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A life history study of the spurred towhee pipilo erythropthalmus montanus

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A LIFE HISTORY STUDY OF THE SPURRED TOWHEE

PIPILO ERYTHROPTHALMUS MONTANUS

A THESIS

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Master of Arts

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by

Travis G. Haws

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This Thesis by Travis G. Haws is accepted in its present form by the Department of Zoology and Entomology as satisfying the Thesis requirement for the degree of Master of Arts.

July 1956

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INTRODUCTION

Relatively little is known about the life histories and habits of many of our most common passerine birds, including the Spurred Towhee (Pipilo erythropthalmus montanus Swarth). Since this species is ground dwelling and is very abundant in the scrub oak foothill areas near Provo, it lent itself very readily to a study of this type and was chosen as the subject for investigation.

The purpose of this study was to determine the populations of this bird in different areas in relation to plant cover, exposure and altitude, the general distribution, especially in Utah, and the seasonal activities. The habitat preferred by this towhee was also investigated during the study. Field work was begun in April 1955, and terminated in June 1956.

Most records of the Spurred Towhee in the available literature proved to be reports of its occurrence in specific areas. Many times additional information was given regarding nests and eggs found, young birds observed and the plant type with which the towhee was found associated. These reports in the literature were so numerous and uniform as to make citation of the references here exceedingly cumbersome and unnecessary.

Woodbury (1933) described the scratching antics of this towhee. Frost (1947) and Bailey (1928) shed considerable light on the food habits of this secretive bird. Rockwell and Wetmore (1914) very briefly described the song and other habits of this species in Colorado. In his study of the biotic communities of the Wasatch chaparral, Hayward (1948) described some of the antics of this most characteristic bird of the foothills and ana-

lyzed its habitat in detail.

METHODS OF STUDY

During the fifteen months this study was carried on, much time was spent examining the literature to obtain information on the general distribution as well as the distribution in Utah. Specimens were examined at the University of Utah, and nesting data as well as other information was obtained there. Throughout the late summer, autumn, and winter of 1955, two or three days per month were spent in the field observing the seasonal activities and distribution. Intensive field work was done during the spring and early summer of 1955, in the study of song habits, territorialism, mating, and in the unsuccessful attempt to locate nests. A spotting scope as well as binoculars were used to aid in this study.

Population studies were carried on during May 1956. This month was chosen for three reasons: first, this was the month of most active singing which made observation easy; secondly, territories had been established making the population relatively stable; and finally, the scrub oak leaves were not yet out which made census taking more accurate. Different study areas were chosen in Utah County presenting different aspects of exposure, altitude, slope and cover. All areas studied were in the scrub oak belt of the foothills east of Utah Valley. Square plots of two and one-half acres were laid out in each area. The corner of each plot was marked with a white flag tied to the top of the nearest shrub. Census counts were made a minimum of three different times until relatively constant numbers were recorded. These census counts were made the same hour of the day each time under similar weather conditions, a clear, windless day. Since experience

has shown that there is almost invariably a female somewhere near a singing male, the population was calculated by doubling the number of singing males counted in each plot.

Details of the Towhee songs were studied by first recording the songs in the field using a tape recorder run by a car battery. A parabolic reflector was used to reflect and focus the sound into a microphone. The songs were analyzed using a sona-graph sometimes called a vibralyzer.

All nests which were found during the field work were measured and studied. Eggs were measured and weighed in the field using an analytical balance. Young birds were weighed daily on a triple beam balance. Care of the young was observed from a blind constructed near the nest and recorded.

The writer made several trips to southeastern and southwestern Utah keeping careful records of the occurrence of this towhee.

THE GENUS, SPECIES, AND SUBSPECIES

The genus Pipilo was described by Vieillot in 1816 (Analyse, p. 32). The type was Fringilla erythropthalma Linnaeus. This genus is in the family Fringillidae, which includes the grosbeaks, finches and buntings, and the order Passeriformes. There has been a great deal of synonomy and revision in this genus during the past seventy-five years. According to the A.O.U. Check List, the genus Pipilo contains at the present time the three following polytypic species which have been subdivided into thirty subspecies.

(1) Pipilo fuscus Swainson, commonly called the Canyon Towhee, is easily distinguished by its fluffy, brown, sparrow-like appearance. Some twelve subspecies have been described which are distributed from southwestern Oregon south through California and Lower California and through the southwest. It has never been reported from Utah.

(2) Pipilo aberti Baird, Abert's Towhee, also is a brown bird, and two subspecies have been described. Their range is the arid southwest. It occurs in Utah only in the Virgin River Valley of Washington County.

(3) Pipilo erythropthalmus (linnaeus), the Red-eyed Towhee, which is the species in question, is one of the most ubiquitous species in North America. It occurs in every state of this country, in Canada, and in Mexico. This species at the present time contains sixteen subspecies. It is a very distinctive bird with its black fore and upper parts, white and brownish-orange under parts, and black wings and tail spotted with varying degrees of white (Figure 1).

Fig. 1.--Mounted Male Spurred Towhee

Pipilo erythropthalmus montanus Swarth (1905), the Spurred Towhee, is the common form found in Utah and the Rocky Mountains. It is much more abundant than one would think from hurried observations because of its secretive nature.

The following is the original description by Swarth (1905):

> Types - male adult; no. 3972, coll. H. S. S.; Miller Canyon, Huachuca Mountains, Arizona; May 20, 1903; collected by H. S. Swarth.
>
> Description - Head and neck all around, black; lower breast and abdomen, white; sides, chestnut, paler than in megalonyx, with a few partly concealed black markings on the edge, between the chestnut of the sides and the white belly; under tail coverts, pale fulvous. Wings, black, greater and middle coverts broadly tipped with white, forming two bars across wing; outer web of scapulars, white, except for an almost imperceptible edging of black; interscapulars with white spot on outer web; size of spots decreasing toward middle of back, but very few feathers on the back not showing some white markings. Rump, grayish, in marked contrast to the back. Three outer tail feathers tipped with white; lateral ones with outer web white for about terminal third. Length 224. Alar expanse 290. Wing 91. Tail 109. White spot on lateral tail feathers 35.
>
> Adult female; no. 3875, coll. H. S. S.; Miller Canyon, Huachuca Mountains, Arizona; May 5, 1903; collected by H. S. Swarth.
>
> Description - Generally similar to the male, but black of head, back, etc., paler, more slaty. Chestnut of sides, paler. Length 215. Alar expanse 270. Wing 86. Tail 101. White spot on lateral tail feather 27.

DESCRIPTION OF THE HABITAT

The Spurred Towhee is a bird of the mountain brush and is so characteristic of it, that should the writer name this community using Shelford's (1945) classification, it would be called the scrub oak - towhee community. This shrubby zone, commonly called chaparral, lies between the desert shrub formation and the montane forest. It is a dry area of rather low growing, deciduous trees, often forming a dense vegetation, especially at higher altitudes and on north-facing slopes (Figure 2).

Throughout the mountains of western America this shrubby zone or chaparral is found. In certain areas it forms a narrow belt and in others it may reach a vertical development of 2,400 feet, for Hayward (1948) states that the "chaparral of the Wasatch Mountains occurs on slopes of medium elevations of 5,100 to 7,500 feet depending upon slope exposure." The chaparral shows ecotonal characteristics, for many plant and animal species are found there, but few are confined solely to this shrubby zone.

By far the most common and dominant plant of the chaparral is the scrub oak or Gambel oak (Quercus gambelii). Along the lower reaches of the chaparral the squawbush (Rhus trilobata), bitterbrush (Purshia tridentata), sumac (Rhus cismontana), and hackberry (Celtis reticulata) are mingled with oak or form separate clumps. At higher elevations where the mountain brush meets the montane forest other shrubs are found such as chokecherry (Prunus melanocarpa), snowbrush (Ceanothus velutinus), rose (Rosa woodsii), service berry (Amelanchier alnifolia), mountain mahogany (Cercocarpus montanus and C. ledifolius), cliff rose (Cowania stansburyana), and especially mountain

Early Spring Aspect

Midsummer Aspect

Fig. 2.--A Typical Towhee Habitat

maple (Acer grandidentatum). The size and density of the mountain shrubs increase with increase in elevation.

Undershrubs are profuse during the spring and early summer. Vetches, Death Camas, sagebrush, balsam root, rabbit brush, mallows, borages, Indian Paintbrush, Sego Lilies, many kinds of umbels, evening primroses, and mustards are some of the many annuals and perennials encountered between and under the larger shrubs.

Common grasses are: Agropyron spicatum, Bromus marginatus, Bromus polyanthus, Bromus tectorum, Hesperochloa kingii, Poa longiligula, Poa nervosa, Poa pratensis, Stipa columbiana, Stipa lettermani.

Few accurate weather data are available for the Utah Valley foothill area, but some insight into this aspect of the habitat is provided by Price and Evans (1937) from records kept at the Great Basin Experimental Station near Ephraim, in central Utah. The mean annual precipitation for the chaparral at 7,655 feet elevation over a twenty-year period was 17.5 inches, and the mean annual temperature over the same period was 42.6 degrees Fahrenheit with 97 degrees the maximum and -30 degrees the minimum.

GENERAL DISTRIBUTION

Swarth (1905) gave the range of the Spurred Towhee as follows:

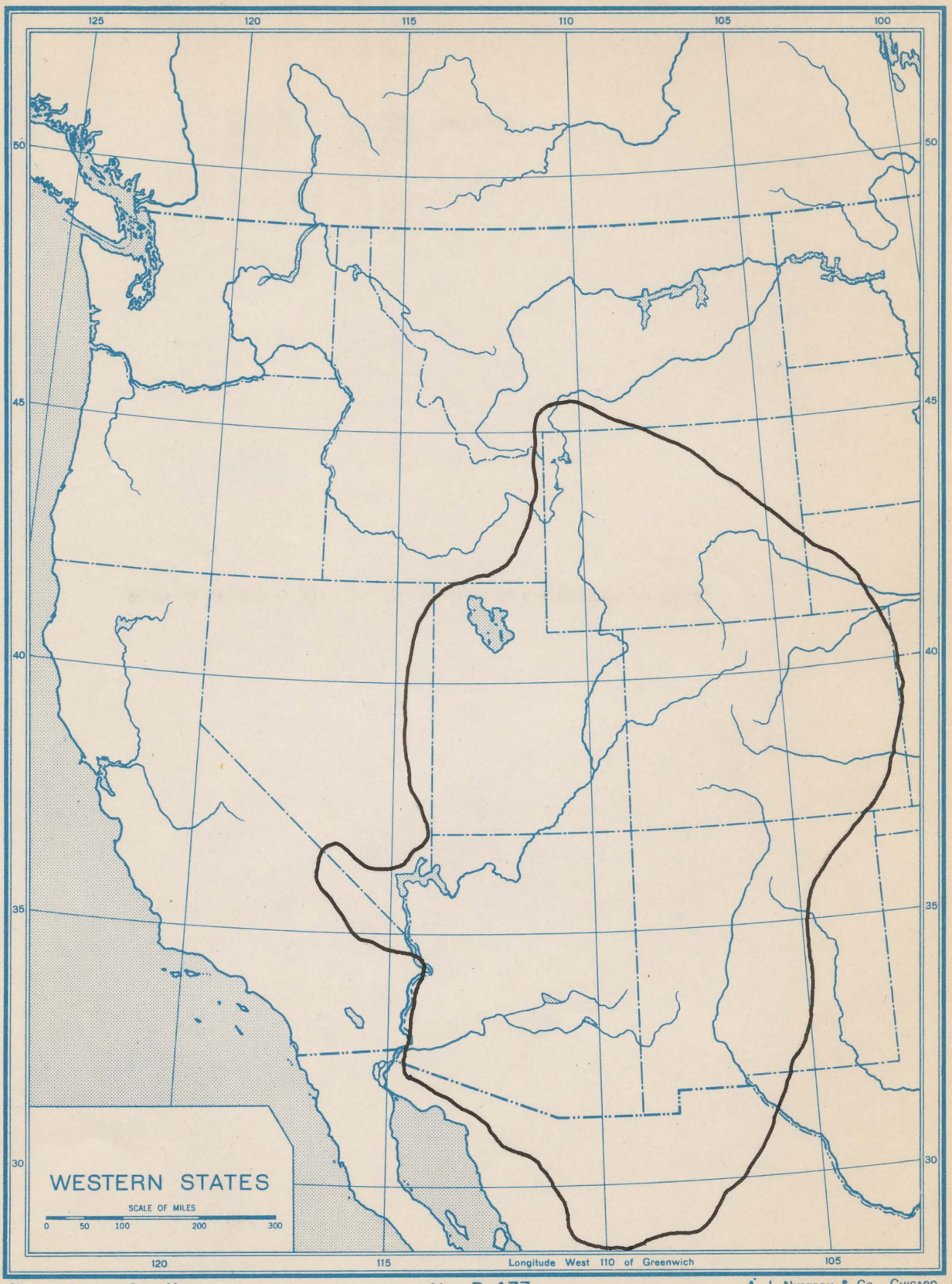
> The higher mountains of eastern Arizona, eastern California, central and southern Nevada and Utah, western Colorado and New Mexico, south into northern Mexico. The western-most extension of the species in Arizona might be indicated by a line drawn from the Santa Rita to the Hualapai Mountains. Specimens of montanus were examined from the following localities: Huachuca Mountains and Fort Verde, Arizona; Rincon and Fort Union, New Mexico; Fort Loveland, Colorado: Provo, Utah; and West Minaca, Chihuahua, Mexico.

Since Swarth's original description of Pipilo erythropthalmus montanus, two new subspecies have been described and taken out of this subspecies. Van Tyne and Sutton (1937) described P. erythropthalmus gaigei from southwestern Texas and eastern New Mexico, and Grinnell (1911) described P. erythropthalmus curtatus with a range from central British Columbia south to eastern Oregon, Nevada and northeastern California.

The known range at present (A.O.U. Check List) of the Spurred Towhee is from northwestern Wyoming south through southeastern Idaho, Utah, Colorado, Arizona, and the western half of New Mexico; Lincoln, White Pine, and Clark Counties Nevada, and Inyo County, California; northern and eastern Sonora and western Chihuahua, Mexico (Figure 3). It is found in the northern parts of its range in areas where enough moisture is present to support a growth of shrubs. In the southern parts of its range it is found generally more restricted and at higher elevations where conditions are less arid. Swarth (1905) states:

> I have never seen it below 5,000 and but seldom below 5,500 feet. In the ranges I visited I found it equally distributed from 5,500 to 10,000 feet, and even when the snow was deep on the ground

Fig. 3.--General Distribution of the Spurred Towhee



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the birds did not descend into the foothills. I can find no record of the occurrence of this bird anywhere in Arizona or New Mexico except in the mountains, nor does it seem to have ever been taken along the lower Colorado River.

DISTRIBUTION IN UTAH

Woodbury (1949) gives the distribution of the Spurred Towhee in Utah as "common permanent resident throughout Utah, breeding in the sub-montane shrub belt and streamside shrubbery of mountain slopes and canyons between 5,000 and 8,000 feet; moving downward as well as southward in winter." The author has observed downward movement in the winter. Swarth (1905) also believes this subspecies to be non-migratory (page 9). It has been taken at elevations as low as 2,800 feet in Washington County and as high as 8,000 feet in San Juan, Garfield, and Washington Counties. Figure 4 shows the localities from which specimens have been examined and observations reported in the literature. This bird appears to be widespread in Utah except in the low mountains of the western deserts.

Specimens examined. - Total, 174, distributed as follows:

Box Elder County: George Creek, Raft River Mountain, 7000 ft., 1 (U.U.); 2 mi. N Bear River City, 2 (U.U.); 1 mi. S Mantua, 1 (U.U.).

Weber County: 2 mi. N Hooper, 4250 ft., 1 (U.U.); Ogden, 1 (U.U.).

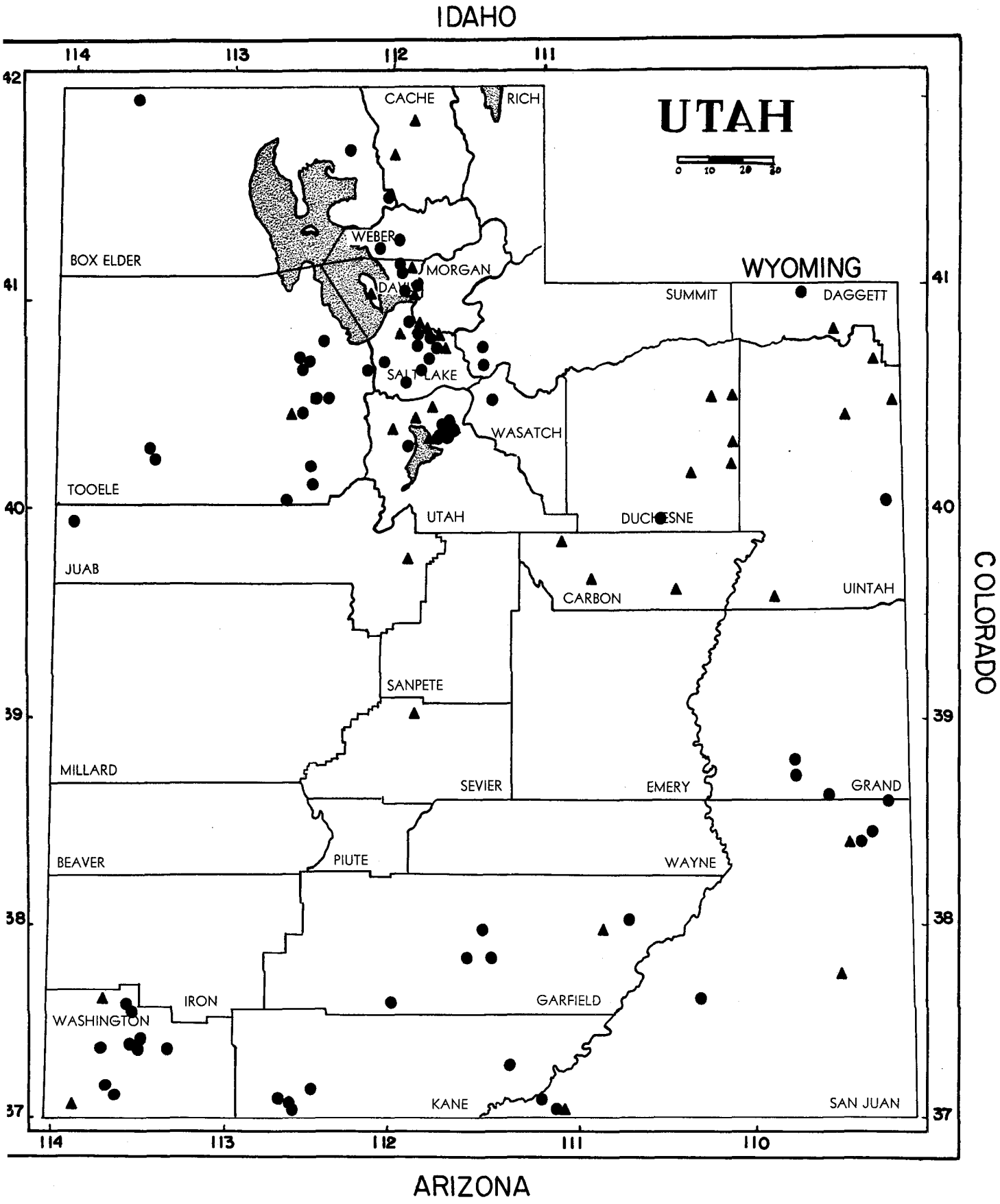
Tooele County: Tooele Canyon, 3 (U.U.); Clover Creek, Clover, 5180 ft., 1 (U.U.); Water Canyon, N end Granite Peak, 4500 ft., 1 (U.U.); Head Clover Creek, 4 mi. W Clover, 1 (U.U.); Death Canyon, SW end Simpson Mountain, 5500 ft., 2 (U.U.); NW side Stansbury Mountains, 4 mi E Iosepa, 1 (U.U.); S Willow Creek R. S., 8 mi. SW Grantsville, 7000 ft., 1 (U.U.); Grantsville, 4100 ft., 2 (U.U.); Box Canyon, 4 mi. NE Iosepa, 5600 ft., 1 (U.U.); Rock Spring Canyon, 1 mi. N Willow Springs, 6500 ft., 1 (U.U.); Canyon at N end Granite Mountain, 4400 ft., 1 (U.U.); Oakbrush Canyon, E side Sheeprock Mountains, 6800 ft., 1 (U.U.); 7 mi. SW Vernon, 1 (U.U.); Clover Creek, 3 mi. W Clover, 5800 ft., 1 (U.U.); Water Canyon, N end Granite Mountain, 1 (U.U.); Willow Spring, W side Johnson Pass, Stansbury Mountains, 5200 ft., 1 (U.U.).

Davis County: E Bountiful, 4700 ft., 4 (U.U.); Kaysville, 1 (U.U.); 3½ mi. S mouth Weber Canyon, 4460 ft., 1 (U.U.); Mouth Parrish Creek Canyon, 4 mi. E Bountiful, 5000 ft., 2 (U.U.).

Fig. 4.--Distribution in Utah

Legend

● Specimen examined ▲ Other record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RICH
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DAVIS
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DAGGETT
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DUCHESNE
JUAB
CARBON
UINTAH
SANPETE
MILLARD
SEVIER
EMERY
GRAND
BEAVER
PIUTE
WAYNE
IRON
GARFIELD
WASHINGTON
KANE
SAN JUAN
COLORADO
ARIZONA
114
113
112
111
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42
41
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Salt Lake County: 1 mi. N Davis, 4800 ft., 1 (U.U.); Little Cottonwood Creek, 4400 ft., 1 (U.U.); Mouth Emigration Canyon, 1 (U.U.); 5 mi. NE Draper, 4520 ft., 10 (U.U.); 2 mi. NE Draper, 4520 ft., 1 (U.U.); Mouth Big Cottonwood Canyon, 4700 ft., 3 (U.U.); Mouth Little Cottonwood Canyon, 4500 ft., 4 (U.U.); Mouth Big Cottonwood Canyon, 5000 ft., 1 (U.U.); Emigration Canyon, 1 (U.U.); Mouth Parley's Canyon, 1 (U.U.); In Salt Lake City, 4300 ft., 1 (U.U.); Herriman, 4425 ft., 1 (U.U.); Dry Fork, Bingham, 1 (B.Y.U.).

Summit County: White Pine Canyon, ½ mi. W Snyderville, 7000 ft., 1 (U.U.); Kimball Junction, 6900 ft., 1 (U.U.).

Daggett County: Hideout Canyon, 5500 ft., 1 (U.U.).

Utah County: 3 mi. N Utah State Mental Hospital, Provo, 5200 ft., 1 (U.U.); W side Utah Lake, 1 (B.Y.U.); Provo, 4600 ft., 5 (B.Y.U.); Rock Canyon, NE Provo, 4 (B.Y.U.); W slope Mount Timpanogos, 2 (B.Y.U.); S slope Mount Timpanogos, 1 (B.Y.U.); Slide Canyon, E Provo, 8 (B.Y.U.); "Y" Mountain, E Provo, 1 (B.Y.U.); Pole Canyon, NE Provo, 2 (B.Y.U.).

Wasatch County: Heber, 5440 ft., 1 (U.U.).

Duchesne County: Mouth Argyle Canyon, 5600 ft., 1 (U.U.).

Uinta County: White River Bridge, 1 (B.Y.U.).

Juab County: Brush Creek, Deep Creek Mountains, 6000 ft., 1 (U.U.).

Carbon County: Taylor's Ranch, 6000 ft., 1 (U.U.).

Grand County: Moab, 3940 ft., 1 (U.U.); 15 mi. SE Moab, 6000 ft., 1 (U.U.); Colorado River above Moab, 1 (U.U.).

Garfield County: Sanford Ranch, 6000 ft., 1 (U.U.); Woodruff Spring, 20 mi. NW Hite, 6000 ft., 1 (U.U.); 5 mi. W Escalante, 5800 ft., 1 (U.U.); 5 mi. N Boulder, 6500 ft., 5 (U.U.); 5 mi. N Boulder, 7500 ft., 2 (U.U.); Mouth Calf Creek, 10 mi. E Escalante 5000 ft., 1 (U.U.); Henrieville, 1 (B.Y.U.).

San Juan County: 5 mi. NE La Sal P.O., 8000 ft., 22 (U.U.); La Sal P.O., 1 (B.Y.U.); Navajo Mountain, 8500 ft., 1 (U.U.); 3 mi. below head Beaver Creek Canyon, 6000 ft., 1 (U.U.); Natural Bridges National Monument, 1 (U.U.); La Sal Mountains, 1 (B.Y.U.).

Kane County: 1 mi. S Kanab, 4900 ft., 1 (U.U.); 5 mi. NW Kanab, 5500 ft., 15 (U.U.); Kaiparowits Plateau, 7000 ft., 5 (U.U.); Hidden Lake, 6000 ft., 2 (U.U.); Johnson Canyon, 10 mi. NE Kanab, 5000 ft., 1 (U.U.); Kanab, 1 (B.Y.U.).

Washington County: 2 mi. SE Pinto, 6500 ft., 1 (U.U.); Middle Fork Canyon, Pine Valley, 7500 ft., 1 (U.U.); Santa Clara, 2800 ft., 2 (U.U.); ½ mi. E Pine Valley, 6700 ft., 1 (U.U.); Tonaquint Fields, St. George, 2800 ft., 1 (U.U.); 4 mi. E Pine Valley, 8400 ft., 1 (U.U.); 5 mi. E Pine Valley, 7400 ft., 1 (U.U.); 1 mi. E Pinto 6500 ft., 1 (U.U.); 2 mi. SE Pinto, 6500 ft., 1 (U.U.); Pintura, 1 (U.U.); St. George, 2800 ft., 1 (B.Y.U.); Pine Valley, 1 (B.Y.U.); Veyo, 1 (B.Y.U.).

Additional Records:

Cache County: Wellsville Mountains; Dry Canyon, Logan: Green Canyon, Logan; Dry Lake, Wellsville; Vernon; Wellsville (Stanford, 1938:144).

Tooele County: Willow Spring, W Johnson Pass, Skull Valley (Ghiselin, 1956); W side Fisher Pass (Muller, 1928).

Davis County: Muehler Park (Bee & Hutchings, 1942:84); E Kaysville (Woodbury, 1936).

Salt Lake County: Antelope Island (Cottam, 1927:107); Salt Lake City; Red Butte Creek; Mouth Dry Canyon; Dry Canyon; Pioneer Fork, of Big Cottonwood Canyon (Ghiselin, 1956); Parley's Canyon (Muller, 1924).

Daggett County: Green Lake (Twomey, 1942:467).

Utah County: Cedar Valley; Lehi vicinity; Provo River, W Provo (Bee & Hutchings, 1942:84); Near Alpine (Muller, 1919).

Duchesne County: Uinta Canyon, 20 mi. N Roosevelt (Twomey, 1942:467); 10 mi. N Neola along Uinta River; Along Duchesne River E Myton; Along river at Bridgeland; Near Roosevelt (Killpack, 1956).

Uinta County: Ashley Creek Canyon; Hill Creek, 40 - 70 mi. S Ouray; Blue Mountain (Twomey, 1942;467); 50 mi. NE Vernal (Killpack, 1956).

Juab County: Nephi (Hardy, 1936).

Carbon County: Soldier Canyon, 7200 ft.; Price (Hardy, 1937); Sunnyside (Hardy, 1936).

Sevier County: Salina (Stanford, 1931:10).

Garfield County: Star Spring, base Mount Hillers, Henry Mountains (Haws, 1956).

San Juan County: Navajo Mountain (Benson, 1935:445); Near La Sal (Tanner & Hayward, 1934:232); 9 mi. N Blanding (Haws, 1956).

Washington County: Mountain Meadows (Cottam, 1927:107); Beaverdam Mountains (Hardy, 1940:108).

SEASONAL DISTRIBUTION AND ACTIVITIES

Spring

About the first of April, depending on the weather, the winter flocks of towhees begin to break up and the birds pair. During the two spring seasons this study was carried on, territories had been established and vigorous singing begun by the males by the middle of April. Nest sites are chosen and nests are built by about the end of April. The spring of 1955, no nests were found although the writer spent long hours in the field in an attempt to locate them. However, two nests were found on May 5 and 6, 1956, each with four eggs being incubated. By the first of May the towhee population seemed to be stable and well established. Other aspects of the spring activity will be discussed in greater detail in following sections.

Summer

The distribution remains the same throughout the summer. Adults of both sexes are busily engaged in rearing the young. Many reports in the literature indicate two or more broods are reared. The writer has no positive evidence for or against such a practice.

The first juvenile birds observed during the summer of 1955, were seen August 9. They were feeding with the female adult and had the characteristic juvenile plumage but were the size of the adult bird. However, a pair of adults was seen carrying food on June 17, 1955, but the nest could not be located. The young towhees have the characteristic juvenile plumage

upon leaving the nest but rapidly acquire the adult plumage, for after September 21, birds of the year could not be distinguished from adults.

Autumn

The towhees begin to group together in small flocks in September. Not all the towhees are in these flocks, for frequently a single or perhaps two towhees were observed. Usually these birds were males. These small flocks keep on the move and range far and wide. There were areas devoid of towhees and other areas literally teeming with them. One male was observed by the writer at the top of a mountain east of Mapleton Bench, Utah, at an elevation of about 9,000 feet. This observation was made in late October. Food, principally insects, is plentiful during this season, and much time is spent in just flitting from one bush to another or one thicket to another with little real earnest scratching or food-seeking involved.

Winter

The winter season and the first snows find the towhees already grouped together in flocks with an occasional single or pair observed. As the weather becomes colder and the snows cover the ground there is a definite vertical movement downward from the mountain slopes into the lower valleys. Mukherjee (1956) records the Spurred Towhee as a winter resident of the Brigham Young University campus from October through March. Several specimens have been taken in the residential districts of Salt Lake City during the winter when deep snows had driven them downward. However, the heaviest population, at least in the Provo area, has been observed in the lower reaches of the foothill areas. It is here that the author has observed as many as twenty towhees in a small area which is later occupied by only one breeding pair. It is also during this winter season when food,

especially insects, is most scarce, that the scratching habit so characteristic of this species is most often seen. As soon as the extremely cold, wet weather is past, usually in March, the groups of towhees begin to move back up the mountain sides in preparation for the breeding season.

SINGING HABITS AND TERRITORIALISM

Singing Habits

The Spurred Towhee has a repertoire of three distinct songs or calls. Of these three, two are little varied from bird to bird, while the third, the spring song of the male, is greatly varied from male to male and even by one particular male.

The tseep note.--This note, uttered by both the male and female, is most often heard during the winter months. Birds were very frequently seen and heard flitting through the shrubs on cold wintery days giving this high, shrill tseep note. This call is not very loud, and one must be within a few feet of the bird to be able to detect it. The tseep note was also heard by the author during the summer while recording weights and photographing nestling towhees. The female invariably had to be flushed from the nest; then the writer would record weights or take pictures as quickly as possible. Usually this work was no sooner begun when the female again approached the nesting area and began to utter this tseep, tseep call. This call did not seem to attract the attention of the male. On April 24, 1955, a male towhee was observed in pursuit of a female uttering the tseep note and a low, soft spring song.

The pshew call.--This call is also given by both the male and the female. It is not characteristic of any one particular season, for it is heard at any time of the year. The pshew call is the scolding cry of the Spurred Towhee. Once while weighing a nestling it squawked, and immediately the female, which was near by giving the tseep note, began to scold vigor-

ously, all the time uttering the pshew call.

The pshew call is of medium intensity but is of good carrying quality and can be heard for a relatively great distance. This call is not always a scolding call, for it is often heard when there is nothing near of disturbing nature. As is the case of the spring or mating song of the male towhee, the pshew call often evokes an answer from another towhee with a chain-like reaction until many birds can be heard pshewing back and forth at each other.

The pshew call is often given at the close of a period of vigorous singing by the male after he has left his perch high in a shrub and flown low into the shrubbery; therefore, it may be assumed that this call is also an expression of ownership and possession. This call is often heard while a bird is actively scratching in the leaves seeking food, and it was not uncommon to hear this call, a bit muffled, from the male as he approached the nest with his beak full of insects.

The spring or mating song.--This song, of the male towhee only, is the one which has the greatest amount of variation. It consists of one, two, three, four, or five introductory notes, two, three, or four being the most common, followed by a trill usually higher than the introductory notes, sometimes at the same level, and more rarely at a lower level. This song of the male towhees is of medium intensity and can be heard for moderate distances. Singing begins the latter part of February or the early part of March, depending on when the first warm weather of late winter comes. The first spring song heard in 1956 was on March 3.

Singing begins just as it starts to get light in the east, and as in the pshew call, the mating song of the male is usually answered by other males. It is not unusual to hear six or seven males singing and answering

each other up and down the foothill area. After this first outburst of singing is over there is a moderate amount until the first rays of the sun reach the birds when there is usually another outburst of singing. Singing continues intermittently throughout the day and is even heard sometimes when it is almost completely dark. The months of most active singing are April and May. Rain and strong spring winds during these months have a marked effect upon singing, for almost no singing is heard on these days.

The longest sustained period of singing observed was on April 14, 1955, which lasted forty-two minutes. Some 260 consecutive songs, or over six per minute, were counted involving four variations. This count was made beginning at 5:17 A. M., the sun coming over the mountain to the east at 7:24 A. M.

As will be explained later in greater detail, after each feeding by the male, the mating song was sung, sometimes from a bush near the nest and sometimes from any other favorable perch in the territory. Sometimes only six or seven songs were sung while at other times singing was sustained for several minutes. The singing of the male gradually decreases during the summer as the nesting season is past, until by late August or early September no singing is heard.

As pointed out by Borror and Reese (1953), analyses of bird songs by ear alone are merely subjective descriptions and not accurate analyses. To attempt to represent a bird song with the musical scale, by spelling out the sound, or using some other symbol, is often inadequate because it is impossible to accurately indicate the unusual intervals, slurs, or erratic rhythms in many songs, and there is no way to indicate the frequency composition of the individual notes. Borror and Reese (1953) also reported briefly on a method of bird song graphing that has been little used; one

which not only gives a picture of the minute details of rhythm but also shows all the frequencies present and gives some data on loudness.

The towhee songs were tape recorded in the field and then analyzed in the laboratory, using a sona-graph (sound spectrograph). The sona-graph analyzes a complex signal as a function of both frequency and time. The resulting portrayal, known as a sonagram, displays frequency along the vertical axis, time along the horizontal axis, and intensity by the darkness of the pattern (Figure 5).

In normal operation, a sonagram portrays the frequency region up to 8000 cycles per second in a vertical distance of four inches and covers a period of time equivalent to 2.4 seconds for a horizontal distance of approximately twelve and one-half inches. A recorded signal can be analyzed by this method in about five minutes.

In operation, a sample of the sound to be analyzed is first recorded on the magnetic disc at 24 R.P.M. After the wanted signal is recorded it is reproduced repeatedly at a speed of 3.3 times the recording speed or 80 R.P.M. On each repetition the signal is scanned by a 45 cycle band pass filter which is effectively shifted slightly in frequency with each repetition. The output of the analyzing filter is then recorded on dry facsimile paper that is fastened around a drum that rotates in synchronism with the magnetic disc. The recording stylus shifts gradually (marks 96 lines per inch) along the frequency scale in step with the scanning oscillator. Fluctuations of intensity at the output of the filter will show up on the sonagram as light or dark areas, with the higher energy levels showing the darker regions.

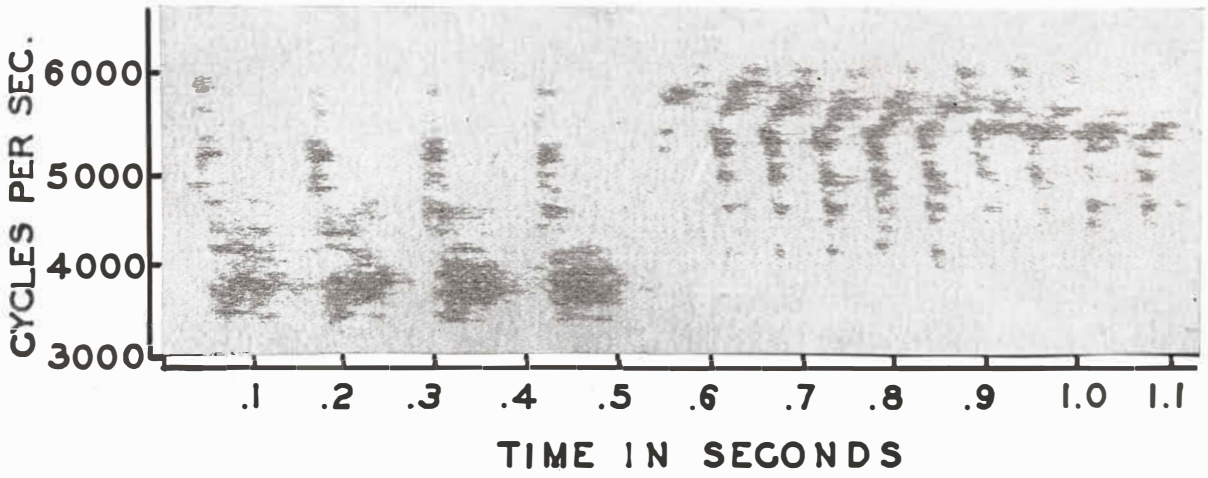
In Figure 5, two variations of the spring song of one male towhee have been analyzed using the sona-graph. Also, the same plate shows the

Fig. 5.--Sonagrams of the Towhee Songs

(Upper) -- One variation of the spring song of the male towhee.

(Center) -- Another variation of the male towhee song.

(Lower) -- The pshew or scolding cry of the Spurred Towhee.


CYCLES PER SEC.
6000
5000
4000
3000
.1
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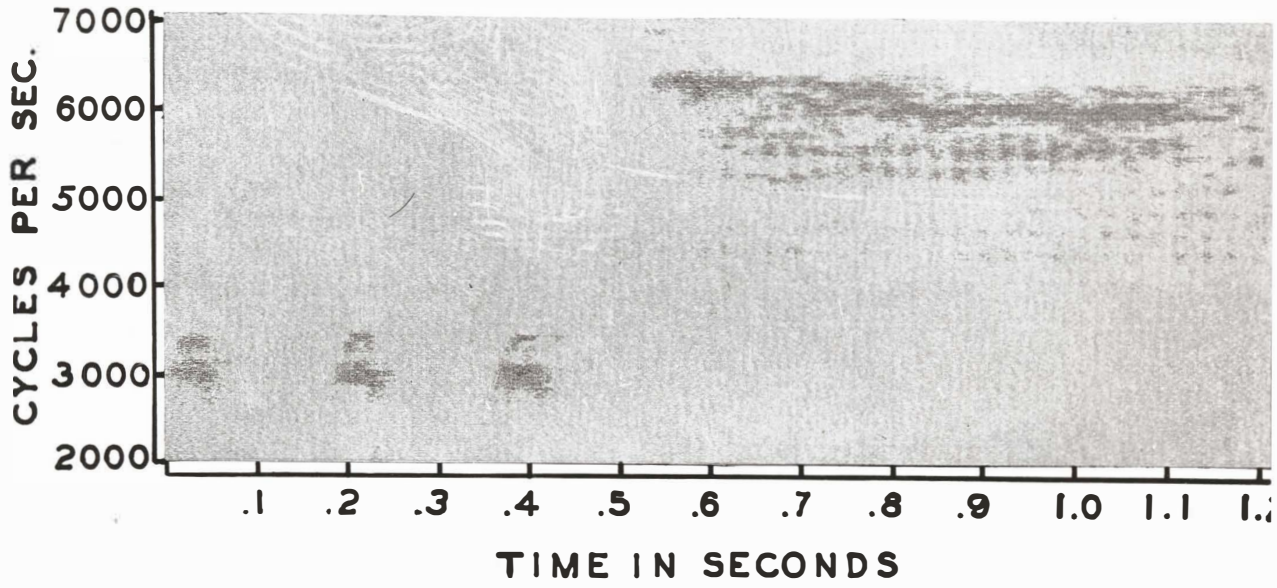
.4
.5
.6
.7
.8
.9
1.0
1.1
TIME IN SECONDS


CYCLES PER SEC.
7000
6000
5000
4000
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2000
.1
.2
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.4
.5
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.7
.8
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1.0
1.1
TIME IN SECONDS

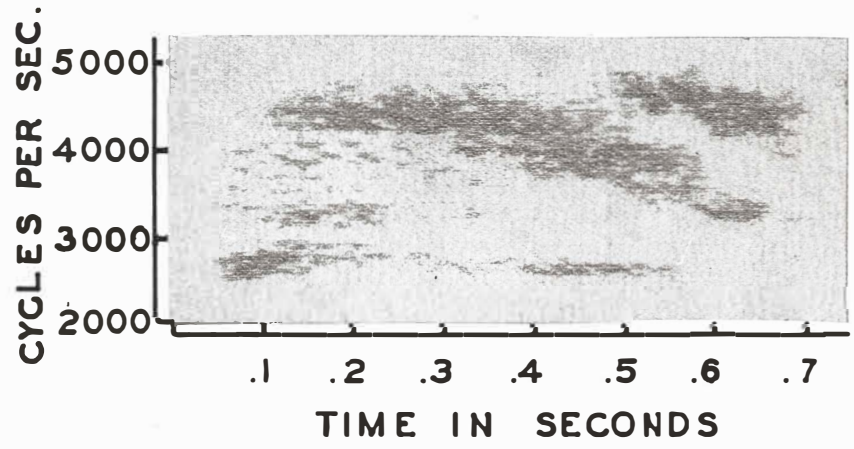
CYCLES PER SEC.
5000
4000
3000
2000
.1
.2
.3
.4
.5
.6
.7
TIME IN SECONDS

FIGURE 5

sonagram of the pshew or scolding call of a different male towhee. The writer could not detect any difference in the pshew of the male and female.

Territorialism

Three factors added greatly to the difficulties in studying territorialism in the Spurred Towhee. First, none of the nests found during the study was close enough to each other to provide a basis for a study of adjacent nesting sites. Second, because of the secretive nature of the species and dense cover in which it is most often found, it was not always possible to follow the movements of a particular bird, nor be sure that when a towhee did reappear, that it was the same bird as had been previously observed. And third, several attempts were made to plot the movements of a particular bird on maps during the spring of 1955, but without success, for invariably the male would leave the presumed territory and fly some distance out of sight. Or at other times four towhees were observed in what was believed to be the territory of one pair without any apparent conflict.

However, the writer does believe that some degree of territorialism is maintained. One male was observed chasing another male away when the latter flew to the top of a scrub oak bush above a sagebrush where the mate of the former was incubating four eggs.

NESTING DATA

Nests and Nesting Sites

No nests were found the spring and summer of 1955, but five nests were located the spring of 1956. Three of the five nests were discovered by flushing the female from the nest. The first nest, hereafter referred to as nest number one, was located May 5, under a sagebrush in a little clear area surrounded by scrub oak clumps. This nest was on a south-facing slope of Mount Timpanogos about one mile northeast of the Orem City water tank at an elevation of 5250 feet. The sagebrush was small and low growing and was four feet from the nearest scrub oak clump. The nest was built in a shallow depression in the soil at the base of the sagebrush. The writer returned May 6, and constructed a blind near the nest. Upon returning May 8, to weigh and measure the eggs and watch the nest, the eggs had disappeared with no evidence as to what had happened to them.

The second nest was found May 6, about fifty feet above the Pole Canyon road just beyond the point where it crosses an irrigation ditch at an elevation of 5500 feet. This nest was also under a sagebrush about three feet high and was situated on a west-facing slope. The nest was nestled in an oak leaf deposit 8 cm. deep at the base of the sagebrush. The hillside was covered with low-growing oak and sagebrush all about three feet in height. The eggs were weighed and measured May 8, but were missing from the nest on May 16. Again there was no indication as to what might have happened to them, for there were no signs of violence or a disturbance in evidence.

The third nest was found at Star Spring, base of Mount Hillers, Henry Mountains, Garfield County, Utah, at an elevation of 6000 feet. The nest was at the base of an unidentified clump of weeds with a scrub oak growing on one side and a live oak (Quercus turbinella) growing on the other. The nest and eggs were collected.

The fourth nest was located May 29, under a dead sagebrush about one-quarter mile northwest of the first nest. The writer, previous to this date, suspected that there was a nest in the area and had searched for it several times. The nest was empty. This nest was situated on a gentle south-facing slope in a low-growing oak patch surrounded by larger clumps. It also was constructed in a shallow depression in a deposit of old oak leaves at the base of the sagebrush.

The fifth nest found was located May 29, in the foothills east of Provo, Utah, and below and north of the "Y" on "Y" Mountain at an elevation of 4750 feet. The nest was located under a sagebrush three and one-half feet from a scrub oak patch. The nest was at the base of the sagebrush in a depression in the soil. The eggs were weighed and measured the same day the nest was found. They hatched June 2, and the nest was robbed of the young between 1:00 P. M., June 8, and 7:30 A. M., June 9.

All of the nests found were lined with dry grass, the outer shell being constructed of sagebrush bark (Figure 6). The only exception was the nest near Star Spring, the outer shell consisting of juniper bark. All nesting records from Utah for the Spurred Towhee are of nests found on the ground, but Van Rossem (1936) reported, in Nevada, two nests of this towhee in rose thickets above the ground. The first nest was found July 10, 1932. It contained four fledglings and was 18 inches above knee-deep water which surrounded the rose thicket. The other was two feet off the ground and

Fig. 6.--Spurred Towhee Nest

contained three fresh eggs. Table 1 shows the measurements of the five nests which were found during this study.

TABLE 1

NEST MEASUREMENTS

	Inside Diameter	Depth
Nest 1	7.0 cm.	5.0 cm.
Nest 2	7.5 cm.	4.0 cm.
Nest 3	8.0 cm.	5.5 cm.
Nest 4	8.0 cm.	6.0 cm.
Nest 5	*9.0 cm.	6.0 cm.

*Probably enlarged by nestlings

Eggs

The eggs of the Spurred Towhee are about midway in size between those of the robin and English Sparrow. Four eggs is the usual number in a clutch; rarely three or five eggs are found. The average length for the twelve eggs measured was 23.4 mm., and the average greatest width was 17.6 mm. The color, using Ridgway's Color Standards and Nomenclature, is near Pale Olive Gray but lighter, finely speckled and spotted with Army Brown and sometimes blotched with Light Mouse Gray (Figure 7). Some eggs are rather uniformly speckled but usually are more heavily pigmented at the large end. Table 2 below gives the weights and measurements for the three clutches examined.

Incubation

Few data concerning incubation were obtained because of the circum-

Fig. 7.--Spurred Towhee Eggs in a Nest

TABLE 2

EGG MEASUREMENTS

	Weight	Length	Greatest Width
Nest 2	3.44 g.	23.2 mm.	17.0 mm.
	3.90 g.	24.3 mm.	17.4 mm.
	4.25 g.	24.5 mm.	17.6 mm.
	3.79 g.	23.4 mm.	17.1 mm.
Nest 3	2.56 g.	23.8 mm.	17.4 mm.
	2.59 g.	23.6 mm.	17.6 mm.
	2.65 g.	22.9 mm.	18.0 mm.
	2.46 g.	24.3 mm.	17.5 mm.
Nest 5	3.59 g.	22.4 mm.	18.2 mm.
	3.37 g.	22.8 mm.	18.0 mm.
	3.26 g.	23.1 mm.	17.3 mm.
	3.48 g.	22.4 mm.	17.8 mm.

stances stated above in the section on nests and nesting sites; however, Burns (1915) gives the incubation period for an eastern subspecies, erythropthalmus, as twelve to thirteen days. All of the writer's observations showed that the female alone incubates the eggs. During this time the male actively sings, moves leisurely over the territory, and feeds and rests. He is fully aware of the location of the nest and the incubating female. At no time was a male observed approaching the nest.

No data were obtained concerning nest building, egg laying or activities of the female during incubation on the nest. When approaching and

leaving the nest the female was very deliberate and secretive. She would slink along the ground if leaving the nest and then, some distance away, fly up into a bush. If approaching the nest site she would carefully survey the area from a nearby shrub, fly quickly to the ground, and carefully and silently approach the nest through the densest cover available. While off the nest the female and the male were usually seen together feeding some distance from the nesting site.

The first, second and fifth nests were discovered because the female flushed from the nest as the author walked by. Thereafter, the female would not flush from the nest until the writer paused a moment and looked directly at her. In the case of the incubating female at Star Spring, not until the hand was extended to within a foot of the nest would the female flush. The manner in which the female flushed from the nest was the same in all cases. She left the nest half running and half fluttering across the ground with great speed and agility, reminding one of a chipmunk or mouse running through the brush. Never did the female towhee utter any sounds nor return immediately to the area. However, the female of nest five returned more quickly to the nest after the eggs hatched than before.

The Young and their Development

The only data for hatching of towhee eggs were recorded on June 2, 1956. At 8:00 A. M., two eggs had already hatched and a third had a small hole pipped in it. The fourth egg had not started to hatch. The egg shells of the two nestlings that had already hatched were not in evidence. By 2:30 P. M., six and one-half hours later, the nestling from the third egg was found dead half out of its shell. Cause of death was unknown, and it was removed from the nest by the writer. The fourth egg was observed to

be pipped at this time. By 7:30 P. M. or five hours later the fourth nestling successfully hatched, but, because of darkness, removal of the egg shell was not observed.

The young nestlings of the Spurred Towhee are altricial or incapable of locomotion and entirely dependent on their parents for food, nidicolous or remain in the nest for an extended period of time being fed by the parents, and psilopaedic or naked at hatching or only sparsely covered with down (Pettingill, 1948).

The newly hatched young are ungainly with short and undeveloped limbs contrasted with a large head and abdomen. The rictal region of the mouth is conspicuous because of its bright yellow color and swollen appearance. Large, sparse down feathers (neossoptiles) are present dorsally on the spinal and capital pterylae, especially the latter and is of a greyish white color. The outlines of all pterylae are only faintly indicated on the newly hatched towhee.

The coloration of the skin is a light salmon pink, slightly darker below than above, with the viscera showing through the skin of the abdomen. The eyes are closed upon hatching and begin to open, first as narrow slits, on the third day. The only activities are simple reflexes related to lifting the head and opening the mouth, swallowing, defecating, and to keeping the body in an upright position.

Figure 8 shows a graph of the growth curves for the three nestlings of nest five over a six-day period until their disappearance.

Noticeable darkening and enlarging of the feather papillae was in evidence the day after hatching. By the third day (counting the day of hatching as 0 day) the sheaths were emerging from the papillae especially on the wings (Figure 9). Figure 10 shows a young towhee six days after

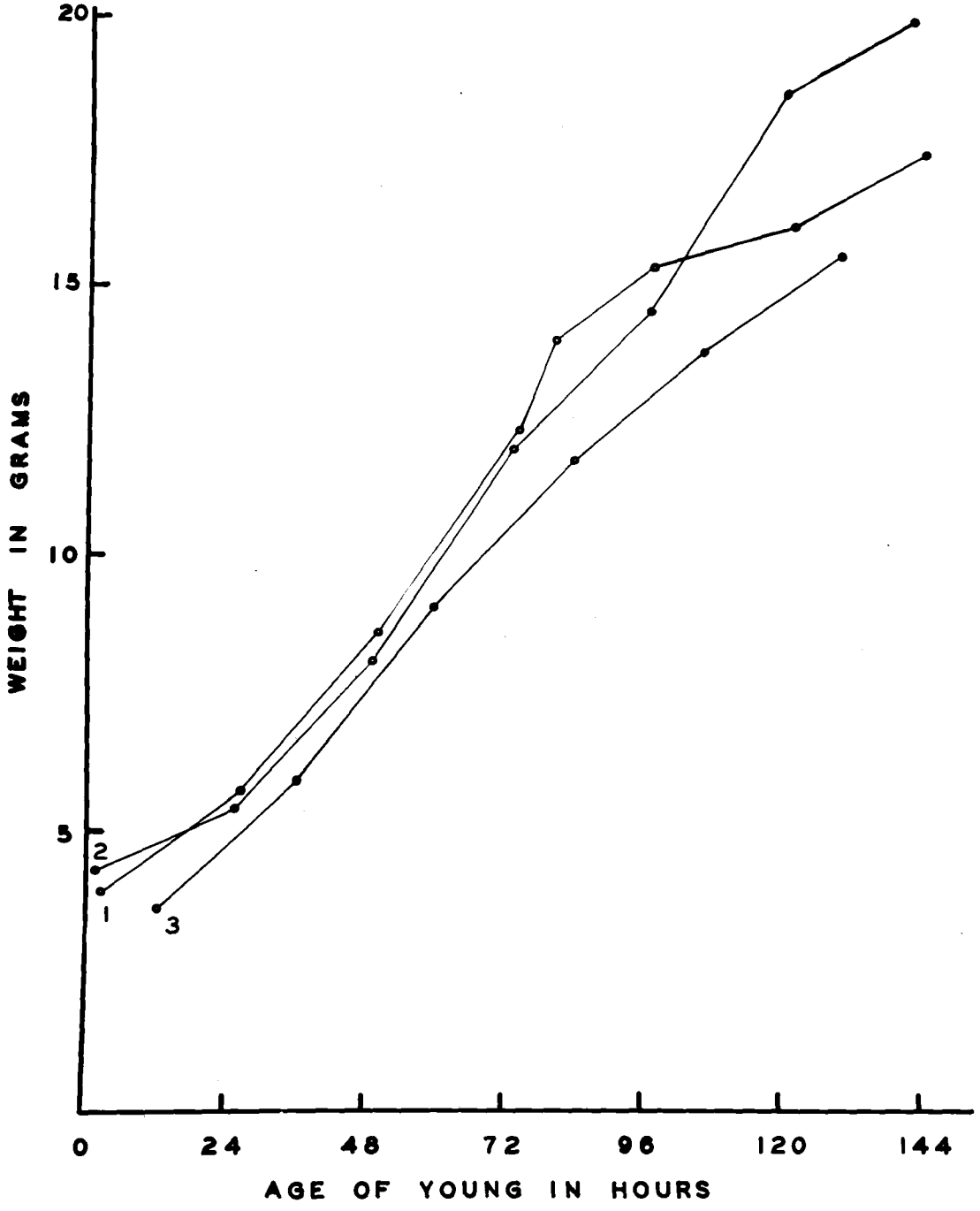

FIGURE 8. DAILY GROWTH RATE OF THREE YOUNG TOWHEES

Fig. 9.--A Three-day-old Nestling Towhee

Fig. 10.--A Six-day-old Nestling Towhee

hatching at about six times the weight at hatching.

No sounds were heard from the young until the third day when a very low, thin tseep note was heard when the young were being handled during weighings and photographing. This sound was emitted when the head was raised and mouth opened to receive food. The only other sound observed was a squawk from one of the nestlings at age six days, when it was picked up to be weighed. The tseep note was heard from all the young nestlings with much more vigor and intensity the sixth day.

On June 9, two young towhees, apparently old enough to provide for themselves, were observed in a scrub oak patch on a hillside only a few yards above the empty nest. A male and female were also observed in the oak way up above these two juveniles, and they seemed to be unattended. The first juvenile was making its way up the hillside toward the two adults giving the tseep note. The second juvenile, below the first, in an oak clump was heard to make several very poor attempts at giving the pshew call, at least that was the writer's impression. This was the earliest observation made of juvenile towhees out of the nest and able to fly.

Parental Care

No data were obtained concerning the removal of the egg shells following hatching. Only the female was observed to brood the nestlings, and the brooding was continued until the time of the young nestling's disappearance. The nest was visited several times during the first five days after the eggs had hatched, and each time, no matter what time of day it was, the female was on the nest brooding. After the fifth day, brooding was observed less frequently, the female being off the nest twice in succession when the nest was visited.

The singing of the male decreases as the young grow older. Only the male was observed to feed the young. The female when off the nest spent much time preening herself, perching in a nearby shrub, and scratching in the leaves but was never observed to bring food to the young. Until the time of disappearance, departure and return to and from the nest by both the male and female was deliberate and secretive.

A direct type of feeding was the method in which the food carried in the bill of the male was placed in the open mouths of the young. No fecal sacs were observed being carried from the nest or eaten. On June 5, from 4:32 P. M. to 5:29 P. M., the male was observed to feed the nestlings three times during this fifty-seven-minute period. On May 6, from 8:37 A. M. to 11:17 A. M., the male fed the young six times during a two-hour and forty-minute period. He remained at the nest an average of forty-seven seconds each time he fed. During this same period the female was observed to brood twice, for a twenty-four minute period and a fourteen-minute period.

Each time the male approached the nest he gave the pshew call, softly and muffled because of a full beak. The female when brooding the young and upon hearing the male give this low pshew call, left the nest before he arrived with the food. The actions of the male after feeding were always the same. He invariably hopped up into the scrub oak thicket directly back of the nest and began to sing, usually several times, and then he flew to other oak clumps nearby to continue his song. Sometimes the singing was extended and prolonged, while at other times he would only sing six or eight times before flying to the ground to begin scratching for more insects. The food carried in his beak always had the same limp, worm-like appearance, but the exact species being utilized could not be determined.

GENERAL HABITS

The Scratching Habit

Certainly one of the most characteristic things about the towhee is its scratching habit. So vigorous is this scratching that one often expects to see a much larger animal or bird emerge from the thicket.

Woodbury (1933) in a paper has so graphically and accurately described this scratching antic that it is quoted here in its entirety.

> The Spurred Towhee (Pipilo erythropthalmus montanus) is a perching bird that has entered the field of scratching to earn a living. In Zion Canyon in Utah it is an inhabitant of the dense thickets of oak, sarvis-berry, squawbush and streamside deciduous trees. It is primarily a ground-dwelling bird, nesting among the thickets and hunting its food chiefly among the trash and leaves, but does not hesitate to ascend the trees and brush at other times.
>
> Certain other birds, such as the Long-crested and Woodhouse jays that frequent such thickets in Zion Canyon, usually garner their supply of insect food from the tree tops or from the visible supply on the surface of the ground, but the towhee has a speciality all of its own that they do not reach. If the visible food supply on the surface is not sufficient for its needs, the towhee takes to turning over the leaves and scratching among the trash with its feet. This is a complex operation that it is fitted admirably to perform. The Woodhouse Jay will, on occasion, dig with its bill into the trash to follow an insect that has disappeared or to hide an acorn, but it does not use the feet in scratching and does not make a business of dipping into the trash.
>
> Scratching birds like chickens stand on one leg and scratch with the other, but not so with the towhee. Being a small bird, it would have a difficult time turning over a leaf with one foot while standing on it with the other. Such difficulties are solved by using both feet. In order to use both feet, the body must be balanced in the air during the scratching operation.
>
> This is accomplished by jumping into the air and drawing the feet backward while the upward momentum lasts. Drawing the feet backward and raking trash or leaves at the same time tends to overbalance the body forward. The bird uses several methods to hold its balance, either singly or in combination. Nearly always, the scratching motion of the feet is accompanied by an upward and forward jerk of the tail. Sometimes the wings flutter forward, and always after the scratching stroke the feet are brought forward quickly to catch the

body and keep it from falling. Sometimes a backward movement of the body is made in jumping and the feet rake the trash while the momentum lasts. This is accompanied by a downward movement of the tail. All of these movements are carried on automatically and seemingly with the greatest of ease.

Sometimes, when the jump is made, the feet are thrust forward and trash in front of the bird is caught and pulled backward. Other times material underneath is moved, while occasionally material just behind the feet will be kicked out of the way by vigorous backward strokes.

Sometimes the trash is kept flying by quick successive strokes, but if insects, spiders, or other interesting food items are exposed to the eye of the bird, it suddenly stops and picks up such items one by one. And thus it taps a food supply not available to its competitors in Zion Canyon. On one occasion, I saw a Woodhouse Jay make a dart at a towhee. The smaller bird merely flitted away a few feet and stopped. The jay did not pursue any farther. At another time, a gray rock squirrel came nosing around very close to the towhee, evidently paying no attention to the bird. The bird, however, flitted quietly out of the way a few feet and went on scratching.

Food Habits

No investigation into the food habits of the Spurred Towhee was undertaken in this study since rather extensive work was done with this species in the Provo area by Frost (1947). Thirty-seven stomachs were examined by Frost, and birds were collected during all four seasons of the year.

The work by Frost shows animal food to be the most important, for it occurs 58.7 per cent of the time, whereas plant food occurs 41.2 per cent of the time. In thirty of the stomachs both animal and plant food was found, and in six stomachs only animal food was found. In one stomach only plant food was found. The most common insect orders were Coleoptera and Orthoptera, especially the former which occurred 19.5 per cent of the time as compared to 6.1 per cent for the latter. The most important plant food was the fruit of hackberry (Celtis sp.) which occurred 11.3 per cent of the time. Oak was next in importance with 7.2 per cent.

Plant food is of major importance during the fall, winter, and early spring, and animal food is the more important the remainder of the year.

Bailey (1928) presented data on the food of the Spurred Towhee in New Mexico.

> Food - About one-third animal to two-thirds vegetable matter. The animal includes alfalfa weevils, harmful beetles, ants, wasps, and bees, the black olive scale, grasshoppers, caterpillars, spiders, millipeds, and sow bugs. In the vegetable, fruit amounts to 17.7 per cent (largely wild or waste); grain 4.7 per cent (mostly from stubble fields); mast 15.6 per cent; weed seed 34.6 per cent, including tar weed, rag weed, alfilaria, and rough pigweed, with a preference for thistle and burr seeds.

POPULATIONS

Population, as here used, is the number of individuals inhabiting a given area. The study plots were laid out and counts made as described in the chapter on Methods. Table 3 shows the results of this study.

One perplexing problem, as yet unanswered, is the conspicuous absence of the towhee in two suitable habitats in Utah County. The first is in the North Fork Canyon of the lower Provo River leading northwest to Aspen Grove, and the second is Soldier's Summit. Both of these areas have what appear to be good habitats, but no towhees have been observed in either.

TABLE 3

POPULATION DATA

Location	Area	Elevation	Exposure	Cover	Slope	Number Breeding Towhees
South face of Mount Timpanogos, 1 mi. NE Orem City water tank	10 acres	5,200	south	55%	30°	16
Pole Canyon Road Utah County, Utah	5 acres	5,200	north	75%	15°	10
Pole Canyon Road Utah County, Utah	2½ acres	5,900	north	95%	20°	6
Pole Canyon Road Utah County, Utah	2½ acres	6,250	north	90%	15°	2
½ mi. E Edgemont Grade School, Utah County, Utah	5 acres	4,650	south-west	60%	15°	10

DISCUSSION

As previously stated, almost nothing is known about the details of the life history of the Spurred Towhee or, for that matter, any of the subspecies of erythropthalmus. There appear to be some minor differences of opinion between some of the statements in the literature and the findings of the writer, but there is relatively little in print with which to compare the findings of this work. The author feels that this contribution adds greatly to our meager knowledge of this bird in revealing its seasonal activities and bringing together all that was previously known about it.

Distribution

The wide-spread distribution of this bird throughout its range can be accounted for by the abundance of suitable habitat throughout the Rocky Mountain region. In the opinion of the writer, the apparent absence of this towhee in the low mountains of the western deserts of Utah may be due to the hot, dry conditions which prevail throughout the summer months. The largest populations in Utah probably occur along the western front of the Wasatch Mountains where shrubby vegetation reaches a climax and is very extensive. Perhaps the reason for the absence of this bird in certain moist, cool, highly suitable habitats, as stated in the chapter on Populations, may be accounted for by the daily cold air movements down through the areas mentioned.

Seasonal Distribution and Activities

Although no nest building was observed, the two nests found on

May 5 and 6, indicate the nest building and egg laying period to be some time in April, probably the last half. Large winter flocks were seen together the latter part of March, indicating that the establishment of territories and pairing of the adults occurs the first part of April.

Flocking together of the towhees in the winter is not due to any gregarious instinct, but is the result of vertical movement downward of birds inhabiting areas at higher elevations. It is easily observed that during winter months the snow lies for short intervals upon the south and west exposures of the lower foothills which is clearly an advantage to the ground-dwelling towhee which must have exposed leaves and litter in which to scratch and seek food.

According to Swarth (1905) the towhee, in the southern parts of its range, does not move downward in winter but remains at high elevations. This very well could be explained on the basis of light snowfall which does not remain for long periods of time on slopes exposed to the winter sun. However, Twomey (1942) and Killpack (1956) have observed mass migrations downward and southward in the Uinta Basin when the birds are seen to leave the southern slopes of the Uinta Mountains and winter along the rivers and streams of the lower valleys. This, however, is a local situation and does not involve any great distances. Twomey (1942) also states that "a considerable migration along the Provo River was observed between September 6 and 9. In following this route the birds passed through the Wasatch Mountains and emerged into the Great Salt Lake Basin." The writer feels that until banding methods are employed and more data are available, we cannot know for sure just how migratory this bird is. From this study it would appear that migration is only vertical no matter which direction it may take the birds, for the writer feels sure that towhees migrate northward

from the northern slopes of the Uinta Mountains down into the lower valleys of Daggett and Summit Counties.

Singing Habits and Territorialism

One of the significant contributions of this thesis is the data obtained and presented with illustrations on the songs of the Spurred Towhee, for the frequency range, exact length of the songs and the intensities were shown for the two important songs or sounds of the towhee. The pshew call is believed by the writer to have several different meanings: scolding cry, expression of possession, danger signal, and perhaps a part of the mating song. The spring or mating song of the male is greatly varied.

Few data were recorded concerning territorialism, but observations would seem to indicate that the immediate vicinity of the nest is jealously guarded by the male. However, field observations show that where territories overlap there is no rigid maintenance of territorial rights on the outer margins other than active singing. Probably the principle factor affecting the size of territories is the amount and kind of cover. Population studies show that there is an increase in breeding pairs per area as the cover increases, up to a certain point, and that exposure affects territory size only indirectly by directly affecting cover. Therefore, from the facts at hand, it appears that a breeding territory is maintained by the male for mating, nesting, and feeding of approximately one, two or three acres, depending on the cover.

Nesting Data

The writer feels sure that nest four also contained eggs, and that it too was robbed as in the other two previous cases, for the nest had just recently been constructed but was abandoned as later visits revealed. The

weight of nestlings of most passerine birds at hatching averages approximately two-thirds of the weight of the fresh egg (Heinroth, cf. Nice, 1943) which would place the fresh egg weight of the Spurred Towhee at about 4.5 grams. The incubation period is probably twelve to thirteen days, which is the period given by Burns (1915) for an eastern subspecies.

The earliest that juvenile towhees were observed out of the nest was June 9, which serves to substantiate the writer's conclusion as to the time of the first nesting period.

The singing of the male decreases after the young hatch, probably because he is kept busy feeding the young, but singing does not cease. This does not agree with the statement by Rockwell and Wetmore (1914) that "the first young were taken July 18 and on this day the males began to sing again, preparatory to raising a second brood."

Food Habits

The work of Frost (1947) gives a good picture of the food types utilized by the towhee in this area. Bailey (1928) does not explain how analyses were made, upon how many stomach analyses the results were based, nor the season of the year the birds were collected. All of these factors are important to consider before making any conclusions.

Populations

It appears that exposure has little effect on population size where the percentage of cover is the same. At lower elevations, the higher the percentage of cover the greater the population. Larger populations seem to be found in areas where large clumps of shrubbery are numerous. As the elevation increases, the cover increases as well as the height of the vegetation. It is the opinion of the writer that this density of cover at

higher elevations is the limiting factor accounting for the small towhee populations. Thus, elevation has a secondary effect on populations. The ideal habitat preferred by this towhee seems to be dense clumps of shrubby vegetation broken by open spaces.

SUMMARY

1. This study was carried on in the foothills of the Wasatch Mountains in Utah County, Utah, during 1955 and 1956.

2. The Spurred Towhee, a subspecies of the Red-eyed Towhees of North America, is the common form found in the central Rocky Mountain region. The habitat preferred by this bird is the shrubby mountain slopes, canyons and streamsides between 5,000 and 8,000 feet.

3. Distribution of the Spurred Towhee is from northern Wyoming, south through Utah, Colorado, eastern Nevada, Arizona, western half of New Mexico and into north central Mexico.

4. Winter snows drive the birds down into the valleys concentrating them in the lower reaches of the foothills. In the late autumn, winter and early spring most towhees are found in flocks as large as twenty birds. About the first of April the flocks break up and the birds pair and establish territories.

5. There are three distinct songs or sounds made by this towhee; two are common to both sexes and one is heard only from the males. Some degree of territorialism is maintained, but many of the details are not known.

6. Nests in this area are built on the ground under sagebrush with the outer shell of sagebrush bark and the inner lining of dry grass. The earliest nest containing eggs was found May 5.

7. Because of the ground-nesting habit, the mortality rate for this species is unusually high.

8. Four eggs are the usual number in a clutch. The fresh egg weight is about 4.5 grams. Incubation of the eggs is done entirely by the female. The male sings vigorously during this time.

9. Growth of the young is rapid, and only the male was observed to feed them after which he would sing. The young probably leave the nest the twelfth to the fifteenth day. The earliest juvenile birds were observed out of the nest was June 9.

10. The principal source of food is insects except in the winter. Insects are found by scratching in the leaves and litter which is a very characteristic habit of the towhee.

11. Largest populations were found in areas where the vegetation was clumped with intermittent open spaces. Elevation was only indirectly important in its effects on population size, while density of cover seemed very important. Slope and exposure did not seem to have a direct effect on populations.

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ABSTRACT

This paper deals with the life history and distribution of the Spurred Towhee (Pipilo erythropthalmus montanus Swarth). Research was begun in April, 1955, and terminated in June, 1956.

The preferred habitat of this bird is the mountain slopes, canyons, and streamsides covered with a shrubby type of vegetation, usually between 5,000 and 8,000 feet in elevation.

Distribution of the Spurred Towhee is throughout the central Rocky Mountain region in the states of Wyoming, Utah, Colorado, Arizona, western half of New Mexico, and into northern Mexico.

During the winter these birds are found concentrated in the lower valleys along the streams in some areas and in the lower reaches of the foothills in others. In April the flocks disband and the birds pair and establish territories.

There are three distinct songs or sounds made by the towhee, and two of these have been analyzed in detail by first tape recording them and then analyzing them on a sona-graph. Few data were assembled concerning territorialism, but it is thought to exist.

The five nests found during this study were all robbed of either their eggs or young. They were constructed upon the ground, with an inner lining of dry grass and an outer shell of sagebrush bark or cedar bark. The four nests found in Utah County were all under sagebrush. The usual clutch size is four. The female does all the incubating and the male sings vigorously during this time.

The growth rate of the young is rapid. Only the male feeds the young, at least during the first six days of nest life, while the female does all the brooding. June 9 was the earliest juvenile towhees were observed out of the nest.

The principal source of food, according to another worker, is insects, except during winter months.

The ideal habitat where populations were found to be highest was in areas where the vegetation was clumped with intermittent open spaces. Size, density, and kind of cover seemed to be the most important factors affecting populations, while slope and exposure had only an indirect effect.