BITTER LAKE NATIONAL WILDLIFE REFUGE
Roswell, New Mexico

ANNUAL NARRATIVE REPORT
Calendar Year 1981

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U.S. Department of the Interior
Fish and Wildlife Service
NATIONAL WILDLIFE REFUGE SYSTEM

Left to right: 2, 6, 4, 5 and 1.

Personnel

1. LeMoyne B. Marlatt, Refuge Manager, GS-11, PFT
2. Jerry D. French, Assistant Manager, GS-9, PFT
3. Mary K. Doyle, Assistant Manager Trainee, GS-7, PPT
4. Lilly B. Fuller, Office Assistant, GS-5, PFT
5. Johnnie J. White, Maintenance Worker, WG-8, PFT
6. Bill L. Nelson, Maintenance Worker, WG-7, PPT
   (Resigned 4/3/81)

Review and Approvals

L.B. Marlatt 2/24/82
Submitted by Date

John E Kurtz 5/13/82
Area Office Review Date

Wayne E Swanson 5/18/82
Regional Office Review Date

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A. HIGHLIGHTS

Refuge impoundments retained optimum water levels for the first time in many summers. (Section F.2)

The refuge experienced significant mortality among sandhill cranes due to a plant produced toxin. (Section G.4)

The deregulation of gas and oil has greatly increased the exploration and production of petroleum adjacent to the refuge. (Section J)

A species of snail, previously known in New Mexico only as a Pleistocene fossil, was found living on the refuge. (Section G.2)

B. CLIMATIC CONDITIONS

Most of the moisture is usually received from summer thundershowers. During 1981, 19.43 inches of precipitation were recorded, a 74% increase over the 20 year average of 11.19 inches. This year's abnormally large amounts of summer rainfall associated with the mild temperatures helped retain water levels in the refuge impoundments and produced excellent growth in the surrounding rangeland. Refuge croplands benefitted since it was unnecessary to apply the highly alkaline irrigation water in great amounts.

Standing water produced an excellent crop of insects, particularly mosquitos. Although a nuisance to refuge visitors, they were highly beneficial to one of the endangered species, the Pecos gambusia (Gambusia nobilis), a member of the mosquito fish family.

Table 1. Weather Phenomena - Bitter Lake NWR Weather Station

Annual Precipitation	19.43 inches
Snow	2.75 inches
Days with Freezing Temperatures	121
Days With Temperatures of 100° or More	17
Growing Season	197 days
Last Frost of Spring	April 9, 32°
First Frost of Fall	October 24, 28°
Coldest Day	February 11, 2°
Hottest Day	June 22, 113°

Table 2. Precipitation totals (inches) and temperature extremes for each month of 1981, as recorded at the refuge weather station.

	Precipitation			Temperatures	
Month	1981	20 Yr. Av.	Snow	Maximum	Minimum
January	.29	.45	2.75	73	16
February	.21	.49		82	2
March	.34	.33		85	20
April	1.04	.78		91	28
May	3.81	.91		96	36
June	2.19	1.45		113	45
July	4.51	2.05		102	58
August	2.81	2.57		99	54
September	2.19	2.15		101	43
October	1.34	.87		87	25
November	.50	.41		85	76
December	.20	.41		83	11
	19.43	11.19	2.75		

D. PLANNING

5. Research and Investigations

Bitter Lake NR 81 - Life History Strategies of a Prey Species (Cyprinodon sp.) in Response to Different Predation and Competition Pressure, 22510-1, Gary P. Garrett and Dr. Clark Hubbs, U.T. Austin. Mr. Garrett's dissertation titled "Variation in Reproductive Strategy in the Pecos Pupfish, (Cyprinodon pecosensis)" was received in September. Three populations of Pecos pupfish were studied, two of which are located at Bitter Lake NWR. Variations between these populations were noted.

Bitter Lake NR 81 - Variation in Cyprinodon pecosensis as a Response to Diverse Environmental Conditions, 22510-2, Robert W. Bouma, Cornell University. The objectives of the study, including resource utilization, the pattern of reproductive behavior variation and population dynamics were met in 1980; however, no final report has been received.

Bitter Lake NR 81 - Completion of Portions of the Draft Management Plan for the Pecos Gambusia, (Gambusia nobilis), on the Bitter Lake NWR, 22510-3, Robert W. Bouma, under contract with the USFWS, Region 2, Endangered Species office. A preliminary survey of all aquatic habitat of the refuge to locate and assess existing populations of the Pecos gambusia; and determination of potential habitat for transplants has been completed. In July, Hatchery Manager Buddy Jensen of Dexter NFH assisted Mr. Bouma with the transplant of Pecos gambusia from existing populations into other suitable habitat on the refuge.

Bitter Lake NR 81 - Bird/Aircraft Strike Prevention Study, Canon Air Force Base, New Mexico, 22510-4. This is an ongoing study with no scheduled completion date. The refuge provides the data from the weekly waterfowl census to the air force base.

Bitter Lake NR 81 - Arizona State University-Pecos River Wildlife and Riparian Habitat Investigation, 22510-5, Thomas Hildebrandt, Project Field Leader. This contract study financed by the Bureau of Reclamation, was initiated to determine the effects of the Pecos River salt cedar eradication program on wildlife populations in the area. (See Other Habitat F.6). Field work was completed in early summer; however, the final report has not been received.

E. ADMINISTRATION

1. Personnel

Maintenance worker Bill Nelson resigned in April to enter the construction industry. This vacancy had not been filled by year's end; however, Mr. Clayton Christenson will transfer from the Morris Wetland Management Office in Minnesota to assume the duties in early January, 1982.

BITTER LAKE STAFF POSITIONS 1977-1981

Year	Permanent		Temporary
	Full Time	Part Time	
FY 1981	4	2	1
FY 1980	4	1	-
FY 1979	4	1	1
FY 1978	5	-	-
FY 1977	4	-	-

2. Funding

Fiscal year 1981 station funding was derived from the following subactivities:

1210	Migratory Birds	$ 112,000	73.3%
1240	Interpretation & Recreation	37,100	24.3%
1994	Quarters Maintenance	3,700	2.4%

In FY 1981, the refuge had an operating budget of $152,800 which represents an 8% increase over FY 1980 funding. By combining a single digit budget increase and double digit inflation, the refuge continues to have less purchasing power.

FUNDING SINCE 1977

Fiscal Year	O&M Funds	% Salaries	YCC	Rehabilitation
1981	152,800	58	-	-
1980	140,400	73	60,200	
1979	146,400	66	47,200	
1978	135,300	72	58,000	37,000
1977	117,400	70	46,500	50,000

3. Safety

Regular monthly safety meetings were chaired by Assistant Manager Kathy Doyle. All staff members completed the American Red Cross Mulitmedia Standard First Aid Course in February and the National Defensive Drivers Course in June.

A new station safety plan was completed and implemented in April.

At year's end this station has compiled an enviable record of 1,985 days without an accident and 2,276 days without a lost time accident.

F. HABITAT MANAGEMENT

1. General

Habitat conditions were far better in 1981 than they have been in recent years. The above average rainfall which the refuge received during the normally dry summer months greatly enhanced the grasslands and refuge crops. The rainfall was also instrumental in maintaining optimum water levels in the refuge impoundments.

2. Wetlands

The refuge maintains over 2,500 acres of wetlands, primarily man-made impoundments and sloughs created by the meandering Pecos River. These wetlands are maintained by precipitation and a naturally high water table. Management of these wetlands is primarily to maintain maximum water levels. High evaporation and occasional rainfall creates ample and ever changing mudflats during the peak shorebird use periods on the refuge.

Due to the alkaline soil of the area, the shallow water strata which feeds the impoundments is also highly alkaline and saline. This poor water coupled with the erratic shorelines is prohibitive to many of the desirable aquatic plants normally associated with productive waterfowl areas. Despite these conditions, good stands of muskgrass (Chara sp.) are produced in five of the seven impoundments, supplemented by the occasional production of widgeongrass (Ruppia maritima), and more limited alkali bulrush (Scirpus paludosus) and giant millet (Echinocholoa sp.). Sparce stands of cattail (Typha sp.) are found in only a few isolated locations. Bitter Lake, the only natural impoundment on the refuge, produces no aquatic vegetation due to it's erratic water supply and shallow nature, yet it is highly important as a nesting ground for shorebirds and as a roost for sandhill cranes.

4. Croplands

The refuge farm, located within the Pecos River flood plain is a combination of alluvial sand and clay. The continual use of this land for raising crops utilizing salty irrigation water has caused a build up of salts making the land quite unsatisfactory for normal farming. The refuge has begun a program of varied farming practices to determine if we can develop a combination of crops, fertilizer and rotation which will ease the problem. The greatest benefit to the farm is abundant precipitation which tends to dilute the salts and relieves the crops from the irrigation water. This past summer's abundant rainfall allowed us to produce better crops than have been grown in the past four years.

The refuge annually produces about 150 acres of grain and green browse by force account farming. Sixty-three acres were fertilized at the rate of 100 pounds of 90% sulphur and 100 pounds of 45% nitrate per acre. This acreage was then planted to Japanese millet which produced quite well.

Several crop manipulation experiments were attempted in order to produce a better millet crop.

#1 - Experimental ridging of Japanese millet versus traditional sowing on level ground. This was an attempt to minimize buildup of alkali salts on the growing surface (see text). 7/81 LBM

#2 - Winter barley after heavy goose utilization, showing alkali typical of most refuge croplands. 2/80 LBM

1. The seeding rate was varied among the fields. A rate of 24 pounds per acre produced the most vigorous plants. This was about two-thirds the rate previously used.

2. Ridging was done on ten acres to determine if better stands of millet would grow on the ridges where, theoretically, better root aeration occurs in these alkaline fields. Due to the unseasonal rain we did not have to use the saline irrigation water, thus no advantage was evident.

3. The millet crop was mowed in mid-July to slow down the maturation of the rain hastened crop. This technique proved valuable, but would probably be of only marginal value during a dry summer when crops need a full season's growth to reach maturity.

In late September the refuge sowed 58 acres of barley and 14 acres of oats. Thirty acres of the barley was over-sown with yellow clover in an attempt to provide a cover crop during fallow seasons.

By years end most refuge crops had been well utilized by geese, cranes, and deer. The oats, planted primarily to use up some old seed, have fared far better than the barley, and both have been utilized equally by the wildlife.

Two hundred bushels of winter wheat were received from the Washita NWR to use for bait in waterfowl banding operations.

5. Grasslands

The refuge has over 10,000 acres of shortgrass prairie composed primarily of warm season perennials. The dominant species are alkali sacaton (Sporobolis airoides) and blue gramma (Bouteloua gracilis) with a wide variety of other perennial and annual grasses ranging from common reed (Phragmites communis) in the marsh land to gyp gramma (Bouteloua brevisita) on the uplands.

There is presently no authorized grazing on the refuge. Occasional trespass cattle do enter the refuge following flooding of the Pecos River when water gaps are washed out. On much of the refuge grazing would be incompatible with present waterfowl and public use management. The largest grassland on the refuge, the Salt Creek Wilderness, is excluded from grazing due to conditions of the Wilderness Act.

The economic value of grazing to the refuge must be considered in light of the investment that would be required to establish and maintain division fences and stock watering facilities. It is believed that the small return that could be realized from such an investment would be outweighed by the esthetic and recreational values that could be derived from wildlife use with the grazing excluded.

#3 - The irrigation reservoir was rip-rapped with broken pieces of old concrete ditch lining to curb bank erosion. 12/81 LBM

#4 - It is difficult to maintain boundary fences at the four crossings of the constantly fluctuating Pecos River 9/81 LBM

6. Other Habitats

The refuge has over 4,000 acres of former grassland that has been lost to the encroachment of salt cedar (Tamarix pentandra). A salt cedar eradication program was begun in the 1960's by the Bureau of Reclamation to return much of the encroached land to grassland and hopefully return more water to the Pecos River. Salt cedar has a reputation of utilizing great quantities of water, so civic and agricultural leaders promoted the idea of eradicating this introduced species along the Pecos River from Santa Rosa, New Mexico to Pecos, Texas. Much of the salt cedar was cleared, however, the Bureau of Reclamation must continue to cut the regrowth from the reclaimed lands every year. By mutual agreement, not all the salt cedar was removed from the refuge, and the alternating strips of grassland and salt cedar provide an ideal "edge" which provides escape cover for several species of wildlife, and is extensively used as nesting cover by mourning doves, pheasants, and other birds.

9. Fire Management

A program of prescribed burning of marshes has been successfully carried out on the refuge for several years. All burning is done during the late winter when water levels are high enough to prevent peat fires and before nesting has begun. A rotational system of burning allows for consistent removal of dead vegetation without denuding the entire area. Care is taken to prevent fire, be it prescribed or wild, from spreading onto the grasslands.

Graded firebreaks are maintained around the refuge boundary to prevent wildfires from entering the refuge. These firebreaks also provide considerable security to neighboring landowners from wildfires originating on the refuge.

Assistance in controlling refuge wildfires is received from the Bureau of Land Management and from the volunteer fire departments which service the rural Roswell area.

10. Pest Control

The only pest control carried out by refuge personnel is the occasional removal of trespass house pets. Animals are returned to their owners or the city pound when possible; feral animals are destroyed.

The few elm and cottonwood trees on the refuge were sprayed with Sevin in mid-July to prevent damage by web worms and other harmful insects. All spraying operations were done by a licensed sprayer from Roswell.

The New Mexico Environmental Improvement Division carried out rodent trapping on the refuge in mid-summer and determined the presence of fleas carrying bubonic plague. Some mosquitos collected on the refuge by the NMEID were found to be carriers of equine encephalitis.

11. Water Rights

Considerable water rights were purchased during the early years following the refuge's establishment. Unfortunately, these rights were for available surface water, much of which has since disappeared due to a lowered aquifer caused by the expansion of civic and agricultural interests. The lack of a guaranteed source of water is presently the most critical item facing the refuge. No water may be removed from the Pecos River since this is primarily owned by the City of Carlsbad and the State of Texas, downstream from the refuge. Even the spring flows which are used to maintain impoundment levels are claimed by the government under a rather obscure ruling which states that the refuge may use it because it was "developed" on the refuge.

Some consideration is currently being given to trading some refuge water rights to the City of Roswell in exchange for sewer effluent which would be used for crop irrigation and marsh management. The refuge has been receiving some of this effluent, mostly during the fall and winter months, and impounding it in the waterfowl hunting area. The city plans on building a more efficient waste water treatment plant in the near future in order to meet EPA requirements, and many area farmers are hoping to purchase the effluent for crop irrigation. Negotiations between the city and the refuge are hinging on the quality and quantity of effluent the city can deliver, and on whether the Service can foot the cost of pipelines, pumping stations and a new charge for the effluent.

12. Wilderness and Special Areas

A management plan for the 9,621 acre Salt Creek Wilderness was completed in January and submitted to the Area Office for approval. Approval had not yet been obtained by year's end. The wilderness, located within the north tract of the refuge, receives little use despite the fact that U.S. Highway 70 is within 800 feet of it at one point. One obstacle to encouraging public use of the area lies in the fact that the land which separates the wilderness from the highway is privately owned. Visitors and refuge staff must trespass in order to enter the wilderness from this access point.

The land owners have not objected to the occasional trespass, but the ownership status prevents the refuge from constructing an all weather road from the highway to the wilderness. A parking area was constructed within the refuge and adjacent to the wilderness, but the present dirt road leading from the highway to the parking area would discourage most visitors. An effort to secure a right-of-way easement is underway.

The Lake St. Francis and Bitter Lake Research Natural Areas are both located within the south tract of the refuge. The Lake St. Francis RNA is a group of gypsum sink holes which provide sanctuary to several species of small native fish. These fish and their unique habitat have been the subject of several doctoral research studies in recent years. The Bitter Lake RNA serves as a primary roosting ground for the lesser sandhill crane, and as a nesting area for numerous shorebirds that use the refuge during the summer months.

#7 - This National Sign Shop prepared sign was erected on the Salt Creek Wilderness. Small gate permits entry by horseback riders, large gate is for access by Southwest Public Service Company. 10/81 LBM

#8 - Maintenance of the waterfowl display pen includes changing the water weekly, a job shared by Maintenance Worker White and Assistant Manager Doyle. 11/81 LBM

G. WILDLIFE

1. Wildlife Diversity

The primary mission of the Bitter Lake National Wildlife Refuge is to manage the area for waterfowl maintenance. No specific management is aimed at increasing wildlife diversity. However, as a by-product of the waterfowl maintenance program, the refuge provides habitat suitable for big game, small mammals, predators, over 300 species of birds, plus numerous species of reptiles, amphibians and fish and invertebrates.

2. Endangered Species

Isolated populations of the Pecos gambusia (Gambusia nobilis), a member of the mosquito fish family, are located in the gypsum sinkholes and impoundments on the south tract of the refuge. Throughout its range, this small fish, native to the Pecos River drainage, is suffering from loss of habitat as the small tributaries of the Pecos River go dry, and hybridization with the common mosquito fish (Gambusia affinis); however, refuge populations appear stable. Preliminary work is underway on the draft management plan for the Pecos gambusia. This work is being accomplished under the auspices of the regional endangered species office. (See Section D.5)

Several sightings of peregrine falcons were made during the fall. The bald eagle did not put in an appearance this year.

Federally listed threatened species observed on the refuge included: inland least tern, white-faced ibis, northern long-billed curlew, western snowy plover, ferruginous hawk, prairie falcon, prairie merlin, osprey, and western burrowing owl.

Several state listed threatened species were observed including: Mississippi kite, red-headed woodpecker, western spiny softshell turtle (Trionyx spiniferus hartwegi), Texas slider turtle (Chysemys concinna texana), (Pecos) western ribbon snake (Thamnopsis proximum diabolicus), trans-pecos rat snake (Elaphe subocularis), eastern barking frog (Hylactophryne augusti latrans).

In May, Mr. Dwight Taylor of the Tiburon Center for Environmental Studies, San Francisco State University in California, under contract with the New Mexico Department of Game and Fish visited the refuge in search of mollusks. He located several species of snail. The latest word is that he plans to propose one species of snail, Polygyra texasiana texasensis, to the New Mexico state endangered species list. This land snail, also found in south Texas, had been known only as a Pleistocene fossil in the Roswell area. No living specimen had ever been found in New Mexico.

3. Waterfowl

Waterfowl use days for CY-81 amounted to 4.67 million, a continuation of the decline apparent over the past few years. In CY-80, 6.3 million, and

in CY-79, 8.5 million use days were recorded.

Throughout the year unseasonably mild weather was experienced, particularly in the fall. A temperature reading of 83° F. was recorded in mid-December. The above average rainfall created optimal water levels in playa lakes, farm ponds and sloughs throughout the South Plains, and it is probable that the birds dispersed to these areas rather than to traditional wintering areas. This factor, in conjunction with the poor production reported in the prairie pothole region, probably accounted for the low numbers recorded on the refuge between July and December 1981.

The year began with 47,000 ducks of which one-third were pintails, however, most of the birds dispersed within a week, dropping the number to 23,000. By late spring, only 500 ducks were observed and these remained throughout the summer. Production was estimated at 900 young, primarily teal, gadwall, and mallard. An occasional brood of pintails was sighted, as well as coots. Arrival of fall migrants was slow, with the build up beginning in late August. The fall peak of 21,000 ducks was reached in late October, and was composed primarily of widgeons and ruddy ducks. The mallard population, normally the largest, remained under 2,000 individuals until the last week of December, when close to 5,000 birds were recorded. Peak populations of 20,000 to 40,000 mallards are normally observed.

After starting the year with 25,000 snow geese, only a few hundred remained by the third week of January, with the last birds observed in mid-March. A few fall migrants arrived in early October, however, the flock did not build until the last week of the month. This year's peak of 30,000 geese was reached on November 13, a considerable drop from the peak of 75,000 recorded in November, 1980. They lingered on the refuge for two weeks, depleting the refuge crops, then the bulk of the birds dispersed over the Pecos Valley or continued south. At the end of the year, 11,000 geese were utilizing the refuge roost, moving out onto private land to forage. A portion of the flock that winters in the Pecos Valley, usually passes on through the refuge to the Artesia Waterfowl Management Area, owned and managed by the New Mexico Department of Game and Fish. Early in CY-81, some depredation was reported on private land in that vicinity.

The refuge continues to cooperate with the regional flyway biologist on the snow goose productivity survey, and this year's sampling indicated that 39% of the flock were young birds, indicating a thriving flock.

This year marked the first observation of a Bosque del Apache NWR neck-collared snow goose. Bitter Lake birds have been sighted at Bosque del Apache NWR since neck collaring was carried out from 1976 through 1980.

During 1981, over 136,000 use-days were recorded for Canada geese. A resident flock of approximately 40 birds, usually remains on the refuge year-round. By nesting season, however, only 22 adults were observed, but reproduction brought the number back to 39.

Although the migrant population steadily builds in the fall, the peak nor-

Table 3. Waterfowl and crane use days and peak populations recorded at Bitter Lake NWR, July-December 1978-1981

	1978		1979		1980		1981	
	Use Days	Peak Pop.	Use Days	Peak Pop.	Use Days	Peak Pop.	Use Days	Peak Pop.
Ducks (all)	2,514,665	57,371	5,233,908	105,202	2,601,171	41,508	1,630,500	21,000
Geese								
Canada	15,315	420	18,438	376	28,520	1,034	22,460	800
Snow	465,244	27,175	625,490	40,000	1,765,940	75,000	1,102,900	30,000
Ross'	12,100	800	41,200	2,400	35,218	2,250	22,050	600
White Front	1,260	18	0	0	0	0	28	3
W. Swans	60	20	0	0	0	0	56	2
Subtotal	3,008,644		5,919,036		4,395,631		2,777,994	
Coots	759,435	26,201	911,485	28,765	555,005	13,727	1,304,580	23,285
Waterfowl Total	3,768,079		6,830,521		4,950,636		4,082,574	
Cranes	304,500	10,630	1,088,192	54,000	765,051	36,200	743,400	18,000

mally occurs in February. This year's peak of 3,300 was recorded in early January, then again in late February. As in the past, the refuge participated in the Short-Grass Prairie and Hi-Line Goose Surveys in cooperation with the state. Of the 400 geese surveyed, approximately 25% were found to be of the Hi-Line population.

A large flock of Canada geese was again reported 15-20 miles west of Roswell on the MX ranch, along the Hondo River. In the early 1960's, this flock numbered only 15 birds, but has since built to several thousand. This year, over 7,000 birds were counted.

Throughout the month of December, the refuge hosted an immature and an adult whistling swan which were included on the National Audubon Christmas Bird Count.

As usual, several white-fronted geese were sighted within the snow goose flock in November.

4. Marsh and Water Birds

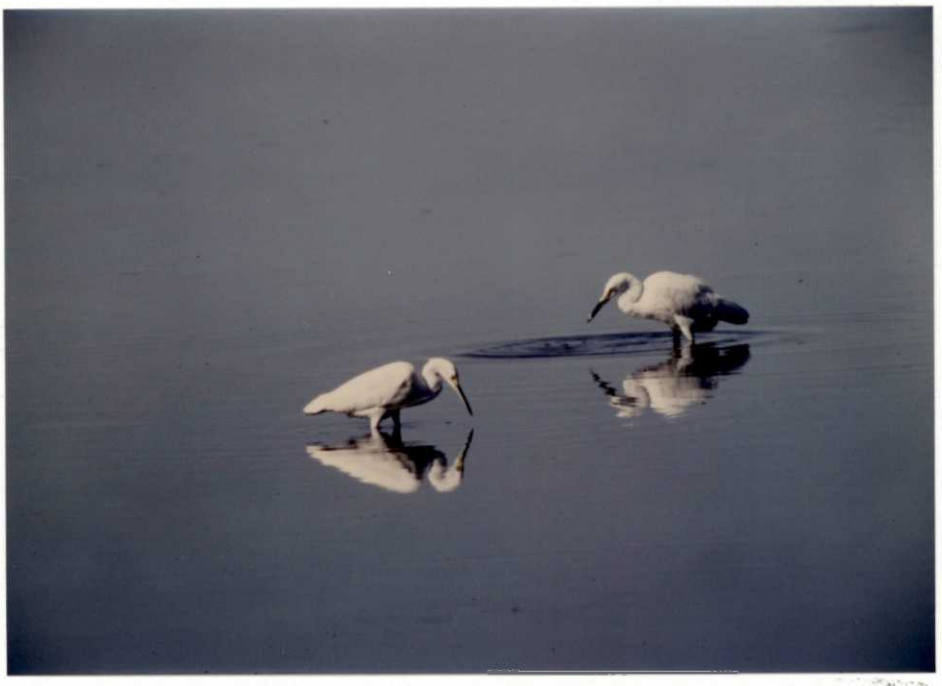
During the fall and winter months, Bitter Lake NWR again hosted good numbers of lesser sandhill cranes. The cranes leave their refuge roosts each day to feed on surrounding farms and rangeland, usually returning in the late afternoon. The year began with 14,000 cranes, but rapidly dwindled to only a few hundred by mid-March. The last cranes were observed during the first week of April. Crane use days for that quarter totalled 316,400.

The first fall migrants appeared on October 1, right on schedule. Crane numbers continued to build until a plateau of 12,000 was reached in November, followed by the peak of 18,000. In the past few years, peaks of 40,000 to 60,000 cranes have been common. Only 743,400 use-days were recorded during the last quarter of CY-81, a 25% decline from the previous year.

On December 31 and January 1, approximately 100 crane carcasses were picked up around the refuge roosts on Bitter Lake, Unit 6 and Unit 16, and the carcasses were burned. Several specimens were collected, frozen and sent to the National Wildlife Health Laboratory. Preliminary results indicated that aflatoxin, a fungus-produced toxin, may have been the culprit. Prior to the die-off, abnormally high crane use was noted on one refuge field, N-4, so plant samples were collected for investigation. This field, planted to Japanese millet, also produces a nutsedge, (Cyperus sp.). However, aflatoxicosis is more often associated with peanuts, corn and sorghum, all of which are grown within 80 miles of the refuge, in the Portales, New Mexico area. A final diagnosis has not been received at this writing.

In examining crane feeding and roosting areas, considerable probing has been noted around Salicornia sp. It is not known whether the birds are searching for plant or animal matter.

In addition to the lesser sandhill crane, sixteen species of marsh and water birds were reported during the year. Great blue herons, American



#11 - Snowy egrets peaked at 123 during August for some summer fishing on the refuge. 10/81 LBM

#12 - Over 500 snowy plovers were produced around the refuge lakes, where they could be seen running at great speed (for such a tiny bird) when only a few days old. 6/81 SLM

bitterns and black-crowned night herons were observed year-round, as were eared and pied-billed grebes.

White-faced ibis stayed on throughout the fall and winter, whereas normally they move out of the refuge in October. Lots of sora activity was noted in late summer in the hunt marsh south of Unit 15. More often than not, the casual observer would hear their whistle-like call, rather than view this elusive marsh bird.

White pelicans lingered on the refuge longer than usual during this year's fall migration. The first birds arrived in August, gradually building to a peak of 489 on October 23. A considerable number remained until mid-December, probably due to the fact that the lakes were stocked with catfish on October 15, the last day of the fishing season. Only a dozen or so birds were observed at any one time during the spring migration.

Reported irregularly in the past, a seldom observed common gallinule was present on Unit 7 for a few days in July.

Over the past few years, observations of the red-throated loon have become more common. This unusual refuge visitor has been reported for the past two years.

Marsh and water birds nesting on the refuge included the snowy egret, black-crowned night heron, green heron, sora, white-faced ibis, great blue heron, American bittern and pied-billed grebe.

5. Shorebirds, Gulls, Terns, and Allied Species

During the year, 31 species from this group were recorded on the refuge. Normally, lake levels recede in the summer, exposing mud flats that provide feeding and nesting areas for shorebirds. Since high water levels continued through the summer this year, a decline in shorebird use was noted, particularly in the number of American avocet, black-necked stilt, yellowlegs and killdeer. Although the inland least tern has been reported nesting on the refuge in the past, this activity has not been observed in recent years, perhaps indicating a decline in this species. A rare sighting of a caspian tern delighted local birdwatchers.

6. Raptors

Raptors are an integral part of the grassland community and during the past year the refuge supported 22 species. The most numerous, the turkey vulture, arrived in late March and remained on the refuge until mid-October. The arrival of turkey vultures has been observed to coincide with the departure of wintering eagles from the area. Marsh hawks, red-tailed hawks and great-horned owls were observed throughout the year and nested here along with the barn owl, swainson's hawk, cooper's hawk and turkey vulture. A prairie dog village west of the refuge boundary is home base for a population of western burrowing owls. Some of the numerous sink holes on the refuge provide nesting sites for great-horned and barn owls.

#9 - Snow geese and white-faced ibis share the water of Impoundment No. 7 11/81 LBM

#10 - This viewing platform was a popular place from which to view feeding snow geese and a few mule deer. 11/81 LBM

Infrequent or rare visitors sighted this year included: Mississippi kite, goshawk, harlan's hawk, golden eagle, peregrine falcon, and screech owl.

7. Other Migratory Birds

A wide variety of songbirds are attracted to the trees at refuge headquarters. Grosbeaks, orioles, warblers, swallows, flycatchers, and sparrows are a few of the common summer visitors. During fall and winter, house finches, sparrows, meadowlarks, juncos, goldfinches and towhees are enticed to the bird feeders.

A worm-eating warbler, photographed by the refuge manager, was the first sighting recorded on the refuge.

In mid-summer, great numbers of barn, rough-winged and cliff swallows fed daily around refuge impoundments.

8. Game Mammals

Mule deer inhabit all brushy areas of the refuge and are quite common in and around the farm fields. With salt cedar for cover, and oats, barley, and millet for feed, the herd has sometimes reached 50-60 in number.

Deer hunting is allowed only on the north unit, which includes the Salt Creek Wilderness.

Badger, weasel, fox, bobcat, muskrat, beaver and raccoon are present in small numbers. No trapping of these furbearers is allowed. Occasionally, problem raccoons are trapped and removed from waterfowl banding sites and around the waterfowl display pen by refuge personnel. Due to a persistent raccoon problem this year, an electric wire was installed around the pen.

10. Other Resident Wildlife

The refuge supports small populations of scaled quail and smaller numbers of bobwhite. Scaled quail were seen with their young throughout the summer and are making a slow comeback from the 1980 drought. For several years, no sign of bobwhite had been reported on the refuge until this year a covey was observed on two occasions along the river.

Both the ring-necked and white-winged pheasants have been stocked on the refuge in the past and have been quite prolific in good habitat. Hybridization between the two races is common throughout the refuge population.

The antics of the desert clown, or roadrunner, delight birdwatchers and photographers alike. Over the past several years, roadrunners have nested around the headquarters complex.

The summer of 1981 was noted for rattlesnakes. Numerous western diamondbacks were found along roadsides, in farm fields and around picnic sites. The largest specimen was found at the farm irrigation well and measured over five feet. A two-foot prairie rattler kept maintenance worker John-

ny White company one afternoon in the carpenter shop. It had crawled up on the workbench and at least thirty minutes passed before he noticed it.

A variety of snakes were photographed by the refuge manager including both the diamondback and prairie rattlesnake, and the desert kingsnake, bull snake, hog-nosed snake and trans-pecos rat snake. A display of these photos in the office seems to fascinate refuge visitors who prefer this kind of close-up to an actual encounter.

11. Fishery Resources

The refuge fishing program remains unproductive despite repeated stocking with channel catfish. Repeated requests have been made for assistance in assessing water quality and determining more suitable species for stocking. In mid-summer, some lake water samples were taken by a biologist from the Gallup Fisheries Assistance office, but that was the extent of the investigation.

Carp continue to be prolific and were often seen spawning along shorelines in late spring. A few are taken by bow fishermen, but otherwise they are considered a pest.

12. Wildlife Propagation and Stocking

The only stocking effort was for the "put and take" refuge fishing program. In March, over 10,000 channel catfish were brought from Uvalde NFH and placed in Units 5, 7 and 15.

Contrary to our recommendations, 7,440 catfish were delivered on October 15, the closing day of the refuge fishing season. These probably provided a food source for the mass of piscivorous birds present on the refuge at the time.

14. Scientific Collections

A permit was issued by the Regional Office to Mr. Robert Bouma, a graduate student from Cornell University, to collect Pecos gambusia for study. Ten percent of the refuge population or 300 individuals, which ever was less, was authorized. The permit expired December 31, 1981

15. Animal Control

As usual, the refuge supplied pyrotechnics to the New Mexico Department of Game and Fish to alleviate depredation problems in the area, particularly those caused by snow geese in the Artesia area.

The migration corridor for eagles tends to over-lay major sheep ranches west of Roswell. Lambing began in February, a month early, and this coupled with bad weather, caused the eagles to congregate in the area. Depredation losses prompted the ranchers to ask for assistance. Assistant Manager French was detailed to ADC to aid with eagle trapping near Dunken, New Mexico.

The Roswell ADC office borrowed propane exploders for use at the MX Ranch west of Roswell, owned by Phelps White. During December, it was estimated that 7,000 Canada geese were doing considerable crop damage on his fields. The rancher does not allow hunting.

16. Marking and Banding

The refuge participates in post-season banding of mallards. The refuge quota was 800, of which 669 were banded. Both a walk-in trap and a Miller cannon net were used, with the former being the most successful. Trapping of mallards was generally productive until the end of February.

Banding was accomplished as follows:

AHY	M	204
AHY	F	101
SY	M	189
SY	F	175
		669

17. Disease Prevention and Control

Although cholera was reported in Oklahoma, Texas, and in New Mexico at the Bosque del Apache NWR, it has yet to be diagnosed at Bitter Lake NWR.

In mid-May, a fisherman reported sluggish catfish along the shoreline of Unit 5. The fish were emaciated and exhibited skin lesions. Samples were taken to Dexter NFH, where acting manager Innsley determined the problem to be caused by the bacteria myxo. Apparently, myxo is ever present in the brackish refuge waters; however, it does not attack unless the fish undergo stress. The bacteria posed no health problem to people eating the infected catfish.

H. PUBLIC USE

1. General

The Bitter Lake NWR provides a variety of wildlife/wildlands oriented recreation and serves as an important recreation resource to the nearby city of Roswell (population 39,000). The refuge attracted visitors from 49 states and 13 foreign countries. During the year the refuge hosted over 28,000 visitors, a slight decline from the 30,000 recorded in 1980. This decline was blamed upon several factors, namely gasoline prices, poor fishing, and below normal fall waterfowl populations.

3. Outdoor Classrooms-Teachers

In September the refuge hosted a meeting for area educators and conservation organizations to assess the need for expanding environmental education in the Roswell area. It was determined that most teachers were cognizant of local facilities and had no desire to expand environment education in the school system.

#5 - After years of requests from the refuge, two of these signs were erected by the state highway department along U.S. 70-285. 10/81 LBM

#6 - The National Sign Shop prepared a number of these directional signs which the refuge installed along the two county roads leading to the refuge. 11/81 LBM

Assistant Refuge Manager Kathy Doyle and BLM Wildlife Biologist Linda Rundell are preparing a directory of conservation education programs available in the Roswell area.

A Project Learning Tree workshop was conducted in Roswell in December and was well attended by personnel from the Fish and Wildlife Service, National Park Service, Bureau of Land Management as well as teachers from area public schools and junior colleges.

5. Interpretive Tour Routes

The seven mile interpretive auto tour route provided over 9,000 visitors with information about the refuge and a chance to view a variety of wildlife on the grasslands, impoundments, and croplands that border the route.

A new self guiding tour leaflet was prepared to update changes in management practices, wildlife populations, and visitor facilities that have occurred since the previous leaflet was prepared.

Increased requests from local teachers saw the refuge reinstate the practice of providing slide talks and conducted tours for school groups. Usually averaging no more than three programs weekly during the fall months, this serves as an ideal tool to introduce conservation and environmental education to the students as well as providing a needed break for the teachers. By year's end, 900 students from all grade levels had received first hand information about the refuge and it's role in the community.

6. Interpretive Exhibits/Demonstrations

Although the refuge does not have a formal visitor contact station, over 11,000 visitors did register at the self service registration booth where they could obtain a variety of refuge leaflets, and current waterfowl population data as well as see displays about refuge programs. The nearby bird display pen allows visitors a close look at several of the many species that inhabit the refuge. The pen contains sandhill cranes, Canada and snow geese as well as several species of ducks. Personnel in the refuge office are also available to answer specific inquiries about hunting, fishing and bird watching.

No off-refuge demonstrations or exhibits were conducted during the year.

8. Hunting

The refuge offers a full hunting program including big game, upland game, waterfowl, and other migratory bird hunting. These hunting activities are limited to three areas which include:

Area A: 9,621 acres; the Salt Creek Wilderness in the north tract is open only to deer and pheasant hunting.

Area B: 2,619 acres; the remainder of the north tract (excluding the

wilderness) is open to all forms of hunting.

Area C: 1,860 acres; the marsh and uplands in the southern end of the south unit is open to all hunting except big game.

There is sufficient diversity of habitat and acreage in the three areas to provide for a large number of hunters, however the scarcity of water and waterfowl habitat causes the greatest number of hunters to congregate in Area C. This area has been managed exclusively as a steel shot area during waterfowl seasons for the past eight years.

Over 1,500 hunters used Area C and bagged 386 ducks, 145 geese, 31 cranes, 30 pheasants, as well as lesser numbers of rabbits, quail and doves.

Big game hunters killed one deer on the refuge during the state primitive weapons hunt, and five during the regular stratified season. Because of the distance between the north tract (Areas A and B) and the refuge headquarters, information on the number of hunters and their success in those areas is often based upon irregular spot checks by the refuge staff and voluntary reports from the hunters.

9. Fishing

Refuge fishing waters, open annually from April 1 to October 15, are managed primarily as a "put and take" fishery with channel catfish stocked by National Fish Hatcheries in Texas. This program, although far from satisfactory, is often the only fishing area reasonably available to Roswell residents, many of whom are retired or on low income.

Due to the poor water quality, the refuge impoundments are prohibitive to many species of fish. However, we still hope to try an experimental stocking of white/striped bass hybrids which will hopefully increase the sport fishing quality of our program. Despite the quality of fishing, over 7,000 fishermen did try their luck in 1981; however, for most it was a futile attempt.

Carp fishing is enjoyed by many local fishermen. Retired refuge biological technician Delbert Boggs "starred" in a locally produced Game and Fish Department movie about bow and arrow carp fishing.

11. Wildlife Observation

This refuge is particularly well adapted for both the casual and serious wildlife observer. The tour route passes adjacent to a variety of habitats and there is very little refuge wildlife that can not be observed from the road. Brush obscures only a small portion of the area, and two observation platforms have been constructed to aid the observer.

12. Other Wildlife Oriented Recreation

Photography is a popular form of recreation among refuge visitors. The

#15 - One of 17 school groups to visit the refuge during 1981 that were treated to a slide show, guided bus tour, and occasionally, a hike along one of the refuge dikes. 11/81 LBM

#16 - Assistant Manager Kathy Doyle, shown in the above two photos, provided most of the programs, with some welcome relief from Jerry French on a few occasions. 11/81 LBM

variety of wildlife and scenery allows the photographer a wide range of photogenic subjects suitable to the novice as well as the professional. Over 3,000 visitors participated in this activity during the year.

13. Camping

The only camping permitted on the refuge is by organized youth groups such as scouts, religious groups, etc. All camping activities are restricted to a closed area adjacent to the refuge farm. One hundred twenty-five campers used the area in 1981.

14. Picnicking

Over 2,200 picnickers used the refuge picnic facilities during the year. Most picnicking is done in conjunction with another form of wildlife/wildlands form of recreation such as fishing, bird watching, or photography. The refuge maintains five picnic areas, however, it is no rarity to see visitors bringing their own tables and grills with them on their refuge visits. Easter Sunday is an especially popular time on the refuge where there is plenty of room for egg hunts.

15. Off Road Vehicling

Off road vehicling is not currently a major problem on the refuge. The location of drainage ditches and brush lines as well as mesquite, cactus, and other thorned plants discourage most off road vehicle use.

The use of petroleum exploration vehicles outside the refuge is creating a problem though. On the southeast corner of the refuge a temporary road was constructed adjacent to the refuge fence with no erosion control features. When this road begins to erode, the refuge fence and grassland will undoubtedly suffer damage.

17. Law Enforcement

By providing adequate signs, warnings, and regulations most refuge visitors are aware of authorized public use activities. The two assistant managers, who reside on the refuge, carry out irregular evening and weekend patrols which serve as a deterent to most violations.

The following violation notices were issued in 1981:

Violation	Date	Fine
Trespass after closing hours	4/18/81	$ 50.00
Hunting without a duck stamp	11/1/81	50.00
Trespass into a closed area	11/08/81	50.00

18. Youth Programs

For the first time in eight years the refuge did not host a Youth Conservation Corps camp. Considerable effort was expended in preparing budgets,

#13 - One of several boy scout troops to use the refuge camp during the winter months . . . . 3/81 LBM

#14 - . . . . is shown constructing a firewood bin as part of an eagle scout project (boy at left) to improve the refuge camp. 3/81 LBM

recruiting and interviewing applicants, and other pre-camp preparations; but the program failed to survive presidential budget reductions.

I. EQUIPMENT AND FACILITIES

1. New Construction

Parking facilities were constructed at the southeast entrance to the Salt Creek Wilderness, adjacent to Highway 70.

2. Rehabilitation

During fiscal year 1981, $3,700 was earmarked for refuge housing rehabilitation. The water line to Quarters 2 was replaced and interior repairs such as replastering and painting, and lowering of two ceilings was accomplished in Quarters 1.

A propane furnace was installed in what was once the YCC dining hall, now used for interpretive presentation.

Twice during the year, the main entrance road was temporarily repaired with cold patch, but major repairs such as resurfacing will be necessary in the near future.

3. Major Maintenance

The refuge farm irrigation well, drilled in 1978, began pumping sand and gravel in mid-July. At first this was attributed to recent heavy rains in the area which may have caused settling around the well casing. After pulling the pump, it was found that the cap screws on the suction manifold has rusted in half due to the corrosive well water, and the suction pipe strainer separated and remained at the bottom of the 110-foot well.

The oil lubricated pump was replaced with a water lubricated pump in August, yet sand and gravel continued to be pumped. Artesia Chemical Company video-taped the well casing and found a hole rusted through at 33 feet below ground level. It was recommended by the regional engineering staff that the present well casing be lined with concrete or plastic to prevent further deterioration. To date, no funds have been made available for the repairs to the casing.

4. Equipment Utilization and Replacement

The refuge had sorely needed some replacement vehicles for use by the maintenance workers. A 1978 4X4 Dodge pickup was received as a result of the closure of the YACC program.

Due to excessive wear, the engine on the John Deere farm tractor was overhauled.

A 1967 Ford pickup and D-7 Caterpillar tractor were disposed of on the GSA

public auction block.

6. Energy Conservation

Other than increased emphasis on consolidating trips to town to conserve gasoline, no other significant energy conservation efforts were made.

J. OTHER ITEMS

1. Cooperative Programs

With recent Government deregulation of the oil and gas industry, there has been a corresponding flurry of activity by petroleum developers in many parts of the country. New Mexico, like many other states, has known and unknown reserves that, until now, were deemed uneconomical to develop. A small "boom" has developed in Chaves County, home of Bitter Lake Refuge, primarily to the north of Roswell and the refuge in what is known as the Abo Slope. Roswell, of course, has become the hub of operations for this rapidly expanding industry.

Bitter Lake Refuge has not escaped attention. Besides the continuing operation of an existing oil field by the Petroleum Corporation of Texas in the the southeastern corner of the refuge (six wells), a permit was issued to Yates Petroleum Corporation to build a short access road and a location pad about one mile southeast of refuge headquarters. Permit No. G-1 was issued on June 26, 1981, but the company was unable to commence drilling this year.

The above mentioned drilling site is located near the refuge's west boundary on what was formerly state owned land. There are 2,240 acres of such lands within the refuge, plus 160 acres of former privately owned land where the mineral rights are outstanding. Also, there are 1,200 acres of refuge land obtained by withdrawal from public domain that are stipulated as lying within a designated oil field, the Bitter Lake Oil Field, which are subject to lease.

In related activity, one inquiry was received concerning a possible access route across the refuge east of Lake St. Francis for laying out a seismic line, but the company apparently has lost interest after a closer look at the low, boggy ground. Another drilling company verbally requested a road right-of-way across the southeastern corner of the north unit in order to reach a prospecting area just outside the refuge boundary on the east and north. The request was denied and the company has abandoned their effort.

2. Items of Interest

Responding to the call for assistance, Assistant Manager Kathy Doyle participated in the Wing Bee held at Fort Collins, Colorado from February 22 to February 27, 1981.

The regional office continued negotiations with the City of Roswell for use of effluent from their proposed new waste water treatment plant. Lit-

tle progress was made since the city requires that the FWS furnish several miles of pipeline from their plant to the refuge and has suggested that the contract could be terminated at any time. The latter is, of course, unacceptable, especially since there would be considerable outlay of money to install the pipeline.

Much lies at stake. Without use of this effluent the refuge may soon find itself out of the farming business, due to the continued poor quality of its only source of irrigation water, an irrigation well. Also, through performing as the dumping ground for much of this effluent over the years, under the terms of an existing easement, considerable marsh land has developed. This marsh provides for the bulk of the shore and wading birds that use the refuge, and is a popular waterfowl hunting area. Should the FWS fail to come to some sort of terms with the city, the refuge chances to lose this primary source of marsh maintenance water. The city plans to sell as much of the effluent as possible after the new plant is built. In the dry Southwest, all water that is uesable sells for a premium.

The questions that face the FWS are: what will be the impacts upon the refuge without the use of the effluent?, and will the benefits to be derived by the refuge investment be worth the costs? The decision may never be reached should it be determined that no funds are available anyway.

3. Credits

Sections A, E, F, and H were written by Assistant Refuge Manager Jerry French. Sections B,D,G, and I were written by Assistant Refuge Manager Kathy Doyle. Sections J and K and editing were done by Refuge Manager Lee Marlatt, and typing and assembly were done by Office Assistant Lilly Fuller.

K. FEEDBACK

New Narrative Report Outline

Like everyone else, this is really our first time under the new guidelines for preparation of this report. Overall, we found it to be a welcome improvement. There is one suggestion, however. Did we overlook it, or is there no section prescribed for the reporting of oil and gas activities? We reported under Part J. OTHER ITEMS, Section 1 Cooperative Programs, but a more likely place seems to be under Part F. Habitat Management. Maybe before or after Water Rights.

The only other problem we had with it was two people were writing the report. Seems there are lots of opportunities for the reporting the same material under several headings and this was compounded by having two writers working on the report. However, we all agreed that the next report will be easier, since we will have this one to follow. Hope we didn't do any duplicate reporting in this report, and if we did, we didn't end up contradicting ourselves.

Miscellaneous

Afraid I can't come up with anything original, but as to a list of concerns that we probably share with other refuges, here goes:

1. How to Successfully Compete for the Dollar

This has been one of this station's cencerns for a long time. Our problem seems to be that there is no tool available to bring to attention the seriousness of the deterioration of our old facilities, especially our office, shop and quarters, and two miles of entrance road. Repairs won't add to the RBU's generated by this refuge, no matter how you would like to. But, even though this refuge has as good a good a record in the RBU deparment as any other refuge in Area 2 (if not better?), just because we aren't in a position to greatly enhance our wildlife habitat, we must continue to see these old (1930's) facilities crumble down around us. To compound the problem, this is a high visibility refuge with lots of visitors. Many of them say to us that they just can't understand why we are letting things run down, why we aren't making some improvements. They see the refuge as a real treasure and wonder if the FWS values it as such.

2. The $2,000 Limit

This problem doesn't need much explanation, I'm sure, but it continued to defeat us. We used to get a lot of jobs done for that amount, but it comes as no surprise that we can no longer have one of our houses or other adobe buildings re-roofed with tar paper and asphalt for under $2,000. Consequently, the job just doesn't get done, because we know what a complicated and costly venture it will be if we have to request assistance from our contracting office. We usually wonder if we can afford the job anyway, without taking on the higher prices caused by compliance with Davis-Bacon Wage Laws, etc. Guess there is no easy solution.

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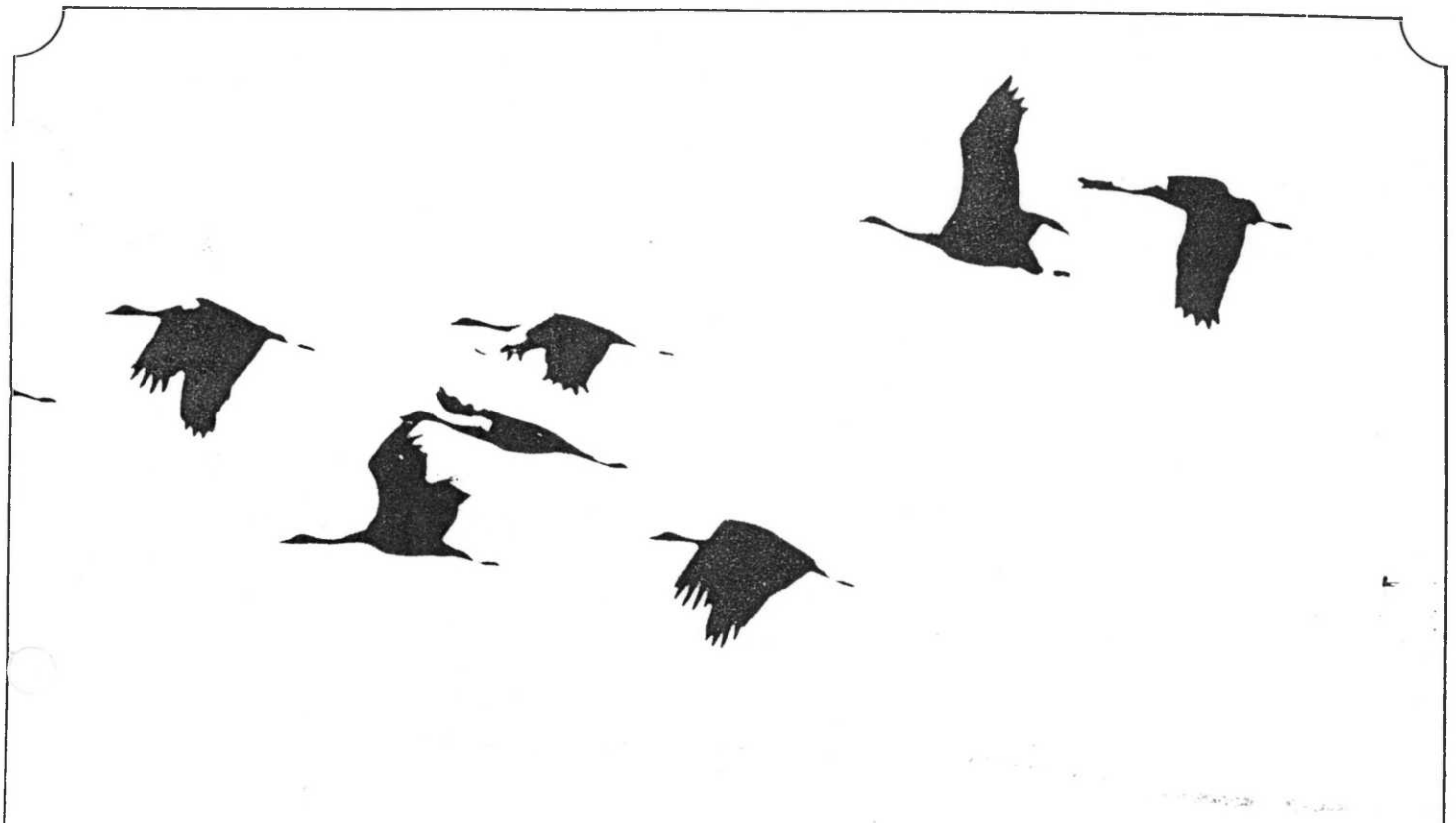


Sandhill cranes fly over Bitter Lake. Judy Vance

SYMMETRY AT BITTER LAKE

by Carole Larson

As if in response to some secret signal a thousand white-winged snow geese rise as one from rippling water and pierce the blazing dawn emerging over tawny bluffs along the Pecos River's eastern shore. We call these dauntless traveling creatures wild. There is no taming, no domesticity here. Yet their lives are ordered, indeed governed, by a survival system insured by timeless instinct. That instinct has brought them to the Bitter Lake National Wildlife Refuge located on 23,000 acres in southeastern New Mexico.

Bordering the western shore of the Pecos in the southern portion of the wide river valley, the Bitter Lake Refuge is just 13 miles northeast of Roswell. It encompasses river bottomland, marshland, areas of dense brush, desert scrub, and some open range, all lying within the vast stretch of land between the southern Rocky Mountains in the west and the high plains in the east. In this sparsely populated southeast quadrant of the state it is easy to feel that the land has changed little since the time in 1582 when Antonio de Espejo, wealthy Spanish rancher, led an expedition up the Rio Grande and returned south to Mexico by way of the Pecos.

The land retains its wild breadth and the subtle, tender coloring lent by mesquite and tamarisk, by pale gold grasses and wildflowers bending in the wind. The blue-gray silhouette of Capitan Mountain shimmers on the western horizon. One feels rather than sees the great flat Llano Estacado beyond the river bluffs to the east, and one imagines the north to south meandering of the long Pecos coming down from its Sangre de Cristo Mountains source. A wholeness is felt, a symmetry between historical past and the world of nature.

But much has changed, even here. Both of New Mexico's two great river valleys — the Rio Grande and the Pecos — have historically been the habitat of a rich variety of wildlife. Mid-16th century Spanish explorers took note of abundant deer, antelope, and "many native fowl, including cocks with great hanging chins." By the 1800s, however, hunting and farming by Spanish and Anglo settlers were taking their toll. The populations of many species, including the sandhill crane and the antelope, showed sharp declines.

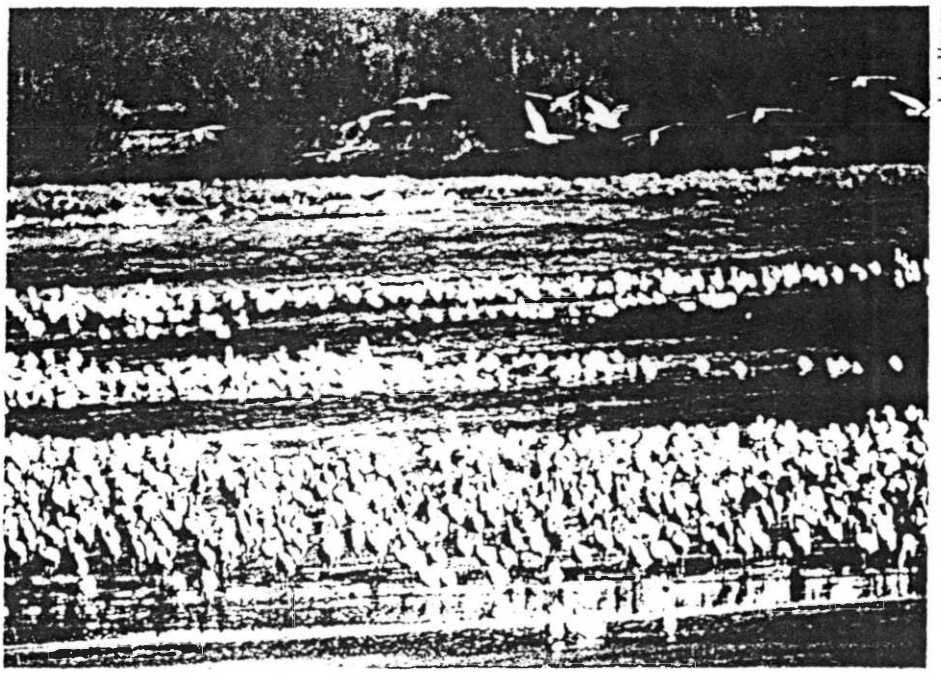
In the southern Pecos Valley fur-

Mark Nohl

In summer the lake is quiet (above) in contrast to the numbers of snow geese and sandhill cranes in winter.

ther change came when Anglo settlers moved into the area in the late 1800s and initiated irrigated farming in the rich alluvial soil, drying up some of the small streams feeding into the Pecos. Use of underground water has further shrunk the river's drainage system — the underground water table has dropped 40 feet over the past 40 years. Wildlife habitat shrank as fields of alfalfa, cotton, and barley expanded.

It was in part to mitigate the effects upon nature of an industrializing nation that the Department of Interior was established in 1918. The Bitter Lake Wildlife Refuge, one of 400 areas in the United States where wildlife is protected and studied, began operations in 1937 by executive order of Franklin D. Roosevelt. WPA workers set



Judy Vance

the boundaries for the original 13,000 acres and constructed the fine, thick-walled adobe headquarters buildings. In 1968 congressional legislation added the 11,000-acre Salt Creek Wilderness Area that now comprises the northern section of the refuge. The U.S. Fish and Wildlife Service manages the refuge.

On one 700-acre portion there is extensive gypsum rock. Over the centuries, water seepage into the porous rock has created a geological wonderland of numerous small sinkhole lakes that are deep, mysteriously beautiful, and still actively evolving as the process of rock erosion and water seepage continues.

A primary purpose of the refuge is to provide resting, feeding, and nesting space for migratory waterfowl who use the central flyway that includes eastern New Mexico. Year-round the refuge is home to deer, to antelope on its range area, to owls and pheasants, weasels and snakes, prairie dogs and rabbits, as well as numberless mallards, meadowlarks, mockingbirds.

But with the passing of the autumnal equinox each year, the population begins to swell as far in the Canadian, Alaskan, and Siberian north, the snow geese, the Canada geese, the cranes, and the multihued ducks, respond to lengthening night and hardening cold by shepherding their young into the sky and guiding them unerringly over thousands of miles to reach warmer winter grounds in such places as New Mexico, West Texas, and Mexico.

Winging southward over eastern New Mexico's sharply etched mesas and valleys where there is abundance of nothing but sun and wind, the wearying, high-flying survivors are surely lured from their height by the starfires of the refuge's shining lakes. Edged with marsh cane and cattails, separated by wandering groves of tamarisk, the six lakes are fed by natural springs below ground just west of the Pecos. Nearby, refuge personnel maintain a field of millet and barley, as grains are important to the diet of several waterfowl species.

In recent years the refuge has recorded the presence of more than 290 species of freewheeling upland birds, stately shore birds, and colorful waterfowl loving sky and water equally. Snow geese began to appear in the valley only in the 1960s, but now the peak winter snow goose population exceeds 60,000.

As autumn slowly gives way to winter, the refuge is a canvas painted anew each day in russet, gold, gray, as changing light casts down new hues. Mourning dove and scaled quail thrive in protective vegetation that includes the seed-bearing alkali sacaton grass. High over the lakes, long, wavering lines of Canada geese and sandhill crane write wordless poetry on a wide sky before downspinning to serene waters. An estimated 50,000 cranes now winter at the refuge.

Duck flocks come in daily, a dazzling array of pintail, gadwall, wigeon, shoveler, redhead, canvasback, ruddy, cinnamon teal, and blue-winged teal. Snow geese group in a sparkling mass against azure blue. Brooding, the black-crowned night heron perches for hours on a bare dead branch emerging from shallow water. Wide-winged pelicans swoop low. Pensive, imperious, a blue-black cormorant commands the low shore line; he will dive into the water and use his hooked beak to catch the small fish that abound there.

In addition to offering the visitor such joys as hiking, driving, picture taking, bird watching, horseback riding, and landscape painting, the refuge takes part in New Mexico's managed hunting season. While some deer are taken, most of the 10,000 or so hunters who use the refuge each year hunt crane, geese, duck, pheasant, quail, and dove. The refuge is open daily from an hour before sunrise until an hour past sunset.

In a frequently irrational world it is somehow comforting to know that the wild, warm-blooded waterfowl have responded prolifically, profitably, in this bit of environment where man has consciously made himself a caring and responsive actor in an ecological drama.

Nov. 1, 1981

Workshop set at Bitter Lake

A "Project Learning Tree" workshop will be held from 9 a.m. to 3:30 p.m. next Saturday in the board room of the Roswell Independent School District office building, 200 W. Chisum St., said Kathy Doyle, assistant manager of Bitter Lake National Wildlife Refuge.

The school district and the wildlife refuge are co-sponsoring the environmental education workshop.

Although the materials are designed for use by elementary and secondary teachers, they are also "useful to anyone interested in teaching children about the world we live in," Mrs. Doyle said.

There is no fee, and persons interested in attending may contact Mrs. Doyle at the wildlife refuge at 622-6755.

The workshop will be conducted by Vivian Lake, elementary teacher at Ranchvale School in Clovis, and April Fletcher, environmental education specialist with the U.S. Fish and Wildlife Service.

The workshop "will provide something useful for teaching math, social studies, English and many other disciplines," Mrs. Doyle said. "Hands-on activities will be emphasized, and all participants will receive a free copy of a Project Learning Tree Supplementary Activity Guide."