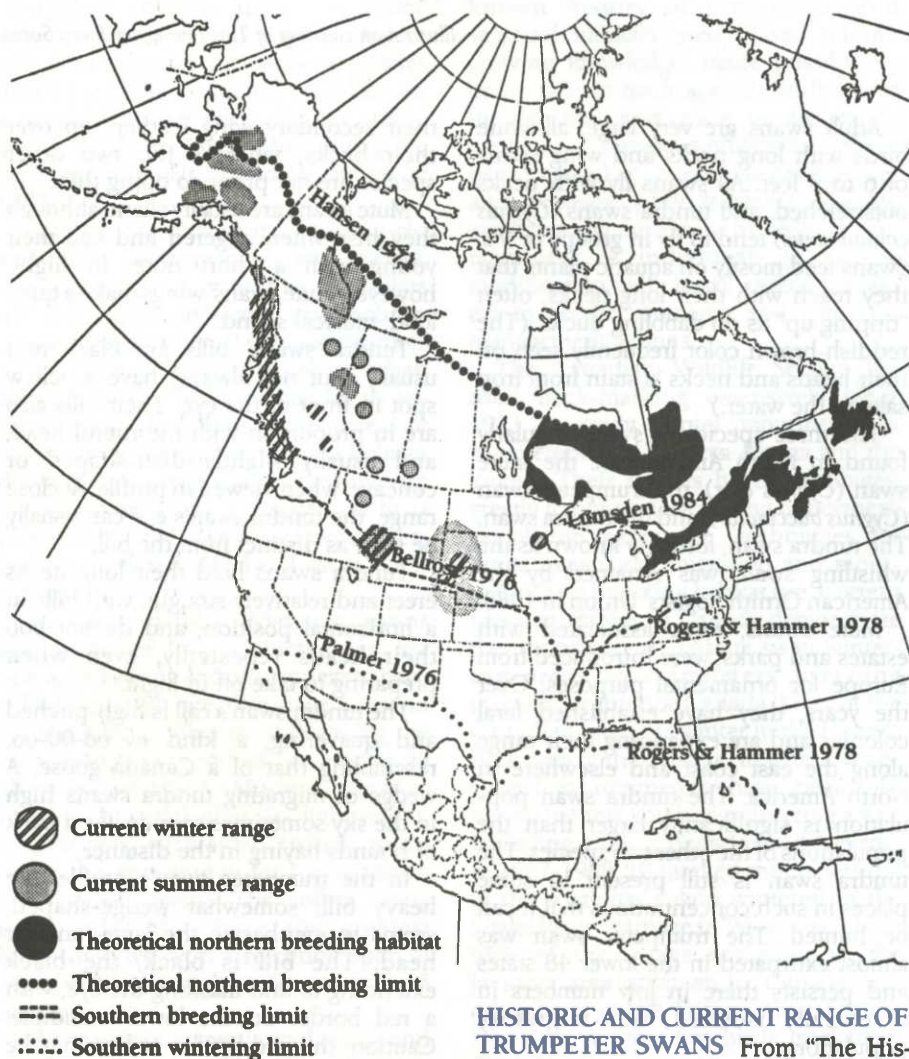
Please report your sighting immediately to one of three locations within the Tristate Area: Red Rock Lakes National Wildlife Refuge, Box 15, Monida Star Route, Lima, Montana 59739 (phone 406-276-3347); Wyoming Game and Fish Department, Box 67, Jackson, Wyoming 83001 (phone 307-733-2321); Idaho Department of Fish and Game, 1515 Lincoln Road,

Idaho Falls, Idaho 83401 (phone 208-522-7783); or The Trumpeter Swan Society, 3800 County Road 24, Maple Plain, Minnesota 55359 (phone 612-476-4663).

If you are interested in the origin and history of your observed swan, that information will be sent to you upon request. □

—Dave C. Lockman, biologist with the Wyoming Game and Fish Department, has been following trumpeters since 1982, studying their life-cycle chronology, behavior, habitats, and population dynamics.

RANGE MAP



HISTORIC AND CURRENT RANGE OF TRUMPETER SWANS From "The History, Ecology and Management of the Rocky Mountain Population of Trumpeter Swans" (draft, scientific report, U.S. Fish and Wildlife Service.) By R.S. Gale, E.O. Garton, and I.J. Ball. Reprinted with permission of R.S. Gale.



GLOSSARY

Terms as they apply to swans

CYGNET: swan in its first year

YEARLING: individual in its second year after fledging

JUVENILE/IMMATURE: young swan that has not reached sexual maturity

SUBADULT: regularly applied to individual believed to be two, three, or four years old, having not reached sexual maturity

ADULT: individual that has reached sexual maturity

PLUMAGE: the feather covering on a bird

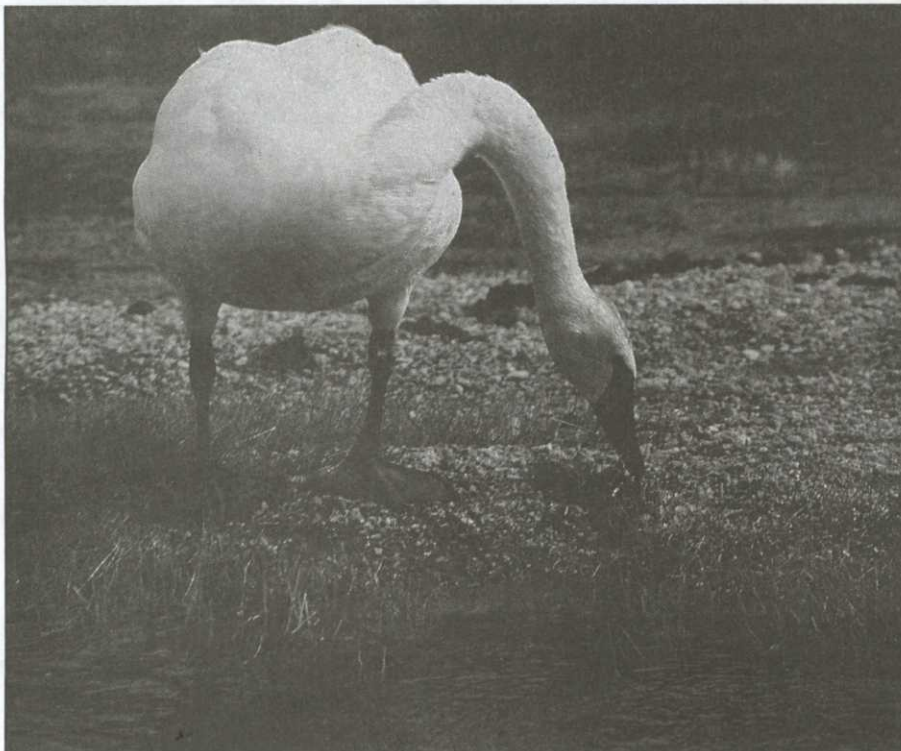
MOLT: the shedding of feathers and renewal of plumage

FLEDGE: to attain strong, sustained flight

TRISTATE AREA: in reference to a trumpeter swan population, includes southwestern Montana, east-central Idaho, and northwestern Wyoming

TRUMPETER BLUES

This excellent video follows the trumpeter through a year showing habits and habitats of the swan and presents current information on the status of the swans. It has won many film competitions and is highly recommended by the American Library Association. Produced and distributed by Landis-Trailwood Films. P.O. Box 1421, Huron, SD 57350. 24 minutes. \$29.95.



Trumpeter swan. Courtesy, Jackie Gilmore.

THE TRUMPETER SWAN SOCIETY

Founded in 1968, The Trumpeter Swan Society is composed of private citizens, biologists, and natural resource managers from the United States, Canada, Japan, and England. Members share a common goal—to maintain existing wild Trumpeter Swan populations and to restore the bird to as much of its original range as possible. The Society has the following objectives:

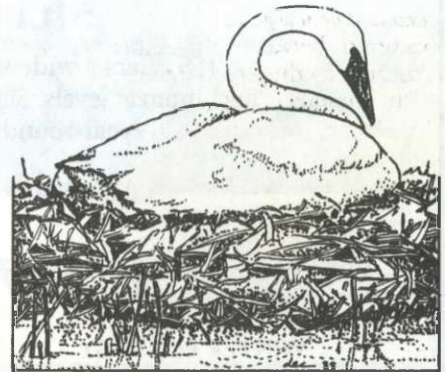
- To promote research on Trumpeter Swan ecology and management;
- To advance the science and art of Trumpeter Swan management, both in captivity and in the wild;
- To assemble known Trumpeter Swan data;
- To coordinate the exchange of knowledge about the Trumpeter Swan; and
- To provide a common meeting ground for anyone interested in the Trumpeter Swan.

A newsletter keeps members informed about the Society and its activities. A biennial conference is held within the original range of the Trumpeter.

If you thrill to the sight and sound of the world's largest waterfowl species in its natural environment, then we invite you to join The Trumpeter Swan Society.

For information, write: The Trumpeter Swan Society, 3800 County Road 24, Maple Plain, Minnesota, 55359.

(A bibliography of publications on the Trumpeter Swan is available through the Society.)



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**FISH OF RED ROCK LAKES
NATIONAL WILDLIFE REFUGE**



ARCTIC GRAYLING



YELLOWSTONE CUTTHROAT TROUT



RAINBOW TROUT



BROOK TROUT



MOUNTAIN WHITEFISH

ARCTIC GRAYLING

Distinguished by large dorsal fin, larger scales than trout and forked tail. May reach two pounds in weight. Spawns in the early spring. Historically, spawning runs of many thousands of grayling were seen in most streams of this area. Now, only a remnant population is found, mainly in Red Rock Creek. Aquatic insects and crustaceans form the bulk of the grayling's diet.

YELLOWSTONE CUTTHROAT TROUT

Distinguished by two red slash marks on underside of jaw and large, round, black spots. Found primarily in Red Rock Creek. Spawns in the spring. Hybridizes readily with rainbow trout. Weighs up to four pounds. Feeds mainly on aquatic insects and less frequently on small fishes.

RAINBOW TROUT

Distinguished by pink side streaks and lack of red cutthroat jaw slashes. Spotting smaller and more irregular shaped than cutthroat. Introduced from the Pacific Coast. Found primarily in MacDonald Pond and Elk Springs Creek. May reach six or more pounds. Spawns in the spring. Feeds mainly on aquatic insects, but large rainbows take small fish of any available species as well.

BROOK TROUT

Distinguished by numerous light colored "worm tracks" on the darker upper body and red spots with blue halos. Introduced from the eastern United States. Found throughout the refuge waters except in MacDonald Pond. Weighs two to three pounds. Spawns in the fall. Feeds mainly on aquatic invertebrates and small fishes.

MOUNTAIN WHITEFISH

A native member of the trout family that is distinguished by a slender shape, large scales, silver color devoid of spots, and a small mouth that is slightly downturned. Whitefish feed on insects, fish eggs, and small fishes. These fish are fall spawners and can be found in Red Rock Creek.



RF6-61570-00

U.S. FISH AND WILDLIFE SERVICE
Department of the Interior



PRINTED NOV. 1986



DUCKS
UNLIMITED

CEREMONIES
OF
DEDICATION

RED ROCK LAKES NATIONAL WILDLIFE
REFUGE PROJECT

WEDNESDAY, AUGUST 24, 1988
4 P.M.

A BRIEF HISTORY OF RED ROCK LAKES NWR...

Red Rock Lakes National Wildlife Refuge was established in 1935 to preserve wildlife habitat in southwestern Montana's picturesque Centennial Valley. The 42,000-acre refuge is located adjacent to the Continental Divide separating Montana and Idaho, and ranges from 6,600 to nearly 10,000 feet in elevation.

The 14,000-acre Red Rock Lakes marsh complex is one of the most important North American breeding and wintering areas for the rare trumpeter swan. This wetland system also provides pair and brood-rearing habitat for 20 other species of resident waterfowl.

Shortly after the Red Rock Lakes National Wildlife Refuge was established, a wooden structure was built to maintain the water levels within the Lower Red Rock Lake wetland. This wooden weir was replaced in 1958 with a fixed level concrete sill. However, the new structure and an associated emergency spillway were not capable of handling the annual spring runoff from the surrounding watershed.

Excess water in the 1,540-acre Lower Red Rock Lake wetland often flooded waterfowl nests and caused damage to territorial pair sites and brood-rearing habitat. The area's aquatic plant community and the wetland's productivity gradually deteriorated.

Refuge personnel were unable to manipulate water levels at the site until 1987 when Ducks Unlimited, working in cooperation with the U.S. Fish and Wildlife Service, funded the construction of a variable water-control structure. The

enlarged spillway will minimize water level fluctuations during peak runoff periods, greatly reducing the loss of over-water nests.

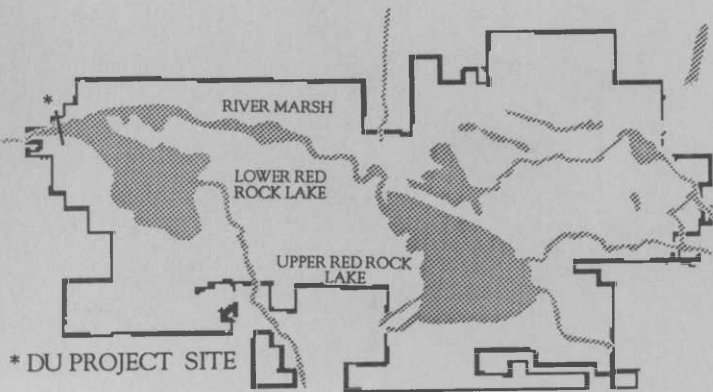
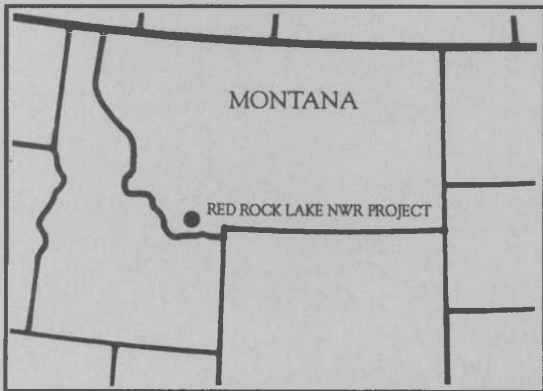
The Adolph Coors Company, Winchester Group/Olin Corporation and the GMC Truck Division played a vital role in making the development possible. Their generous support helped DU initiate its national golf and shooting tournaments at the Broadmoor Hotel in Colorado Springs on July 19-21, 1987. The events netted \$275,000 for DU's North American wetland conservation programs.

The Lower Red Rock Lake wetland is now in drawdown. By lowering the water level, refuge management allows oxidation and the recycling of important nutrients. The water manipulation will result in increased production of natural waterfowl foods.

Trumpeter swan production boomed this year. While the early 1980's showed some years of four and six cygnets, more than 100 cygnets were counted on the refuge over the summer.

Primary waterfowl species using the refuge include lesser scaup, mallards, cinnamon teal, redheads, canvasbacks, ruddy ducks, ring-necked ducks, gadwall, pintail, green-winged teal and Canada geese. A variety of other wildlife, such as sand hill cranes, great blue herons, willets, grebes, muskrat, beaver, moose and otter will also benefit from the wetland habitat project.

RED ROCK LAKES NWR DU PROJECT



TRUMPETERS



OF RED ROCK LAKES

"For a perfect conception of their beauty and elegance, you must observe them when they are not aware of your proximity, as they glide over the waters of some secluded inland pond. The neck, which at other times is held stiffly upright, moves in graceful curves, now bent forward, now inclined backwards over the body. The head, with an extended scooping movement, dips beneath the water, then with a sudden effort it throws a flood over its back and wings, while the sparkling globules roll off like so many large pearls. The bird then shakes its wings, beats the water, and, as if giddy with delight, shoots away, gliding over and beneath the surface of the stream with surprising agility and grace. Imagine a flock of fifty Swans thus sporting before you. I have more than once seen them, and you will feel, as I have felt, happier and freer of care than I can describe."

J.J. Audubon



A single clear note, as from a French horn, travels across MacDonald Pond, followed by another note, and yet another. Into view flies a family of trumpeter swans, the parents are snowy white, their young cygnets a sooty grey. They settle on the frozen pond amidst others of their species and proceed to visit back and forth with honks, soft hisses, gurgles, trumpeting and much nodding and dipping of their heads.

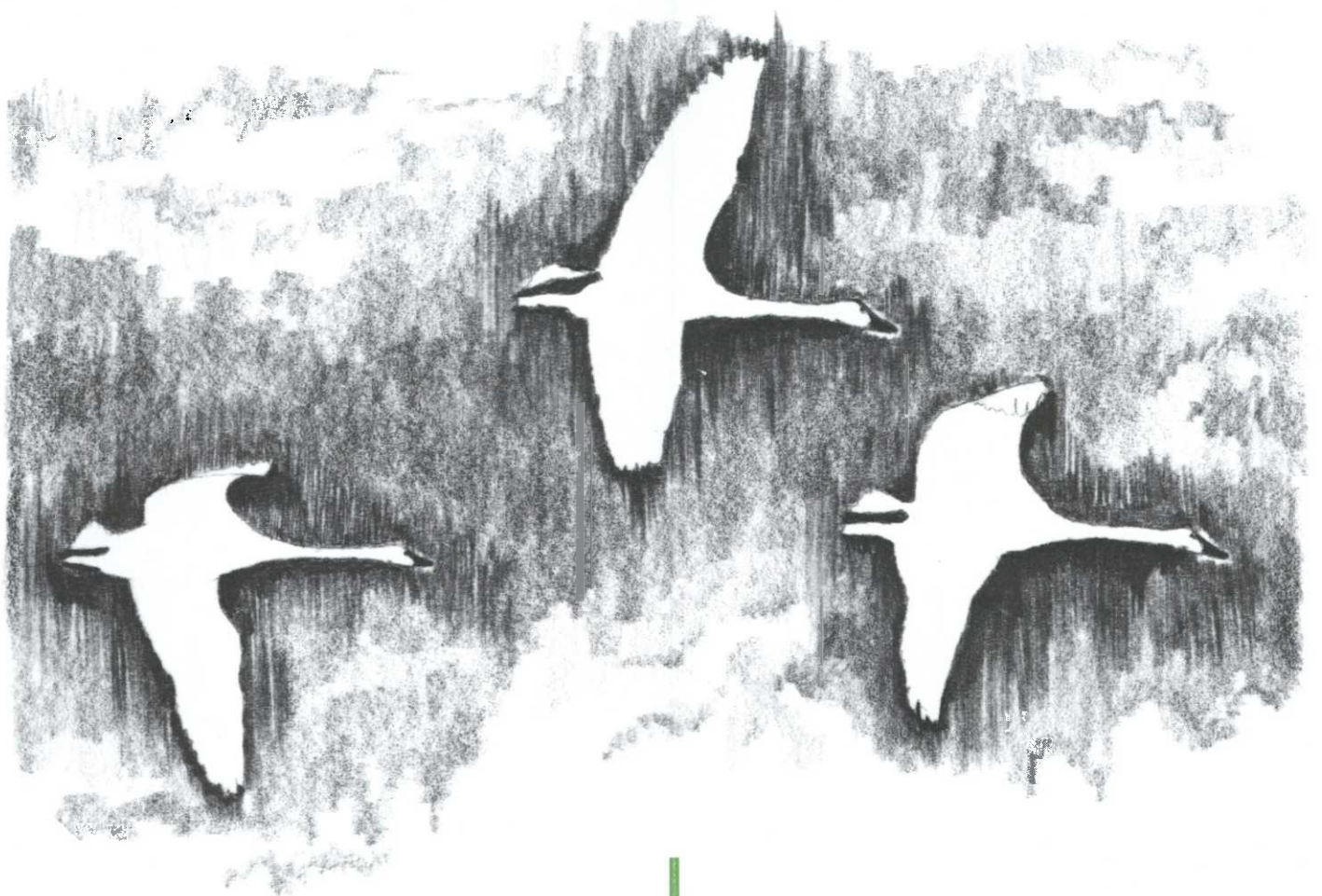
A very shy bird by nature, the trumpeter swan is the subject of intense study in an attempt to learn how to ensure their survival. Rescued from near extinction, trumpeters breeding in the Greater Yellowstone Ecosystem, including Red Rock Lakes, have grown in number from a low of only 69 birds in 1932, to a success of more than 500 in recent years. These birds are joined each winter by an additional 1000 trumpeters from Canada to form the Rocky Mountain population of trumpeter swans.



These largest of all North American waterfowl measure up to 4 feet, weigh between 20-30 pounds, and have a wingspan of up to 8 feet. The swans must remain near open water to obtain their preferred diet of aquatic plants. Their staple diet includes: waterweed, pondweed, water milfoil and duck potato. A mature adult will consume up to 20 pounds of wet herbage each day! They also feed occasionally on grain, seeds, freshwater invertebrates, snails and worms.

Winter is a sociable time for the rare trumpeter swans of the Red Rock Lakes National Wildlife Refuge, but in late winter the swan families drift apart. The subadult birds form loose flocks, the migrant birds leave for their summer nesting grounds in Canada, and other pairs visit their nearby nesting territories. The 2-3 year olds select their lifelong mates, wooing with a ritualized display of slow synchronized swimming, bill-dipping and blowing in the water.

After spring mating, the pair builds a nest. They may select a new site or refurbish their old one. Favorite sites are on muskrat houses or in broad beds of marsh plants. The swans uproot plants in a large ring and build in the center, leaving plenty of open water all around for good visibility. The nests measure about 6-7 feet in diameter at the base and rise 1½ feet above the waterline. Pairs lay their first eggs when they are 4-6 years of age. In early May, the pen, or female swan, lays from 3-9 dull white eggs which measure 4½ inches in length and weigh about 12 ounces. Considerable trumpeting and display by both parents usually accompanies the laying of eggs. The pen incubates them for approximately 5 weeks. She covers the eggs with grasses when leaving the nest for several short periods of foraging each day.



Both parents are somewhat protective of their nesting area and will usually drive off invaders. They conclude a successful defense with loud trumpeting, head bobbing, and raised-wing quivering, with the cob (male) especially defensive and demonstrative. Trumpeter swans require a large, undisturbed territory for successful nesting, and if their chosen area is infringed upon repeatedly, they will generally abandon their nest and eggs completely.



Cygnets generally hatch in mid-June and are paddling on the water within a day or two. They feast on insects, crustaceans and aquatic beetles for their first month, staying close to the parents' puddling (rapid paddling) which stirs up the bottom morsels. Playful and energetic, the cygnets frequently dash about and dive under the water, uttering their breathy little peeps all the while. Nights are spent on the nest with the parents for the first month of life. Between 4-6 weeks of age they molt and begin to get a mottled black pattern on their flesh-colored bills. At this time, they begin feeding primarily on herbage. One parent also molts during this time, rendering it flightless for about a month. The other partner often molts later so that one adult is always capable of flight while rearing cygnets.

In October, at about age 4 months, the cygnets begin flying lessons. Weighing over 15 pounds, they flap and run over the water, bouncing and struggling. They must be capable of flight before the waterways freeze over, and the parent swans

urge them on day after day until all of the cygnets attain flight. At about this time, the cygnets begin to trumpet. With upstretched neck, the head held horizontal and the bill partly open, they utter the trumpeting call.

Whole families now fly closely together and as autumn progresses, the northern migratory flocks begin descending to their wintering areas. The pen and cob relax their vigilance somewhat, and the sociable interaction of winter begins once again. By their second year, young trumpeters have full adult plumage and coloring, with brown eyes, black legs and feet, and a black bill accented with a thin red streak.



For further information write:
 Refuge Manager
 Red Rock Lakes NWR
 Monida Star Route, Box 15
 Lima, Montana 59739
 Telephone: (406) 276-3347



**U.S. Department of the Interior
 FISH AND WILDLIFE SERVICE**



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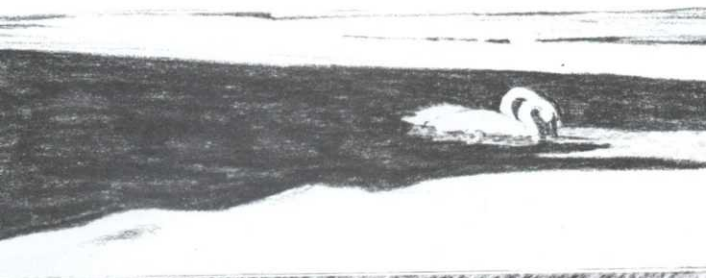


June 1986

The continued existence of trumpeter swans in the Yellowstone region depends in a large part upon the willingness of people to forgo development in important swan habitat. Trumpeter swans are extremely sensitive to many human activities and development in or near their habitats. Only a limited amount of suitable habitat exists in the region that is used regularly by trumpeters for breeding and wintering activities. When these areas are disturbed by inappropriate recreational activities, summer home development, or through improper logging or road building practices, the birds will abandon these habitats. Since most of the suitable swan habitat in the region is already occupied, the displaced birds have no other areas in which to reestablish themselves.

Winter habitat is especially critical and limiting. To survive the severe winters of the Yellowstone region, the swans choose lakes and streams which contain a suitable food supply of aquatic plants, and more importantly, do not freeze over no matter how far below zero the temperature drops. It is in these limited areas the trumpeters survive the fierce winters.

Few water areas in the region supply this type of habitat and once lost, cannot be replaced. Disturbance by winter recreationists which forces birds off of these areas or man-caused changes in the lakes and streams which allows them to freeze over, places the trumpeters in danger of starvation. These aquatic habitats must be protected for the use of the swans during this critical time of the year. Only through the diligent efforts of the public at large, interested groups and conservation agencies to protect their habitats, can these magnificent birds be assured an enduring place in the mountains and forests of the region.



**VISITOR MAP
AND
RECREATION
GUIDE**



**RED ROCK LAKES
NATIONAL WILDLIFE REFUGE**

WELCOME TO RED ROCK LAKES

Red Rock Lakes National Wildlife Refuge was established in 1935 to protect the rare trumpeter swan. Today, this 40,300-acre refuge continues to be one of the most important nesting and wintering areas in North America for these majestic birds.

Red Rock Lakes National Wildlife Refuge lies in the eastern end of the Centennial Valley, near the headwaters of the Missouri River. The rugged Centennial Mountains border the refuge on the south and east and catch the heavy snows of winter, providing a constant supply of water that replenishes the refuge's 14,000 acres of lake and marsh. The flat, marshy lands of the valley floor merge into the rolling foothills of the Gravelly Range to the north. This is the habitat that provides the solitude and isolation so essential to the trumpeter swan.

Photographers, birdwatchers, anglers, hunters and other visitors will find Red Rock Lakes an unforgettable outdoor experience. Accommodations are available at two resorts near the refuge, and at other resorts along the shores of historic Henry's Lake about 25 miles east of the refuge. Hotel and motel accommodations can be found in West Yellowstone and Lima, 50 miles east and west of the refuge, respectively.

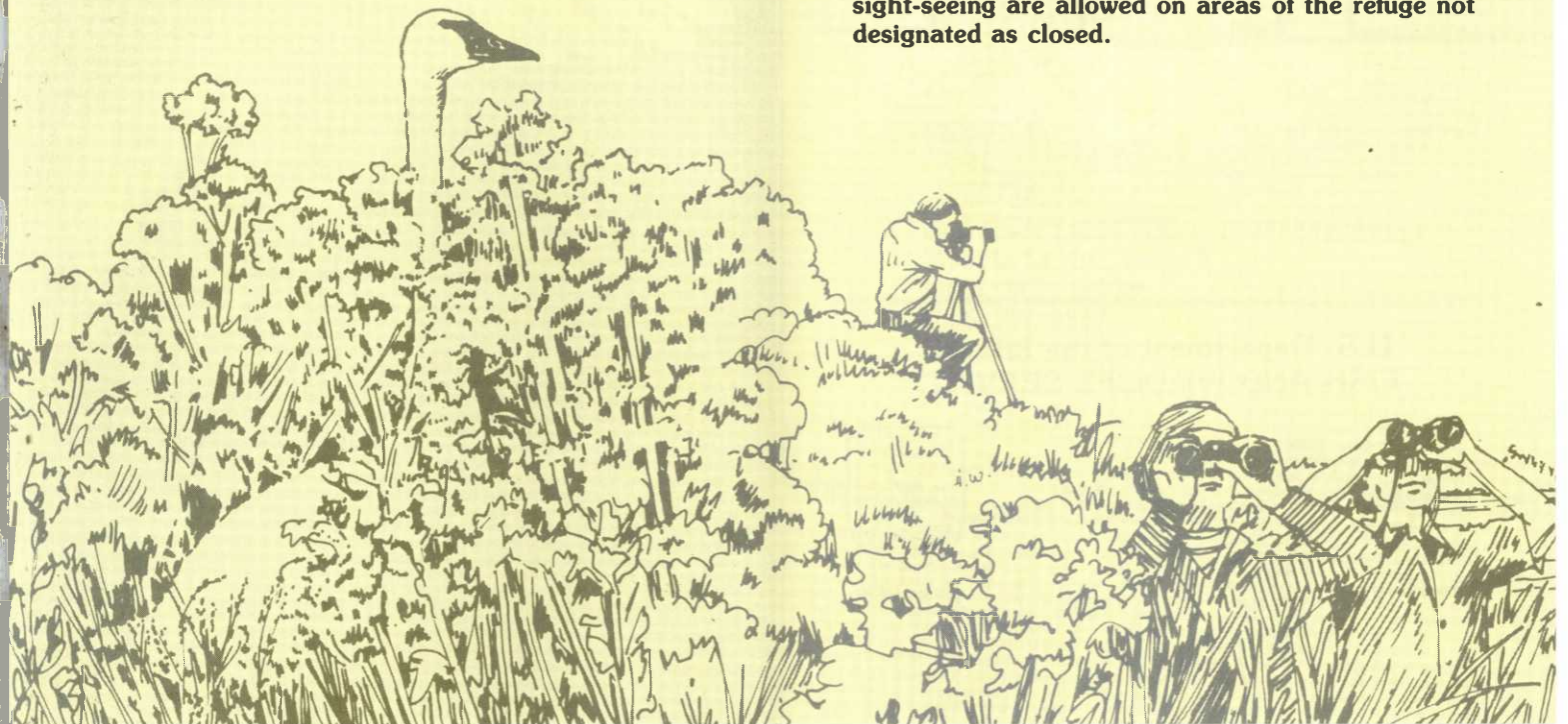
Visitors should be prepared to deal with weather extremes in this remote area. Summer temperatures are cool and snow is possible during every month. Mosquito infestations can be severe in June and July.

There is no gasoline available in the Centennial Valley.

The best times to visit the refuge are May through September. Headquarters can be reached by turning off Interstate Highway 15 at Monida, Montana, and driving 28 miles east over a dirt road; or by traveling west from Montana Highways 87 or 20, past Henry's Lake, over 30 miles of dirt road, usually not open until mid-May. The road from Monida on the west side of the valley opens about mid-April, but can be difficult for passenger cars until mid-May. All the dirt roads are often closed again in November. Summer rains can make these routes all but impassable, so local inquiry regarding road conditions is advisable at any time of the year.

PUBLIC USE REGULATIONS GENERAL

- Trumpeter swans are extremely sensitive to human disturbance. Please do not approach nesting swans closer than 400 yards. Your cooperation is extremely important. If their privacy is infringed upon they may abandon their nest and cygnets.
- Wildlife observation, hiking, photography, and sight-seeing are allowed on areas of the refuge not designated as closed.



- A Special Use Permit, which can be obtained at refuge headquarters, is required for all professional photography on the refuge.

- Dogs must be kept leashed, except during waterfowl hunting.

TRAVEL

- All motor vehicles are restricted to maintained refuge and county roads, and parking areas. This includes all-terrain vehicles, motorcycles, and snow machines.

- The Red Rock Pass, North Side and Elk Lake roads are open to all forms of travel throughout the year.

- The Lower Lake Road is only open to travel from May 15 to December 1 each year.

- The Culver Road is only open to travel from July 15 to October 1 each year.

- That portion of the refuge east of the Elk Lake Road and north of Red Rock Creek is closed to all public use from October 1 to July 15 each year.

CAMPING

- For your enjoyment, camping is permitted at the Upper Lake and River Marsh campgrounds. Tables, grates, water, and toilets are available at the Upper Lake Campground. There are no facilities at the River Marsh Campground.

- Fires are permitted only in grates at the campgrounds.

- Camping is not permitted outside established campgrounds.

- Please pack out your trash.

HUNTING

- Gun and bow hunting are allowed in designated areas of the refuge for the following species: waterfowl, elk, white-tailed deer, mule deer, pronghorn, and moose.

- Hunting shall be in accordance with all state and federal regulations.

- Only properly licensed hunters are allowed to carry firearms on refuge hunting areas.

- The possession or use of lead shot shells in the waterfowl hunting area is prohibited.

- Temporary blinds for waterfowl hunting may be constructed, but such blinds shall be made of onsite materials and shall be available to the public on a first-come, first-serve basis.

FISHING

- State regulations apply to refuge fishing waters. Culver and MacDonald ponds are managed under special regulations.

- Only artificial lures and flies are allowed on Culver and MacDonald ponds. No bait fishing.

- Lead sinkers are prohibited on all refuge fishing waters.

- Tubes and other floating devices are prohibited on refuge ponds unless specifically posted as open at parking areas.

Fishing area: *Odell Creek, Grayling Creek, East Shambo Creek, Red Rock Creek, Elk Springs Creek* west of the Elk Lake Road.

Season dates: 3rd Saturday in May through November.

Fishing area: *Widgeon Pond, Culver Pond, MacDonald Pond, Picnic Creek, Elk Springs Creek* east of Elk Lake Road.

Season dates: July 15-October 1.

- All other waters on the refuge are closed to fishing.

BOATING

- The use of motor boats is prohibited on the refuge, with the exception of the waterfowl hunting area during season.

- An approved floatation device for each occupant is required to be aboard all boats on refuge waters.

- Boaters are urged to use caution on refuge waters as sudden storms and cold temperatures can make boating hazardous.

- Boating is allowed on the following areas:

Area open: *Red Rock Creek* from the east refuge boundary downstream; west to and including the Upper Red Rock Lake.

Season dates: July 15 to freeze-up.

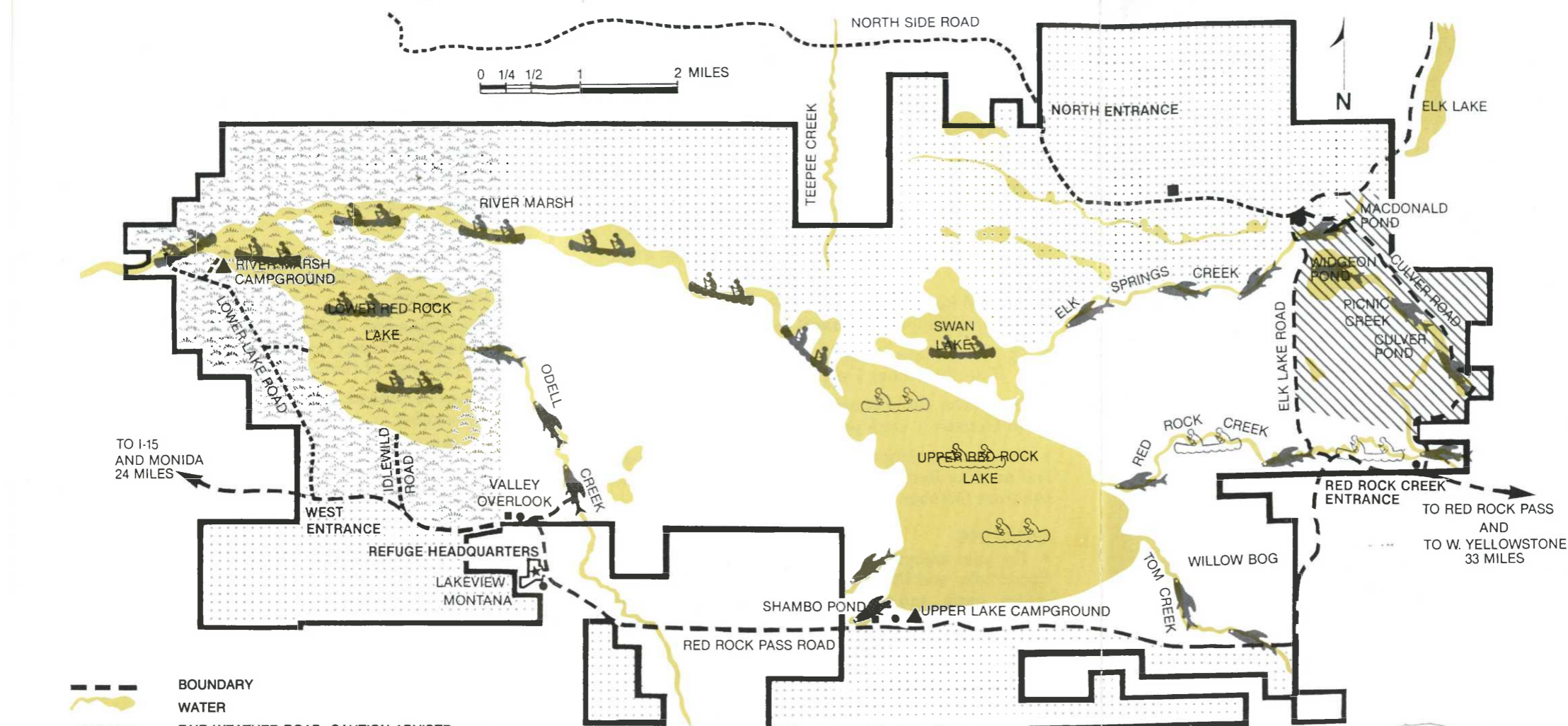
Area open: *Swan Lake*, and the *River Marsh* from the outlet of the Upper Red Rock Lake downstream west to and including the Lower Red Rock Lake.














Season dates: September 1 to freeze-up.

Area open: Waterfowl hunting area.

Season dates: Opening of waterfowl season to freeze-up

Motors of 10 h.p. or less may be used on the waterfowl hunting area during the waterfowl season. No air-thrust boats are allowed.



-  BOUNDARY
-  WATER
-  FAIR WEATHER ROAD, CAUTION ADVISED
-  CLOSED OCT. 1 - JULY 15
-  HEADQUARTERS
-  CAMPGROUND
-  INFORMATION
-  INTERPRETIVE SITE
-  BIG GAME HUNTING
-  WATERFOWL & BIG GAME HUNTING
-  FISHING
-  CANOEING, JULY 15 TO FREEZEUP
-  CANOEING, SEPT. 1 TO FREEZEUP

Red Rock Lakes National Wildlife Refuge
 Monida St. Rt., Box 15
 Lima, MT 59739
 (406) 276-3347



**U.S. Department of the Interior
 FISH AND WILDLIFE SERVICE**



RF6-61570

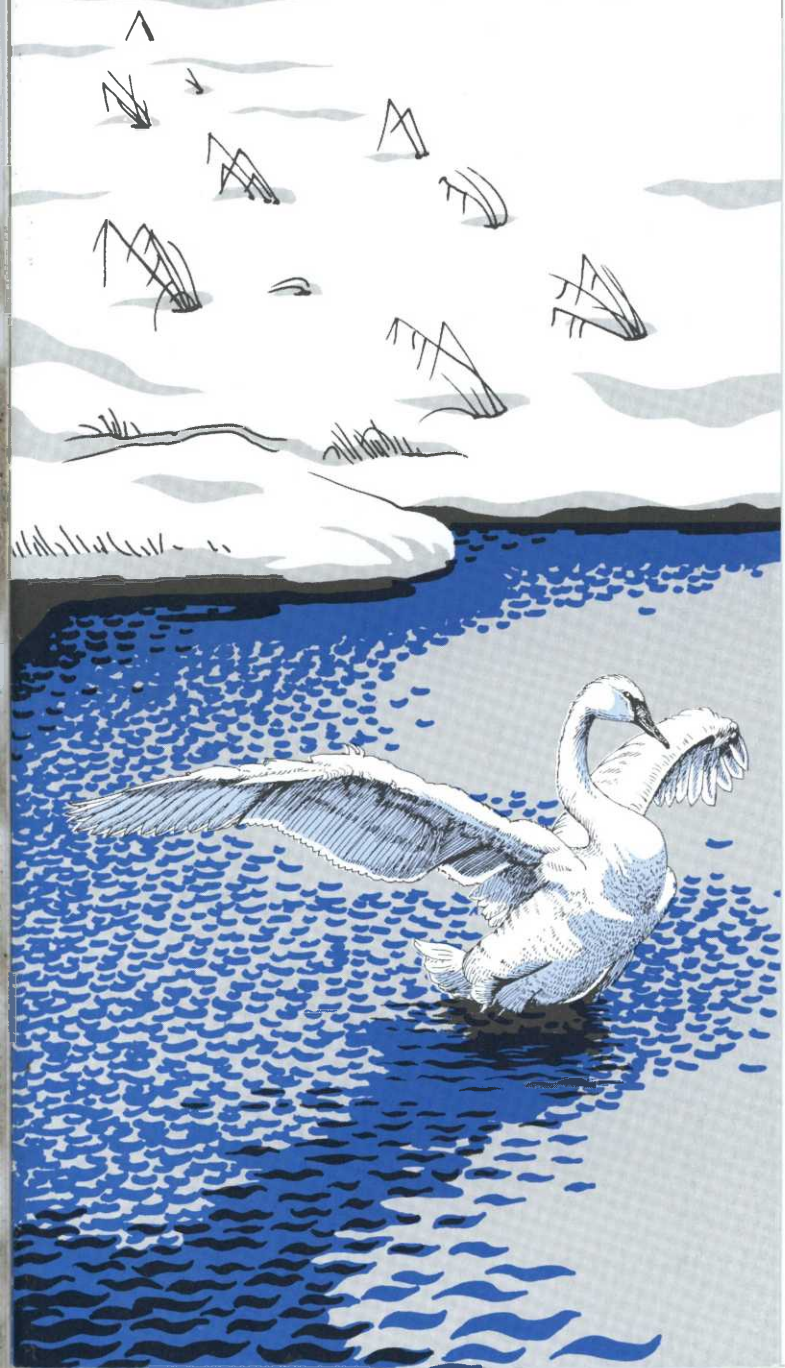


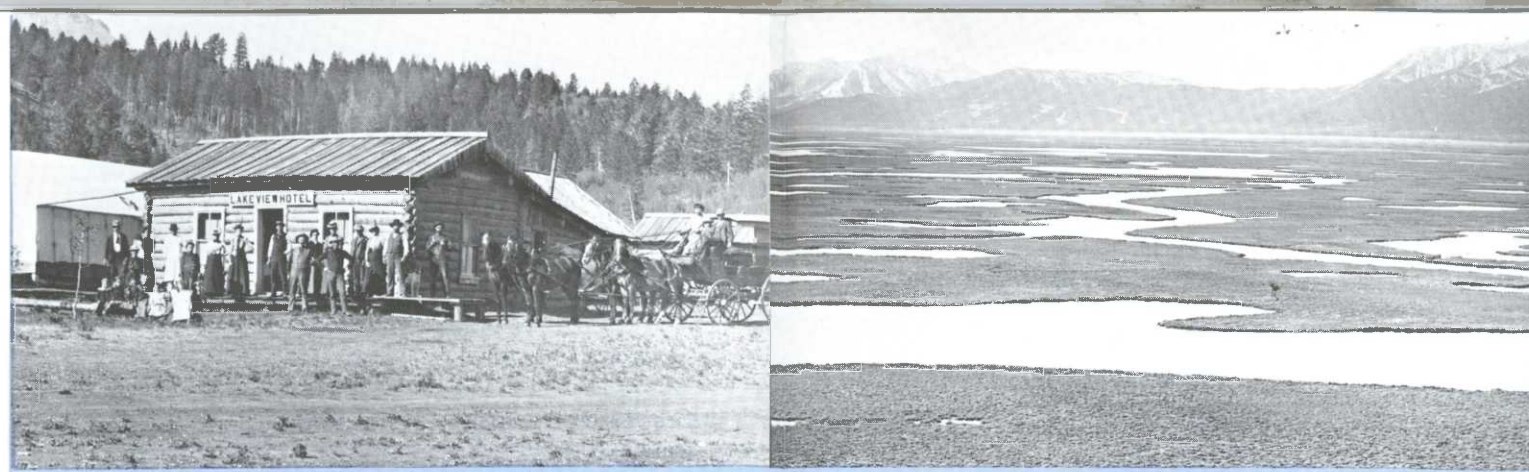
June 1986



RED ROCK LAKES

National Wildlife Refuge





Above: Lakeview, Montana was the center of activity in the Centennial Valley during the pioneer days. Right: Undeveloped marshes provide the seclusion and solitude required by the breeding trumpeter swans.

HISTORICAL PERSPECTIVE

The valley was well known to the Bannock Indians as a favored travel route between the headwaters of the Big Hole River and the Yellowstone country. Settlement by the white man did not occur until 1876. With settlement, herds of livestock were driven into the valley and homesteads sprang up at scattered locations. In the early days, market hunting for waterfowl and big game brought some revenue to local residents, but most settlers concentrated on livestock and sporadic lumbering. The long winters, great distances to market and small land parcels combined to make subsistence difficult. Few survived the depression of the 1930's.

Moose are often seen in late fall and in winter on the refuge.



RETURN OF THE TRUMPETERS

The trumpeter swan once ranged over much of the interior of the United States, but their numbers decreased as their habitat diminished. By the early 1900's, only a remnant population was left in the tri-state area of southwestern Montana, southeastern Idaho, northwestern Wyoming, and in parts of Canada and Alaska. Less than 100 swans were in the tri-state area in 1935 when the refuge was established. The refuge provided protection and solitude, and the swans increased. Their slow, steady build-up continued until the nesting population peaked in the early 1960's. Current trumpeter swan summer population figures for the tri-state area range from 400-500 swans. Due to the influx of migratory trumpeter swans from the northern latitudes, the wintering tri-state population figure is approximately 1,400-1,500 individuals.

During the winter, the birds are limited to the confines of the open water on the refuge and elsewhere within the tri-state area. In the earlier years, wildlife managers believed that natural foods were insufficient to maintain the growing population. Therefore, grain was provided for the swans at MacDonald and Culver Ponds during the severe winters. Winter feeding continues to be conducted carefully at Red Rock Lakes NWR. The U.S. Fish and Wildlife Service has also introduced swans from the refuge to repopulate their former habitats. As a result, wild flocks of trumpeters are now reestablished in Oregon, Nevada, South Dakota, Nebraska and Minnesota. Zoos and parks throughout the United States, Canada and Europe exhibit trumpeter swans originating from Red Rock Lake birds.

WILDLIFE AND WATERFOWL OF THE REFUGE

The refuge's lakes, marshes and creeks also provide attractive habitat for a multitude of ducks. Eighteen different kinds of waterfowl, including the Barrow's goldeneye, raise their young here each year.

Each spring, greater sandhill cranes nest in the refuge meadows and marshes. These long-legged birds are most easily observed in the open areas near Upper Red Rock Lake from April through September. Their courtship display and dance takes place in April and May.

In August and September, thousands of ducks and geese congregate on the refuge before their southward migration. Tundra swans often make their appearance on the refuge in October and November.

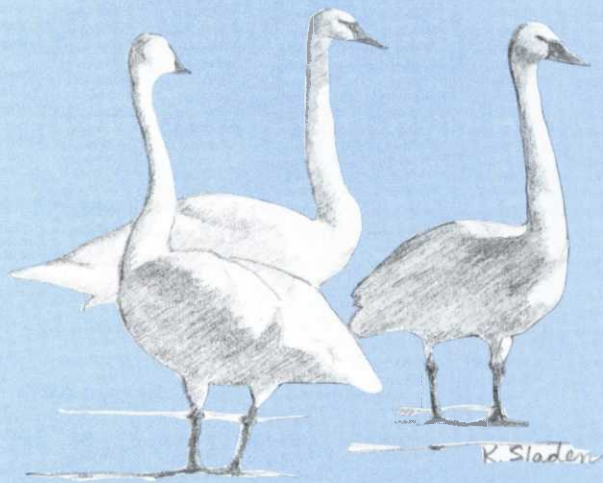
Great blue herons, willets, avocets and long-billed curlews are other conspicuous waders and shorebirds that frequently nest on the refuge. The timber covered slopes and aspen stands on the south side prove attractive to blue and ruffed grouse and many different songbirds and raptors. Brewer's sparrows are among the more common sagebrush residents north of the marsh.

Moose are year-round residents, but most elk, deer and pronghorn antelope are forced to migrate out of Centennial Valley due to the severe winters. Refuge visitors will encounter other familiar mammals such as the red fox, badger, striped skunk and Richardson's ground squirrel.

Beginning in May a myriad of wildflowers begin to appear on the refuge. By July, the refuge becomes a wildflower paradise. Shooting stars, buttercups, sticky geranium, lupine and loco weed paint the grasslands in multicolor hues of reds, pinks, blues and yellows.

A trumpeter swan family group.

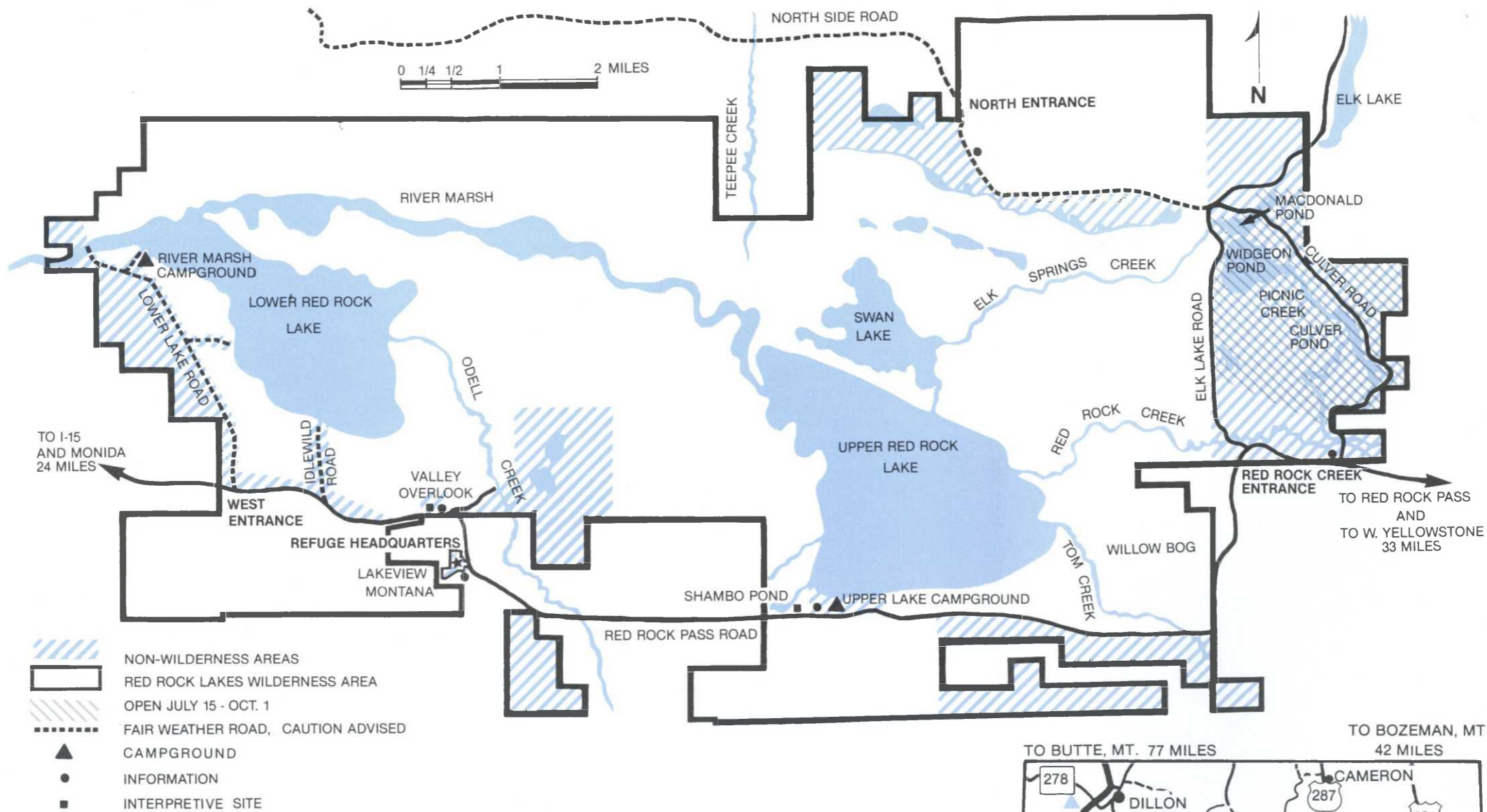




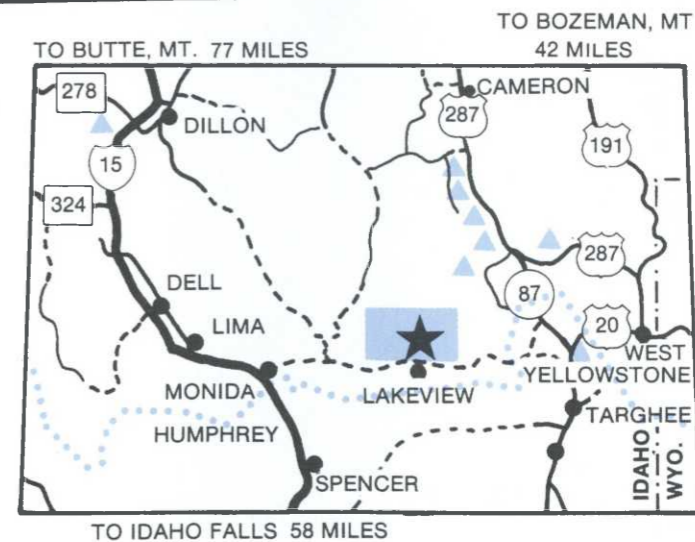
WELCOME TO RED ROCK LAKES NATIONAL WILDLIFE REFUGE

Red Rock Lakes National Wildlife Refuge was established in 1935 to protect the rare trumpeter swan. Today, this 40,300 acre refuge continues to be one of the most important nesting and wintering areas in North America for these majestic birds.

Red Rock Lakes National Wildlife Refuge lies in the eastern end of the Centennial Valley, near the headwaters of the Missouri River. The rugged Centennial Mountains border the refuge on the south and east and catch the heavy snows of winter, providing a constant supply of water that replenishes the refuge's 14,000 acres of lake and marsh. The flat, marshy lands of the valley floor merge into the rolling foothills of the Gravelly Range to the north. This is the habitat that provides the solitude and isolation so essential to the trumpeter swan.



A trumpeter swan family group.



VISITOR OPPORTUNITIES

Photographers, birdwatchers and other visitors will find Red Rock Lakes an unforgettable outdoor experience. Picnicking and camping facilities are available on or near the refuge. Fishing, hunting and boating are permitted on specific areas of the refuge during certain seasons. Consult refuge headquarters in Lakeview, Montana as to special refuge regulations concerning these activities. Accommodations are available at two resorts near the refuge, and at other resorts along the shores of historic Henry's Lake about 25 miles east of the refuge. Hotel and motel accommodations can be found in Lima and West Yellowstone, 50 miles east and west of the refuge.

The best time to visit the refuge is May through September. Headquarters can be reached by turning off Interstate Highway 15 at Monida, Montana, and driving 28 miles east over a dirt road, or by traveling west from Highway 87 or 20, past Henry's Lake, over 30 miles of dirt road, which is usually not open until mid-May. The road from Monida on the west side of the valley opens about mid-April, but can be difficult for passenger cars until mid-May. These roads are often closed again in November. Summer rains can make these routes all but impassable, so local inquiry as to road conditions is advisable at any time of the year.

Trumpeter swans are extremely sensitive to human disturbance. Please do not approach nesting swans any closer than 400 yds.

For further information write:

Refuge Manager
Red Rock Lakes NWR
Monida Star Route, Box 15
Lima, Montana 59739

Telephone: (406) 276-3347

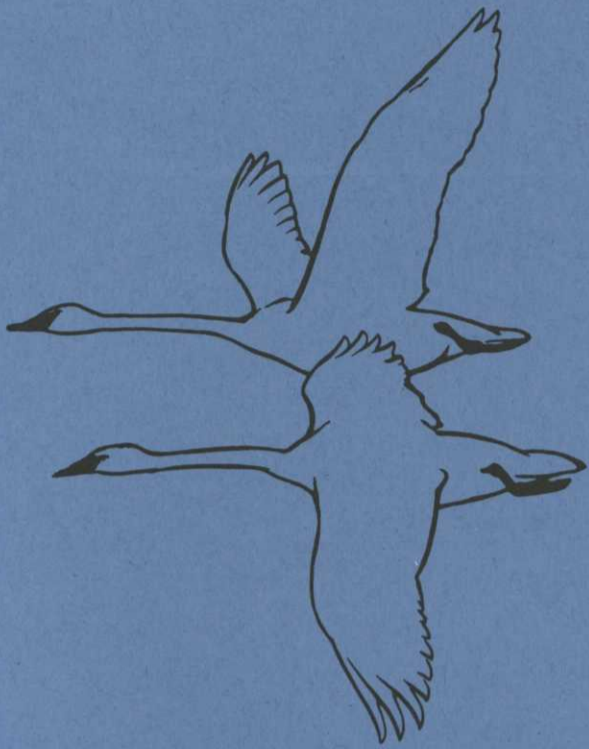
U.S. Department of the Interior FISH AND WILDLIFE SERVICE



RF6-61570



"Reprint November 1986"



BIRDS OF THE...

Red Rock Lakes

National Wildlife Refuge
and the
Centennial Valley
Montana

Red Rock Lakes National Wildlife Refuge

Red Rock Lakes National Wildlife Refuge is located in the scenic and isolated Centennial Valley of southwestern Montana, approximately 50 miles west of Yellowstone National Park. The refuge has a vast array of habitat, ranging from high elevation prairie at 6,600 feet, to the harsh alpine habitat of the Centennial Mountains at 10,000 feet above sea level. It is this diverse, marsh-prairie-montane environment that gives Red Rock Lakes its unique character.

Because of this habitat diversity, Red Rock Lakes is a unique wildlife area. The rugged mountains bordering the valley catch the heavy snows of winter that replenish the vast Red Rock marsh. The Red Rock Lakes ecosystem is one of the most important trumpeter swan breeding and wintering areas in North America, and for this reason the refuge was established in 1935. But Red Rock Lakes is more than trumpeter swans, it is a unique birding area.

A total of 258 species of birds have been recorded at Red Rock Lakes and the Centennial Valley. A small percentage of this total are year-round resident birds. Because of the short summer season, most birds migrate out of this area to winter. The black tern (*Chlidonias niger*) exemplifies the extremity of this type of movement, for it nests at Red Rock Lakes and winters in Peru and northern Chile. Spring migration is very slow, and many migrants pass over Red Rock Lakes without stopping due to the harsh conditions. Fall migration, however, is much more spectacular.

In the following list, those species marked with a • denote a confirmed breeder (nests, eggs, or young have been observed). The relative abundance of each species at each season is coded as follows:

S—March-May F—September-November
 S—June-August W—December-February

a—abundant common species, 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 to 5 years

GOOD BIRDING!

Species	Season			
	S	S	F	W
Common Loon	o	o	o	
• Western Grebe	c	c	c	
• Red-necked Grebe	o	o		
• Horned Grebe	o	o		
• Eared Grebe	c	c	c	
• Pied-billed Grebe	c	c	c	
• Am. White Pelican	c	c	c	
• Double-crested Cormorant	c	c	c	
Tundra Swan	o	r	u	
• Trumpeter Swan	c	c	c	c
• Canada Goose	c	c	c	o
Snow Goose	u	u	u	
• Mallard	a	a	a	a
• Northern Pintail	c	c	c	
• Gadwall	c	c	c	o
• Am. Wigeon	c	c	a	o
• Northern Shoveler	o	c	c	
• Blue-winged Teal	c	c	u	
• Cinnamon Teal	c	c	c	
• Green-winged Teal	c	c	u	
• Redhead	c	c	c	
• Canvasback	c	c	c	
• Ring-necked Duck	u	u	u	
• Lesser Scaup	c	c	c	
• Common Goldeneye	c	u	u	c
• Barrow's Goldeneye	c	c	c	c
• Bufflehead	c	c	c	o
• Ruddy Duck	c	c	c	
• Hooded Merganser	o	o	o	
• Red-breasted Merganser	u	o	u	
• Common Merganser	c	u	u	o
• Northern Goshawk	o	o	o	o
• Cooper's Hawk	o	o	o	
• Sharp-shinned Hawk	o	o	o	o
• Northern Harrier	u	u	c	o
• Rough-legged Hawk	u		c	o
• Ferruginous Hawk	u	u		
• Red-tailed Hawk	c	c	c	
• Swainson's Hawk	c	c	c	
• Golden Eagle	u	u	u	u
• Bald Eagle	c	c	c	c
• Osprey	u	u	u	
• Prairie Falcon	c	c	c	
• Peregrine Falcon	o	o	o	
• Merlin	o	o	o	
• American Kestrel	c	c	c	
• Blue Grouse	u	u	u	u
• Ruffed Grouse	u	u	u	u
• Sage Grouse	o	o	o	o
• Gray Partridge	o	o	o	o
• Snowy Egret	o	o		
• Great Blue Heron	c	c	c	o
• Black-crowned Night Heron	u	u	u	
• Am. Bittern	u	u	u	

Species	Season			
	S	S	F	W
• White-faced Ibis	o	o	o	
• Sandhill Crane	a	c	a	
• Virginia Rail	o	o	o	
• Sora	u	u	u	
• Yellow Rail	o	o	o	
• Am. Coot	a	a	a	
• Am. Avocet	c	c	c	
• Black-necked Stilt	o	o		
• Semi-palmated Plover	o			
• Killdeer	c	c	c	
• Marbled Godwit	u	u	u	
• Long-billed Curlew	c	c	u	
• Greater Yellowlegs	u	u	u	
• Lesser Yellowlegs	u	u	u	
• Solitary Sandpiper	o	o	o	
• Upland Sandpiper	o	o	o	
• Willet	c	c	c	
• Spotted Sandpiper	u	u	u	
• Long-billed Dowitcher	u	u	u	
• Wilson's Phalarope	c	c	c	
• Common Snipe	a	a	a	o
• Sanderling			o	
• White-rumped Sandpiper	o			
• Baird's Sandpiper	o			
• Least Sandpiper	o	o		
• Semi-palmated Sandpiper	o	o	o	
• Western Sandpiper	o	o	o	
• California Gull	a	a	a	
• Ring-billed Gull	u	u	u	
• Franklin's Gull	c	c		
• Forster's Tern	c	c		
• Black Tern	c	c		
• Mourning Dove	u	u	c	
• Great Horned Owl	c	c	c	c
• Long-eared Owl	u	u	u	
• Short-eared Owl	u	u	u	
• Great Gray Owl	o	o	o	o
• Burrowing Owl	u	u	u	
• Northern Saw-whet Owl	o	o	o	o
• Northern Pygmy Owl	o	o	o	o
• Common Nighthawk	o	o	o	
• White-throated Swift	u	u	u	
• Broad-tailed Hummingbird	u	u		
• Calliope Hummingbird	u	u		
• Black-chinned Hummingbird	o	o		
• Rufous Hummingbird	u	u		
• Belted Kingfisher	c	c	c	c
• Northern Flicker	c	c	c	
• Lewis' Woodpecker	o	o	o	
• Yellow-bellied Sapsucker	c	c	c	
• Williamson's Sapsucker	o	o	o	
• Hairy Woodpecker	c	c	c	u
• Downy Woodpecker	c	c	c	u
• Black-backed Woodpecker	o	o	o	o

Species	Season			
	S	S	F	W
• Three-toed Woodpecker	o	o	o	o
• Eastern Kingbird	u	u	u	
• Western Kingbird	u	u	u	
• Say's Phoebe	o	o		
• Willow Flycatcher	u	u		
• Dusky Flycatcher	u	u		
• Hammond's Flycatcher	u	u		
• Western Flycatcher	u	u		
• Western Wood Peewee	c	c		
• Olive-sided Flycatcher	u	u		
• Horned Lark	c	c	c	c
• Barn Swallow	c	c	c	
• Cliff Swallow	c	c	c	
• Violet-green Swallow	c	c		
• Tree Swallow	c	c	c	
• Bank Swallow	u	u		
• N. Rough-winged Swallow	u	u		
• Stellar's Jay	o	o	o	o
• Pinyon Jay		o		
• Gray Jay	u			u
• Black-billed Magpie	c	c	c	c
• Clark's Nutcracker	c	c	c	c
• Common Raven	c	c	c	c
• American Crow	u	u	u	
• Black-capped Chickadee	c	c	c	c
• Mountain Chickadee	c	c	c	c
• American Dipper	c	c	c	u
• White-breasted Nuthatch	u	u	u	u
• Red-breasted Nuthatch	c	c	u	u
• Pygmy Nuthatch	o			o
• Brown Creeper	o			o
• House Wren	c	c	c	
• Rock Wren		u	u	
• Canyon Wren	o	o		
• Marsh Wren	c	c	c	
• Gray Catbird	o	o		
• Sage Thrasher	u	u	u	
• American Robin	c	c	c	
• Townsend's Solitaire	c	c	c	u
• Hermit Thrush	u	u		
• Swainson's Thrush	u	u		
• Veery	u	u		
• Western Bluebird	o	o		
• Mountain Bluebird	a	a	a	
• Golden-crowned Kinglet	u	u	u	
• Ruby-crowned Kinglet	c	c	c	
• Water Pipit	c	c	u	
• Bohemian Waxwing	o			o
• Cedar Waxwing		u	u	
• Northern Shrike	c	c	c	
• Loggerhead Shrike	u	u	u	
• European Starling	c	c	c	

Species	Season			
	S	S	F	W
— Solitary Vireo	c	c	u	
— • Warbling Vireo	c	c	u	
— Tennessee Warbler	o	o		
— • Orange-crowned Warbler	o	o		
— • Yellow Warbler	c	c	u	
— • Yellow-rumped Warbler	c	c	u	
— Townsend's Warbler		o		
— Northern Waterthrush	o	o		
— • Common Yellowthroat	c	c		
— • MacGillivray's Warbler	c	c		
— • Wilson's Warbler	c	c		
— • American Redstart	u	u		
— • House Sparrow	u	u		
— • Bobolink		o		
— • Western Meadowlark	c	c	c	
— • Yellow-headed Blackbird	c	c	u	
— • Red-winged Blackbird	c	c	c	
— • Brewer's Blackbird	c	c		
— • Brown-headed Cowbird	c	c		
— • Western Tanager	c	c		
— Black-headed Grosbeak	o	o		
— Evening Grosbeak	o	o		
— • Lazuli Bunting	u			
— • Cassin's Finch	c	c	c	u
— • Pine Grosbeak	c	c	c	c
— • Rosy Finch	c		o	c
— Common Redpoll	c			c
— • Pine Siskin	c	c	c	o
— • American Goldfinch	u	u		
— • Red Crossbill	u	u	u	u
— • Green-tailed Towhee	o	o	o	
— • Savannah Sparrow	u	u	u	
— Lark Bunting		o		
— • Vesper Sparrow	c	c	c	
— • Lark Sparrow	u	u	u	
— • Dark-eyed Junco	c	c	c	u
— American Tree Sparrow		o		o
— • Chipping Sparrow	c	c	c	
— • Brewer's Sparrow	c	c		
— • White-crowned Sparrow	c	c		
— Fox Sparrow	u			
— • Lincoln's Sparrow	c	c		
— • Song Sparrow	c	c	c	
— Lapland Longspur	u		u	u
— Snow Bunting	u		u	c

The following birds have been observed in the Centennial Valley and are considered rare. These birds are either out of their normal range or are observed very infrequently in highly restrictive habitat types.

- | | |
|-----------------------------|----------------------------|
| Arctic Loon | Caspian Tern |
| Great Egret | Band-tailed Pigeon |
| Mute Swan (feral) | Rock Dove |
| Black Swan (feral) | Yellow-billed Cuckoo |
| Ross' Goose | Black-billed Cuckoo |
| Greater White-fronted Goose | Western Screech Owl |
| Wood Duck | Pileated Woodpecker |
| Greater Scaup | Red-headed Woodpecker |
| Harlequin Duck | Least Flycatcher |
| Old Squaw | Blue Jay |
| White-winged Scoter | Northern Mockingbird |
| Surf Scoter | Red-eyed Vireo |
| Turkey Vulture | Yellow-breasted Chat |
| Gyrfalcon | Common Grackle |
| Sharp-tailed Grouse | Northern Oriole |
| Ring-necked Pheasant | Rose-breasted Grosbeak |
| Whooping Crane | House Finch |
| Mountain Plover | White-winged Crossbill |
| Black-bellied Plover | Rufous-sided Towhee |
| Snowy Plover | Grasshopper Sparrow |
| Red-necked Phalarope | Sage Sparrow |
| American Woodcock | Clay-colored Sparrow |
| Pectoral Sandpiper | Harris' Sparrow |
| Dunlin | White-throated Sparrow |
| Herring Gull | McCown's Longspur |
| Bonaparte's Gull | Chestnut-collared Longspur |
| Common Tern | |



Observer: _____

Address: _____

Weather: _____

Date: _____

Time: _____

Total Species _____

**For Additional Information Contact
Refuge Manager
Red Rock Lakes
National Wildlife Refuge
Monida Star Route
Box 15
Lima, Montana**

Red Rock Lakes National Wildlife Refuge is one of a system of refuges administered by the U.S. Fish and Wildlife Service and dedicated to the preservation of wildlife. The financial base for this system was firmly established in 1934 through the passage of the Migratory Bird Hunting Stamp Act. This Act requires waterfowl hunters to purchase annually a migratory bird or "duck stamp." Funds collected from duck stamps sales have been used to purchase numerous refuges that provide habitats necessary to sustain a variety of wildlife for both hunters and nonhunters to enjoy.

**UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE**



RF-661670-2



GPO 845-611

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