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A SURVEY OF BREEDING AND MIGRATORY BIRDS SOUTHWEST OF FARMINGTON, NEW MEXICO

Duane A. Tolle¹

ABSTRACT.— The relative abundance and habitat affinities of breeding and migratory waterfowl were documented for a 16,556 ha (40,880 acre) area of the Navajo Indian Reservation, San Juan County, New Mexico. The objective of the 1973-1974 study was to obtain baseline data for use as part of an environmental assessment for coal gasification plants and an associated strip mine proposed for an area not previously described in ornithological journals.

Roadside breeding-bird surveys resulted in the observation of 26 species of birds, of which the horned lark was most abundant. Additional breeding-bird observations were made during afternoon reconnaissance surveys around stock ponds and arroyos, and by a helicopter survey of cliff-nesting raptors. Nine of 30 raptor nests located were active.

Migratory waterfowl surveys were made in September and November at four stock ponds and a marsh on the study area. Peak waterfowl numbers were present in September, when teal and shovelers were the most abundant species.

The importance of stock ponds to breeding and migratory birds and the significance of cliffs to nesting raptors were discussed. Details of observations made for five species of birds designated "threatened" or "status undetermined" were presented.

Avifauna of a 16,556 ha (40,880 acre) area (hereafter called the study area) located in San Juan County, New Mexico, about 48.3 km (30 miles) southwest of the city of Farmington were studied during four- to seven-day periods in mid-November 1973 and late February, early June, late September, and mid-November 1974. This overgrazed grassland ecosystem is located in the Navajo Indian Reservation bordering the Chaco River at an elevation of about 1615 m (5300 ft). It is intersected by arroyos which provide a maximum relief of about 122 m (400 ft).

The climate of the study area is arid, with an average of 16.8 cm (6.6 inches) of precipitation per year. The period from July to October normally accounts for half of this precipitation.

The study area includes plants and animals typical of both the grassland and basin sagebrush biocinations (Kendeigh 1961). Although vegetation is sparse, it includes grasses, forbes, and low-growing shrubs. A few trees and larger shrubs are located in the arroyos and near ponds. The vegetation

has been heavily grazed by livestock, including sheep, cows, horses, and goats. Plants requiring more water are located at the small, man-made stock ponds scattered over the area.

The objective of this study was to document relative abundance and habitat affinities of species of breeding birds and migratory waterfowl, using an area not previously described in ornithological journals, where coal gasification plants and an associated strip mine are planned. These two general groups of birds were considered to be the most likely to be affected by this major industrial development. The resultant baseline data on avifauna of the area was used as part of an environmental impact report.

A substantial number of ducks are present in the San Juan River Valley during the migratory season, due in part to the concentrated production of food crops in this valley (Huey 1967). Bellrose (1971) considers the San Juan River Valley to be a major (nationwide) waterfowl concentration area. Undoubtedly, the attractiveness of the San

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Juan River Valley influences waterfowl use of ponds on the study area.

The San Juan River is part of the Upper Colorado River Basin, which is known as an important migratory route for waterfowl and shorebirds, as well as smaller passerine birds. The Upper Basin has been the site of continued development of aquatic habitat in the form of lakes and reservoirs. This has materially changed the status of waterfowl and shorebirds throughout the entire area (Hayward, 1967). Morgan Lake and Navajo Reservoir are examples of the water bodies which have recently been created in the San Juan River area of New Mexico.

METHODS

Avifauna of the study area were surveyed by three methods during the breeding season and by two additional methods during the migratory seasons. All common names of birds are reported in the form designated by the Fifth AOU checklist (Wetmore 1957) and the twenty-third supplement (Eisenmann, 1973) (See Appendix I.).

BREEDING BIRD SURVEY METHODS.—*Roadside surveys:* Breeding birds were surveyed during 1 to 7 June 1974 by the following three methods: (1) roadside surveys, (2) reconnaissance surveys along stock pond arroyos, and (3) a helicopter survey of cliff-nesting raptors. The roadside survey developed by the U.S. Department of the Interior (1973a) was conducted on four mornings to obtain an index of abundance of breeding birds. The only variance from the standard operating procedure was the seven-hour period required for completion of the survey. Four and one-half hours are normally allotted to reach the end of a 40.2 km (25 mile) route, with three-minute stops made 0.8 km (0.5 miles) apart to count all birds within a 0.4 km (0.25 mile) radius. On this study area, the additional time was necessary due to the rough roads and backtracking required to reach a representative portion of the area.

All four roadside surveys were run on mornings without precipitation or fog. Wind speed was less than Beaufort 3 (8-12

mph) during all survey periods except for the finish of the 2 and 3 June surveys.

Mid-afternoon reconnaissance surveys: Afternoon surveys were conducted at five stock ponds (only one had water during the survey period) and their adjacent vegetation, plus five arroyos. Walking surveys were made by a party of two observers for a total of eight hours after each of the four roadside surveys, and during the afternoon of 5 June. A special effort was made to locate nests.

Helicopter survey of raptor nests: Four hours were spent searching for cliff nests of large raptors from a Bell B-1 helicopter on 4 June 1974. A total of 112.7 km (70 miles) of suitable cliff-nesting areas were searched, using the helicopter flight patterns suggested by White and Sherrod (1973) to avoid disturbance of adult and nestling raptors. The flight was made at a time when most of the raptors in the area had finished incubation, but before the majority of the nestlings had fledged. During this period the adult raptors are least likely to desert the nest.

One of the two observers plotted nest locations on topographic maps. The number and description of eggs or nestlings, plus nest materials, diameter, and height were recorded for identification of inactive nests or nests where adults were absent. Photos were taken of nearly all of the nests.

MIGRATORY-BIRD SURVEY METHODS.—*Waterfowl surveys:* Waterfowl surveys were made during the following four periods: (1) 13-16 November 1973, (2) 20-24 February 1974, (3) 22-25 September 1974, and (4) 11-14 November 1974. The November and February survey periods were chosen to coincide with the peak period of both waterfowl numbers and variety of species migrating through San Juan County. The September period was chosen to coincide with peak populations of early migrants (J. L. Sands, pers. comm.).

Five waterfowl observation sites were selected on the study area. Of these five sites, four were at man-made stock ponds created by damming arroyos, and one was at a marsh created by overflow from a spring-

fed stock pond. When any one of the ponds was dry or frozen during a survey period, no counts were made. Since all ponds were frozen in February 1974, no waterfowl surveys were made. During all other survey periods, 0.5-hour observation periods were conducted at each of the sites.

General observation of non-waterfowl birds: Non-waterfowl bird species were also recorded during each of the four waterfowl survey periods listed above. An accurate census during these periods was not possible, due to the nonterritorial, flocking behavior of most nonbreeding birds. However, the total number of each species observed was recorded. These data were used to prepare tables of the relative frequency of observation of all nonwaterfowl species. Small birds not associated with the playas or marsh were likely missed. A special effort was made to record all raptors observed while driving between survey sites.

SURVEY RESULTS

RELATIVE ABUNDANCE AND DISTRIBUTION OF BREEDING BIRDS.—Species observed along roads: Twenty-six species of birds were heard or observed during 200 three-minute stops made over a four-day period (Table 1). The most abundant species was the Horned Lark, followed by the Mourning Dove and Black-throated Sparrow. The number of stops where a species was observed is an indication of how widely distributed it is over the survey area. The commonness of the Horned Lark probably resulted from the fact that the majority of the study area is relatively flat, mesa habitat with short vegetation which is the preferred habitat for the Horned Lark (Ligon 1961, Fautin 1946).

Species of birds observed at the only marsh on the area were considerably different from birds seen at other survey stops. Nine species of birds were recorded only at a marsh created by overflow from a spring-fed stock pond. These nine species recorded during roadside surveys included the Great Egret, Mallard, Pintail, Green-winged Teal, Cinnamon Teal, Killdeer, Spotted Sand-

piper, Tree Swallow, and Brown-headed Cowbird. Also, the following five-bird species were seen at this marsh after the three-minute survey period was over: Savannah Sparrow, Hummingbird (spp. undetermined), American Coot, Western Meadowlark, and Rough-winged Swallow. Observations of all of the above 14 species were restricted to the overflow marsh.

Species observed in arroyos below ponds: Mid-afternoon reconnaissance surveys around stock ponds and along arroyos resulted in the observation of 21 species of birds (Table 2). Although the time of day prevented an accurate census of the avifauna, a rough estimate of relative abundance between species indicated that the mourning dove, horned lark, and house finch were more abundant around stock ponds and arroyos than other bird species.

Very few nests were located during mid-afternoon surveys, in spite of a careful search of the vegetation by two observers during eight hours of survey. This searching resulted in the location of active nests of the four following species: Red-tailed Hawk, Ferruginous Hawk, Great Horned Owl, and Cliff Swallow. The Red-tailed Hawk and Cliff Swallow nests were located in cliffs along the Chaco River. Two inactive nests believed to be House Finch nests were located at one of the dry stock pond sites.

Cliff-nesting raptors: Thirty large raptor nests were located during the helicopter survey (Table 3). Nine of these nests were active (Table 4), with the majority of the occupants either Golden Eagles (two nests), Great Horned Owls (two nests), or Red-tailed Hawks (two nests). The Ferruginous Hawk, Prairie Falcon, and Common Raven were recorded at only one nest per species. One of the Golden Eagle nests may have been abandoned, since only one egg and a rock were observed in the nest, and no adult eagle was seen near the nest.

Only four of the six species of raptors had successfully raised young by the survey date (Table 4). Nestling or fledgling Great Horned Owls, Red-tailed Hawks, Ferruginous Hawks, and Common Ravens were observed.

During the helicopter search for nests, a record was kept of all large birds (Table 5). In addition to the six cliff-nesting raptors, eight Mourning Doves, a Burrowing Owl, and two Common Nighthawks were observed during the four-hour flight. The Common Nighthawk was not seen during any of the other surveys; however, no evening surveys were conducted.

RELATIVE ABUNDANCE OF MIGRATORY BIRDS.— *Waterfowl at stock ponds*: Ten spe-

cies of waterfowl were observed during the three survey periods (Table 6). The greatest variety (6) of species were recorded during the November 1973 survey period, but by far the greatest number (268) of individuals were seen during the September 1974 survey period. This large number of individuals was due mainly to the presence of Blue-winged and Cinnamon Teal. These two species of teal and the Northern Shoveler normally migrate south before November in

TABLE 1. Summary of roadside breeding-bird survey on the study area, June 1974^a.

Common Name	Daily Totals				Four-Day Totals	
	1	2	3	6	Total Individuals	Stops per Species ^b
Horned Lark	77	71	98	74	320	121
Mourning Dove	17	27	18	17	79	53
Black-throated Sparrow	6	23	8	7	44	27
Rock Wren	7	6	15	2	30	25
House Finch	2	14	7	7	30	20
Loggerhead Shrike ^c	3	7	7	8	25	8
Mockingbird	4	3	11	4	22	17
Red-winged Blackbird	4	4	5	7	20	4
Say's Phoebe	3	6	3	3	15	13
Cinnamon Teal	6	2	-	-	8	4
Common Raven	1	2	3	1	7	2
Killdeer	1	4	2	-	7	6
Brown-headed Cowbird	-	-	3	4	7	2
Green-winged Teal	-	1	2	1	4	3
Ferruginous Hawk	-	-	-	3	3	2
Spotted Sandpiper	-	-	3	-	3	1
Mountain Plover ^c	-	1	1	-	2	2
Mallard	-	-	2	-	2	1
Lark Sparrow	2	-	-	-	2	1
Great Egret ^d	-	1	-	-	1	1
Pintail ^d	-	-	-	1	1	1
Golden Eagle	-	-	1	-	1	1
American Kestrel	-	-	-	1	1	1
Burrowing Owl	-	-	1	-	1	1
Empidonax Flycatcher	-	1	-	-	1	1
Tree Swallow	1	-	-	-	1	1
Totals	134	173	190	140	637	
Average Ind./Stop	2.68	3.46	3.80	2.80	3.18	

^aFifty three-minute stops were made at 0.8 km (0.5-mile) intervals beginning at 0.5 hour before sunrise on 1, 2, 3, and 6 June 1974. The route was reversed on two days.

^bIndicates the number of stops, out of a possible 200, when one or more individuals of a species were observed.

^cEggs, nestlings, or fledglings observed.

^dProbably a late spring migrant.

New Mexico (Chattin 1964, Ligon 1961).

Most of the Blue-winged and Cinnamon Teal observations were lumped together because the eclipse molt made positive field identification difficult during September. Female Blue-winged and Cinnamon Teal are inseparable through binoculars all year long.

General observations of nonwaterfowl birds: As expected, the September 1974 survey resulted in observation of the greatest number (32) of nonwaterfowl species out of the four waterfowl survey periods (Table 7). Three-fourths of these species were either shorebirds or passerines. Since the bulk of the shore and passerine bird migration takes place in late April and May and again in

late August through early October (Hayward 1967), the September survey period was the most likely to include species in these two large families.

The fewest (12) species of nonwaterfowl birds were recorded during the February 1974 survey period, when most migrants are still on their wintering grounds. The total bird species seen during each November survey (1973 and 1974) was intermediate in number between species lists for the September and February surveys.

The most frequently observed species during all four survey periods was the Horned Lark. This permanent resident of San Juan County (Hubbard, 1970) was considered abundant during all survey periods except November 1974, when it was considered common relative to other birds observed (Table 7).

Four nonwaterfowl species were observed during seasons not previously recorded by Hubbard (1970) and/or Alan P. Nelson (unpubl. county checklist). These species included one Black-throated Sparrow observed during November 1973, one Swainson's Hawk and 53 Sage Sparrows observed during February 1974, and four Pectoral Sandpipers observed during September 1974.

DISCUSSION

IMPORTANCE OF STOCK PONDS TO DESERT AVIFAUNA.—*Breeding birds:* Some desert birds seen on the study area are dependent on drinking water from the 10 temporary and 4 permanent ponds on the area. In June, 1974, the unusually dry weather reduced the normally "permanent" ponds to only 2. This reduced water supply was undoubtedly a limiting factor for the granivorous birds. Smyth and Coulombe (1971) observed that all of the birds which drank regularly at a desert spring in California were granivorous; three of these species of birds (Mourning Dove, House Finch, and Black-throated Sparrow) were also seen on the study area. Another granivorous bird which requires water every day is the Scaled Quail (Sprunt and Zim 1961). Al-

TABLE 2. General reconnaissance survey around stock ponds and along arroyos in the study area, June 1974^a.

Common Name	Frequency of Observations ^b
Red-tailed Hawk ^c	U
Ferruginous Hawk ^c	R
Killdeer	R
Mourning Dove	A
Great Horned Owl ^c	R
Burrowing Owl	R
Western Kingbird	R
Ash-throated Flycatcher	R
Say's Phoebe	C
Empidonax Flycatcher	R
Western Wood Pewee	R
Horned Lark	A
Cliff Swallow ^c	R
Common Raven	U
Rock Wren	U
Mockingbird	U
Northern Oriole	R
Brown-headed Cowbird	R
Blue Grosbeak	R
House Finch	A
Black-throated Sparrow	C

^aRepresents eight hours of midafternoon walking surveys by two observers on 1, 2, 3, 5, and 6 June 1974. Includes surveys at five stock ponds (only one pond had water), and five arroyos (including the dry Chaco River) on the study area.

^bThe approximate number of birds observed are indicated as follows: A = Abundant, 20+; C = Common, 8-19; U = Uncommon, 3-7; and R = Rare, 1-2.

^cAdult in nest, eggs, nestlings, or fledglings observed.

though the House Finch and Black-throated Sparrow are grain eaters, they may be able to live without drinking when succulent vegetation or insects are available (Smyth and Bartholomew 1966). The Mourning Dove, however, needs water to drink at least once a day (Sprunt and Zim 1961). This may account for the groups of 5 to 10 mourning doves recorded every day at the overflow pond.

Insectivorous, carnivorous, or frugivorous birds were observed to drink very little or not at all at a California desert spring

(Smyth and Coulombe 1971). These birds may be limited more by their food resource than by a lack of drinking water. Leopold (1969) suggests that water is no problem for insect feeders and raptors, since the flesh they eat is made up mostly of water. Smyth and Coulombe (1971) listed the following three species which were never seen drinking at the California spring: Ash-throated Flycatcher, Rock Wren, and Loggerhead Shrike. They also listed the Say's Phoebe and Mockingbird as drinking infrequently. All of the above five species were observed

TABLE 3. Helicopter survey of raptor nests on cliffs in the study area, 4 June 1974^a.

Common Name	Nest Number	Nest Diameter (Ft.)	Nest Height Above Ground (Est. in Ft.)	Nest Materials
Great Horned Owl	1	2 (scrape)	30	None (scrape)
?	2	?	40	Sticks
Golden Eagle	3	4-6	150	Twigs + ?
Golden Eagle?	4	4-6	150	Twigs + ?
Golden Eagle?	5	4-6	100	Twigs + ?
Golden Eagle?	6	4	100	Twigs, rock
?	7	3	50	Sticks
Red-tailed Hawk	8	2	50	Sticks and grass
?	9	?	30	Sticks
?	10	?	50	Sticks
?	11	?	50	Sticks
Golden Eagle?	12	?	15	Sticks
Prairie Falcon	13	1.5 (scrape)	40	None (scrape)
?	14	?	—	Sticks
Common Raven	15	2	40	Sticks
Common Raven?	16	2.5	55	Sticks
Common Raven?	17	2.5	55	Sticks
?	18	3	55	Sticks and grass
?	19	3	60	Sticks
?	20	2	70	Sticks
?	21	2.5	60	Sticks
Golden Eagle?	22	3.5	80	Sticks
Ferruginous Hawk?	23	4	50	Sticks, grass, and Yucca stems
Red-tailed Hawk	24	2	40	Sticks (1 rabbit leg)
Falcon?	25	scrape	30	None (scrape)
Golden Eagle?	26	3-5	40	Sticks
Falcon?	27	scrape	50	None (scrape)
Ferruginous Hawk	28 ^b	3	0 (on brow of 15' hill)	Sticks, grass, and Yucca stems
?	29	2	40	Sticks (in crevice)
Great Horned Owl	30	scrape	45	None (scrape)

^aFlying time was four hours in a Bell B-1 helicopter. Two men made observations.

^bDiscovered in low rolling hill area from observation of adults during roadside surveys.

on the study area, and none of them are considered granivorous (Martin et al. 1961). The ability to obtain water through their food may account for the relative abundance of these birds (excluding the Ash-throated Flycatcher) in the roadside survey (Table 1).

The overflow pond which is adjacent to a spring-fed stock pond had the greatest bird diversity of any area of comparable size on the study area. Thirteen species of birds were seen during the June survey only at this location. These species alone represent more than one-quarter of the breeding species recorded. The overflow pond is the only pond with emergent aquatic vegetation on the mine lease, and thus is the only habitat suitable for breeding waterfowl. The four species of dabbling ducks observed at the overflow pond (Table 1) were the only waterfowl observed on the mine lease during the June surveys.

Constant disturbance by livestock drinking at the pond may have prevented waterfowl and other birds from nesting, since no nests were located during a search of the vegetation around the pond. Fautin (1946) suggested that disturbance by livestock at a

spring in Utah may have prevented birds from nesting in the area. Also, Hensley (1954) suggested that the constant influx of birds coming to water sources in the Sonoran desert of Arizona may have reduced the number of birds nesting around those limited sources of water. The number of birds, particularly Mourning Doves, coming to the overflow pond to drink, may have increased the disturbance caused by livestock, and

TABLE 5. Flying birds observed during helicopter survey of Wesco Mine Lease, 4 June 1974^a.

Common Name	Number Observed
Red-tailed Hawk ^b	2
Golden Eagle ^b	1
Prairie Falcon ^b	1
American Kestrel	4
Mourning Dove	8
Great Horned Owl ^b	1
Burrowing Owl	1
Common Nighthawk	2
Common Raven ^b	4

^aFlying time was four hours in a Bell B-1 helicopter. Two men made observations.

^bEggs, nestlings, or fledglings observed.

TABLE 4. Active raptor nests located during a helicopter survey, 4 June 1974^a.

Common Name	Nest Number	Number and Color of Eggs	Number and Size ^b of Nestlings	Number and Size ^b of Fledglings
Red-tailed Hawk	8	—	2	—
Red-tailed Hawk	24	1 (white w/dark blotches)	—	1 (¾ Ad.)
Ferruginous Hawk	28 ^c	1 (white w/reddish brown spots)	3 (½ Ad.)	—
Golden Eagle	3	—	1 or 2 (¼ Ad.; dead)	—
Golden Eagle?	6	1 (white)	—	—
Prairie Falcon	13	2 (light brown w/dark spots)	1 (hatchling dead?)	—
Great Horned Owl	1	—	3 (½ Ad.)	—
Great Horned Owl	30	—	—	1 (¾ Ad.)
Common Raven	15	—	5 (½ Ad.)	—

^aNumbers correspond to nest descriptions in Table 3.

^bFraction of adult (Ad.) size.

^cDiscovered in low rolling hill area during roadside survey.

thus added to the unsuitability of this area for nesting.

Migratory Waterfowl: Edminster (1964) has noted that the stock ponds in the high plains of New Mexico are not only used for nesting and rearing of young waterfowl, but were visited by surprisingly large numbers of waterfowl and shorebirds during migratory periods. Ponds with aquatic plants and/or ponds with shores that are not bare or overgrazed were most heavily used. Also, dugouts or pit-type ponds are less useful to waterfowl than ponds formed by damming arroyos. Since the overflow pond had gradually sloping sides and emergent vegetation, it is not surprising that many more ducks were seen on it than any other stock pond.

An abundant food supply of aquatic insect larvae and mollusks was probably one reason that the overflow pond was heavily used by migrant Blue-winged Teal, Northern Shovelers, and Bufflehead. During the September 1974 survey, teal accounted for 75 percent of all waterfowl recorded on the study area (Table 6), and all but four ducks recorded were observed at the overflow pond. In addition, 15 of the 17 Bufflehead seen on the study area during both Novem-

ber surveys were seen on the overflow pond (Table 6). About one-quarter of the Blue-winged Teal and Northern Shovelers diet and over three quarters of the Bufflehead's diet are aquatic insects and mollusks (Martin et al. 1961).

IMPORTANCE OF CLIFFS TO NESTING RAPTORS.—Cliffs are important as nesting sites for many of the raptors on the study area, because large trees are nearly nonexistent. Eight species of large raptors (hawks, eagles, falcons, owls, and ravens) were observed during the June surveys (Table 7), and five of these raptors were found nesting on cliff ledges (Table 4). In addition, American Kestrels were observed around cliffs, and probably used them as nesting sites. The American Kestrel is a cavity nester (Ligon 1961), which would make its nest difficult to locate by the helicopter survey used in this study. There was evidence of old Ferruginous Hawk nests on cliffs, although the only active nest found in this study was on the ground. Ligon (1961) reported that Prairie Falcons, Great Horned Owls, and Common Ravens prefer to nest on cliff ledges. He also observed that Red-tailed Hawks, Golden Eagles, and American Kestrels normally nest on cliff ledges or in trees. Therefore, the absence of large trees on the study area, and the fact that most of the large raptor nests located on the study area were on cliff ledges suggests that six of the eight raptor species found on the study area are dependent on the cliffs for nesting.

Although cliff ledges are extremely important to many of the raptors nesting on the study area, they do not appear to be a major limiting factor to raptors in this area. Not only were 21 inactive cliff nests located (Tables 3 and 4), but also distance between existing nests was greater than for three other western study areas. Two nests each were located for the Red-tailed Hawk and Great Horned Owl in this study (Table 4). Distances between these nests were 8.1 km (5 miles) for the Red-tailed Hawk and 10.5 km (6.5 miles) for the Great Horned Owl. However, Craighead and Craighead (1969) found that the maximum diameter of nest-

TABLE 6. Migratory waterfowl^a observations at four stock ponds and a marsh on the study area.

Common Name	Number of Observations		
	Nov. 1973	Sept. 1974	Nov. 1974
Mallard	8		1
Gadwall	2		
Pintail		12	
Green-winged Teal	2	20	
Cinnamon Teal		3	
Blue-winged or Cinnamon Teal		198	
Northern Shoveler		35	
Bufflehead	11		6
Ruddy Duck	2		
American Coot	1		
TOTAL	26	268	7

^aAlthough coots are not in the waterfowl family (Anatidae), they were counted along with waterfowl.

ing ranges for both the above raptors was 2.4 km (1.5 miles) at their semiwilderness study area near Moose, Wyoming. Also, Smith (1969) found that great horned owl nests averaged 1.6 km (1 mile) apart in the Great Basin desert of central western Utah. Maximum and minimum distances between nearest owl nests were 4.8 km (3 miles) and 1.2 km (0.75 miles). In contrast, Hensley (1954) studied the Red-tailed Hawk in the lower Sonoran desert of Arizona and found that the greatest distance between two nests was about 9.7 km (6 miles), while the closest distance was about 4.8 km (3 miles). It appears that nesting distances are greatest in the cold desert of this study area, least in

the Wyoming wilderness area and Great Basin desert of Utah, and intermediate in a warm desert habitat.

PEAK WATERFOWL MIGRATION PERIODS.—No set patterns have been established when any one species can be counted on to occur in peak numbers in the San Juan River valley (J. L. Sands, pers. comm.). The peak population of each species migrating through San Juan County depends on weather conditions and brood population. However, some of the species observed during this study appeared to peak during the portion of the season considered normal for that species. Blue-winged Teal, Cinnamon Teal, and Northern Shovelers are considered

TABLE 7. Nonwaterfowl birds observed during four migratory waterfowl surveys^a on the study area.

Common Name	Frequency of Observation ^b during Survey Periods				Common Name	Frequency of Observation ^b during Survey Periods			
	1	2	3	4		1	2	3	4
Turkey Vulture	R	-	-	-	Common Raven	C	U	U	U
Cooper's Hawk	-	-	R	-	Rock Wren	-	-	R	-
Red-tailed Hawk	R	R	R	U	Sage Thrasher	-	-	R	-
Swainson's Hawk	-	R	-	-	American Robin	-	-	R	-
Rough-legged Hawk	-	R	-	-	Blue-gray Gnatcatcher	-	-	U	-
Ferruginous Hawk	R	-	R	U	Ruby-crowned Kinglet	-	-	R	-
Golden Eagle	-	R	-	R	Loggerhead Shrike	R	R	-	U
Marsh Hawk	-	R	R	R	Yellow-rumped Warbler	-	-	R	-
Prairie Falcon	R	R	R	R	(Audubon's Var.)				
Merlin	R	-	-	-	Wilson's Warbler	-	-	U	-
American Kestrel	R	-	R	-	Western Meadowlark	-	-	-	R
Scaled Quail	C	-	-	-	Yellow-headed Blackbird	-	-	U	-
Killdeer	-	-	U	-	Red-winged Blackbird	R	-	-	R
Pectoral Sandpiper	-	-	R	-	Cassin's Finch	R	-	-	-
American Avocet	-	-	U	R	House Finch	R	R	R	R
Wilson's Phalarope	-	-	R	-	Green-tailed Towhee	-	-	U	-
Mourning Dove	-	-	R	-	Vesper Sparrow	-	-	R	-
Great Horned Owl	R	-	-	R	Black-throated Sparrow	R	-	-	-
Burrowing Owl	-	-	R	-	Sage Sparrow	U	C	R	U
Say's Phoebe	-	-	R	-	Dark-eyed Junco	-	U	-	-
Western Wood Pewee	-	-	R	-	Clay-colored Sparrow	-	-	R	-
Horned Lark	A	A	A	C	Brewer's Sparrow	-	-	U	-
Bank Swallow	-	-	R	-	White-crowned Sparrow	R	-	-	R
Barn Swallow	-	-	R	-	Number of Species	17	12	32	15

^aSurveys were made during the following four periods: (1) 13-16 November 1973, (2) 20-24 February 1974, (3) 22-25 September 1974, and (4) 11-14 November 1974.

^bThese birds were not censused. Letters indicate frequency of observation during waterfowl surveys. The approximate number of observations are indicated as follows: A = Abundant, 200+; C = Common, 30-199; U = Uncommon, 5-29; R = Rare, 1-4.

early fall migrants (Chattin 1964, Bellrose 1976). These ducks were relatively abundant during the September survey but were absent during the November surveys (Table 6).

The Mallard is hardy, and normally migrates southward late, when it is forced to move south by the fall freeze (Chattin 1964). Since the Mallard is a permanent resident in San Juan County (Hubbard 1970), the fall migration is usually apparent as a steady increase in numbers. In surveys on the study area, Mallards were relatively common only in November of 1973 but were absent in September (Table 6).

Peak waterfowl use of stock ponds on the study area probably occurs during late September due to the preference of early migrants for this habitat type. The normal peak of fall waterfowl migration through San Juan County is in mid-November (J. L. Sands, pers. comm.). However, early migrants like Cinnamon Teal, Blue-winged Teal, and Northern Shovelers prefer to feed in shallow water, and thus make frequent use of small ponds (Sprunt and Zim 1961). On the other hand, ducks such as the Mallard constitute a major portion of the waterfowl migrants present along the San Juan River during November (J. L. Sands, pers. comm.). Because these birds often feed on waste grain (Bellrose 1976), they are attracted to the fields along the river and probably do not utilize desert ponds in San Juan County to the degree that teal and shovelers do. The effect on fall waterfowl migration is that the major wetland areas in San Juan County (along the San Juan River) are heavily used by late-migrating species, and desert ponds (like those on the study area) are primarily used by early-migrating species.

THREATENED OR STATUS UNDETERMINED SPECIES.—Four species of birds observed on the study area during the June breeding

bird surveys deserve detailed discussion due to their federal designation as "threatened" (Prairie Falcon) or "status undetermined" (Ferruginous Hawk, Mountain Plover, and Burrowing Owl) (U.S. Department of the Interior 1973b). Two Prairie Falcons were observed in separate locations at the cliffs bordering the Chaco River. A Prairie Falcon nest with eggs was located at one of these sites on a tall rock column (Tables 3 and 4). A pair of Ferruginous Hawks (plus their nest, Tables 3 and 4) and three Mountain Plovers (plus one nest) were located on open mesa habitat, where the vegetation varies from 0.6 m (2 feet) tall to nonexistent and the soil is sandy with some gravel (Tolle, 1976). Four Burrowing Owls were observed at three different Gunnison's prairie dog towns on the mine lease. In addition, a Merlin (which is considered "status undetermined") was seen during migratory surveys in November 1973.

The Ferruginous Hawk nest located on the study area was slightly less than 1.6 km (1 mile) from a Gunnison's prairie dog town. Because the prairie dog is one of this hawk's major food sources (Ligon 1961), the prairie dog town may have influenced the nest location.

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APPENDIX I. Scientific nomenclature of birds observed on the study area.

Common Name ^a	Scientific Name ^a	Common Name ^a	Scientific Name ^a
Great Egret	<i>Casmerodius albus</i>	Ash-throated Flycatcher	<i>Myiarchus cinerascens</i>
Mallard	<i>Anas platyrhynchos</i>	Western Wood Pewee	<i>Contopus sordidulus</i>
Gadwall	<i>Anas strepera</i>	Horned Lark	<i>Eremophila alpestris</i>
Pintail	<i>Anas acuta</i>	Tree Swallow	<i>Iridoprocne bicolor</i>
Green-winged Teal	<i>Anas crecca</i>	Bank Swallow	<i>Riparia riparia</i>
Blue-winged Teal	<i>Anas discors</i>	Barn Swallow	<i>Hirundo rustica</i>
Cinnamon Teal	<i>Anas cyanoptera</i>	Cliff Swallow	<i>Petrochelidon pyrrhonota</i>
Northern Shoveler	<i>Anas clypeata</i>	Common Raven	<i>Corvus corax</i>
Bufflehead	<i>Bucephala albeola</i>	Rock Wren	<i>Salpinctes obsoletus</i>
Ruddy Duck	<i>Oxyura jamaicensis</i>	Mockingbird	<i>Mimus polyglottos</i>
Turkey Vulture	<i>Cathartes aura</i>	Sage Thrasher	<i>Oreoscoptes montanus</i>
Cooper's Hawk	<i>Accipiter cooperii</i>	American Robin	<i>Turdus migratorius</i>
Red-tailed Hawk	<i>Buteo jamaicensis</i>	Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>
Swainson's Hawk	<i>Buteo swainsoni</i>	Ruby-crowned Kinglet	<i>Regulus calendula</i>
Rough-legged Hawk	<i>Buteo lagopus</i>	Loggerhead Shrike	<i>Lanius ludovicianus</i>
Ferruginous Hawk	<i>Buteo regalis</i>	Yellow-rumped Warbler	<i>Dendroica coronata</i>
Golden Eagle	<i>Aquila chrysaetos</i>	Wilson's Warbler	<i>Wilsonia pusilla</i>
Marsh Hawk	<i>Circus cyaneus</i>	Western Meadowlark	<i>Sturnella neglecta</i>
Prairie Falcon	<i>Falco mexicanus</i>	Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>
Merlin	<i>Falco columbarius</i>	Red-winged Blackbird	<i>Agelaius phoeniceus</i>
American Kestrel	<i>Falco sparverius</i>	Northern Oriole	<i>Icterus galbula</i>
Scaled Quail	<i>Callipepla squamata</i>	Brown-headed Cowbird	<i>Molothrus ater</i>
American Coot	<i>Fulica americana</i>	Blue Grosbeak	<i>Guiraca caerulea</i>
Killdeer	<i>Charadrius vociferus</i>	Cassin's Finch	<i>Carpodacus cassinii</i>
Mountain Plover	<i>Charadrius montanus</i>	House Finch	<i>Carpodacus mexicanus</i>
Spotted Sandpiper	<i>Actitis macularia</i>	Green-tailed Towhee	<i>Chlorura chlorura</i>
Pectoral Sandpiper	<i>Calidris melanotos</i>	Vesper Sparrow	<i>Poocetes gramineus</i>
American Avocet	<i>Recurvirostra americana</i>	Black-throated Sparrow	<i>Amphispiza bilineata</i>
Wilson's Phalarope	<i>Steganopus tricolor</i>	Lark Sparrow	<i>Chondestes grammacus</i>
Mourning Dove	<i>Zenaidura macroura</i>	Sage Sparrow	<i>Amphispiza belli</i>
Great Horned Owl	<i>Bubo virginianus</i>	Dark-eyed Junco	<i>Junco hyemalis</i>
Burrowing Owl	<i>Speotyto cunicularia</i>	Clay-colored Sparrow	<i>Spizella pallida</i>
Common Nighthawk	<i>Chordeiles minor</i>	Brewer's Sparrow	<i>Spizella breweri</i>
Western Kingbird	<i>Tyrannus verticalis</i>	White-crowned Sparrow	<i>Zonotrichia leucophrys</i>
Say's Phoebe	<i>Sayornis saya</i>		

^aCommon and scientific names are from the Fifth AOU Check-list (Wetmore, 1957) with revisions from the 32d Supplement (Eisenmann, 1973).

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