

stub at 07:05 and 07:00, respectively. On the latter date he made a long flight across the open swamp, dropping the feces in mid-air about 16 m from his roosting place.

I waited by the hole on 2 March to watch him emerge again. When he failed to do so, I rapped on the stub and, to my surprise, a female Downy Woodpecker flew out. Thus, in three of five roosting stubs, there was an interchange between the White-breasted Nuthatch and Downy Woodpecker. These trees, however, were the only ones which, from the size of hole and the degree of preservation of the dead stub, one might have considered suitable for the woodpeckers. On the first two occasions the nuthatch appeared to have taken the hole of the Downy Woodpecker, and on the last the reverse was the case. As the Downy Woodpecker excavates roost holes and White-breasted Nuthatches do not, the woodpeckers may have possessive feelings towards some of the holes. Woodpeckers in general, however, like holes that fit the width of their bodies. A peculiarity of White-breasted Nuthatches in roost as well as in nest holes (Kilham, Auk 85:477, 1968), is that they prefer entrances double or even triple the size of their bodies. Possibly this is due to their ability to move, mouse-like, over surfaces in any direction. Given this maneuverability, they may be able to squeeze out of a roost hole (to imagine a case) past the inreaching paw of some predator, such as a raccoon (*Procyon lotor*), and thus escape. A woodpecker with a stronger bill would defend a hole if it were just the size of his head and body. This type of defense, however, would be nullified if the hole had been taken over by a nuthatch and enlarged.

Of my hand-raised nuthatches, Pair A attempted to nest in the same nest box in two successive years. Male A used this as his roost hole in intermediate seasons, invariably appearing with feces in his bill when the aviary lights were turned on at 05:30. Sometimes, after depositing the first bit of feces, he reentered to find a second one and brought that out

also. Roost hole sanitation thus appears to be a fixed habit comparable to nest sanitation. Among other hole-roosting species, woodpeckers frequently defecate shortly after emerging and hence do not foul their roost holes. Why White-breasted Nuthatches should do so is not obvious. One can readily surmise the survival value of nest sanitation, for the fecal pollution would soon become overwhelming. The value of cleaning roost holes is less apparent. Two reasons, however, are conceivable. Keeping roost holes clean may reduce odors such as might attract a predator in the night, and nuthatches may use cavities in trees first as roost holes and later as nest holes (as was the case in the aviary). So far I have not encountered any description of this habit of roost hole sanitation for *S. carolinensis* or any other species of nuthatch. I have kept numbers of hand-raised Red-breasted Nuthatches (*S. canadensis*) in the aviary without observing this habit, and Löhr (pers. comm.) states it is not done by the European Nuthatch (*S. europaea*). Löhr (Z. Tierpsychol. 15:191, 1958), however, does state that the latter species roosts under bark occasionally as well as in nest boxes, and prefers a wide entrance to its roost hole.

A third feature of roosting nuthatches in the aviary was the reversal of dominance which took place over some weeks in mid-winter. The male roosted in both of two years in what became the subsequent nest box, but the female started to take it over from him in February. This dominance of the female was associated only with the near vicinity of either the roost or nest hole. Although my observations on this female dominance in regard to a roost hole was limited to hand-raised White-breasted Nuthatches, Tyler (Wilson Bull. 28:18, 1916), who had opportunity to watch a male coming to a roost hole all winter, has described the dispossession of this male by a female on 16 of April 1914. It would thus appear that my aviary experience is also observable under natural conditions.

Accepted for publication 13 July 1970.

THE 1966-67 SNOWY OWL INCURSION IN SOUTHEASTERN WASHINGTON AND THE PACIFIC NORTHWEST

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During the winter of 1966-67 the Pacific Northwest experienced an influx of Snowy Owls (*Nyctea scandiaca*) of unusual magnitude. In the past the presence of this conspicuous and unwary bird during the upland game and waterfowl hunting seasons has resulted in many specimens being killed or wounded by irresponsible persons (Gross 1947). I made an attempt to prevent such needless destruction and to stimulate public interest in wildlife conservation by popular articles and appeals in news media. Reports of Snowy Owls were solicited and authenticated by personal observation whenever possible. A total of 86 reports representing 104 sightings were received during the period November 1966-April 1967. These reports concerned owls wintering in southeastern

Washington near the confluence of the Columbia, Snake, and Yakima Rivers (fig. 1). My evaluation of the reports indicates that these observations represent 20-27 individual birds.

The first Snowy Owl was reported in early November, and the majority evidently arrived during the last week of November and the first week of December. About half of the birds established hunting territories and remained until early spring, ranging over 3-5 km², either singly or in small groups. Concentrations of five to seven birds were twice noted sharing common areas in the gently rolling dryland wheat fields, old fields, and irrigated farmland of this region. From late December until April, 13 to 16 owls were present; the remainder evidently continued southward, as subsequent sightings in California (Harris and Yocom 1968) and several Oregon newspaper accounts indicate. At least three of the local owls were shot by unknown persons. The last reported sighting of an owl was on 1 April 1967; departure (presumably northward) dates of three individuals seen daily at widely separated points for periods of two to three months were 22, 25, and 29 March.

Previous incursions into Washington State, as summarized by Jewett et al. (1953), occurred during the winters of 1889-90, 1896-97, 1908-09, 1916-17 (an outstanding year), and 1917-18. Three of these dates coincided with "principal heavy invasions" into southern Canada and the United States reported by Bent

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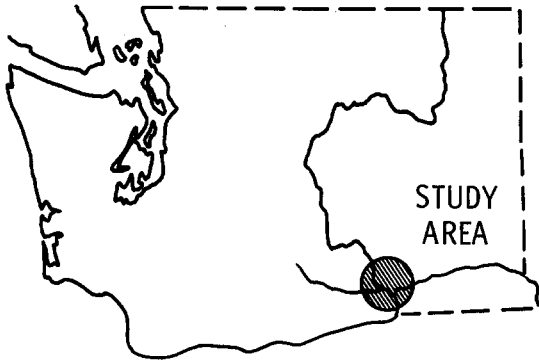


FIGURE 1. Map of Washington State showing location of study area.

(1938) to have "occurred at intervals of four or five years, or multiples thereof, which probably coincide with the periodic fluctuations in the abundance of lemmings and Arctic hares." Subsequently, Hudson and Yocom (1954) reported an incursion of this "rare and irregular winter visitor" into eastern Washington during the winter of 1950-51, one year after a peak reported in northern states (Davis 1960). There are no published references to other northwestern incursions. This is surprising in view of the impressive 1945-46 event reported by Gross (1947) to have contained some 13,500 owls (of which 4400 were reported as killed) that occupied the northern United States from the Pacific to Atlantic coasts, and the abundance of Snowy Owls in northern Alaska during 1953, a year in which the brown lemming (*Lemmus trimucronatus*) reached a peak in their cyclic fluctuation (Pitelka et al. 1955).

In an effort to detect other incursions, an analysis was made of Audubon Christmas Bird Counts for Snowy Owl reports in Washington State for the period 1946-47 through 1967-68 (National Audubon Society 1947-1968). The eight owls reported during that 22-year period were insufficient to indicate a pattern for the incursions, and the analysis was then arbitrarily expanded to include the total counts in the region comprised of Alberta, British Columbia, Idaho, Montana, Oregon, and Washington. Results were expressed in "Snowy Owls per census" (fig. 2) because the number of reporting stations in this region increased from 8 in 1947 to 41 in 1968. These showed five or seven years (depending on interpretation) in which "peaks" of Snowy Owls were reported in a cyclic pattern of three to four year intervals. Five of those peak years exceeded an index of 0.3 Snowy Owls per census, and coincided with reported incursions in northern United States and southern Canada (Davis 1960; Nicholls 1968) and with the Alaskan data reported by Pitelka et al. (op. cit.). The 1960-61 peak was obscure because of the shallow penetration of owls that year; of the six states and provinces only Alberta reported Snowy Owls in that year. The greater magnitude of the 1966-67 incursion (39 owls reported) compared with those of previous incursions is readily apparent, although only seven Snowy Owls were reported from Oregon, two from Washington, and none in Idaho or Montana.

Alberta and British Columbia contributed 55 and 29 per cent, respectively, of all reports during their participation in the Christmas Bird Counts, and the Alberta data showed five incursions during the period 1953-1967. Reports of Snowy Owls at Washington

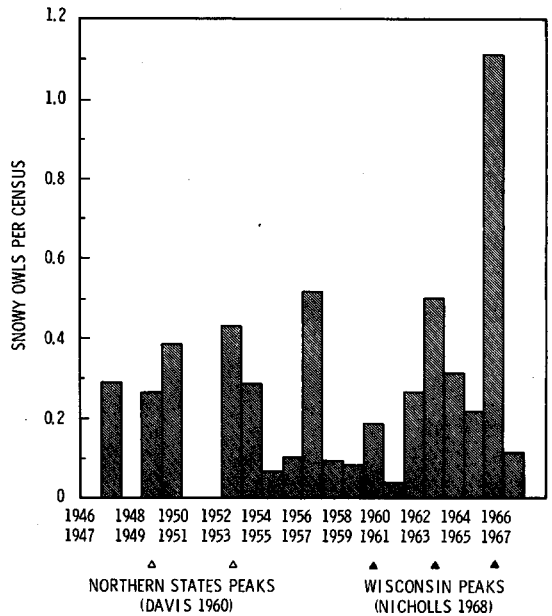


FIGURE 2. Snowy Owls reported by Christmas Bird Counts in Pacific Northwest region, 1946-47 through 1967-68.

stations were very scattered, although Larrison and Sonnenberg (1968) reported that influxes into the state occurred every four or five years and that "hundreds" were seen in the Seattle region during fall and winter months of 1966-67. Although no quantitative information was given by these authors, the habits and habitat preferences of the Snowy Owl suggest the "hundreds" probably represented repetitive reports within a heavily populated area. This is also indicated by the fact that only two birds were seen during the Seattle Christmas Bird Count of that year, and these were the only ones reported by the four Washington stations participating in the 1966 count. Conversely, the number of owls reported herein is probably a conservative estimate of the population in the 4700-km² region from which my reports were obtained. A similar relationship between numbers of reported Snowy Owls near human population centers in Wisconsin was discussed by Sindelar (1966).

Three Snowy Owls were seen in the local area again during the period December 1967-February 1968; however, public interest was not so great and the total reporting effort was considerably less. Reports of previous incursions suggest that a particularly large flight of Snowy Owls was often followed by a smaller incursion the following winter. A total of five birds was reported in the six states and provinces of the Pacific Northwest during the 1967-68 count, compared with 39 during the previous count.

In a review of 24 dates during the period 1833-1945 in which major Snowy Owl incursions varied in density, geographical region, and amount of territory covered, Gross (1947) concluded that a few birds were present each winter at the southern limits of their range and that major incursions occurred every three to five years. These were ascribed to a greater owl production and survival increase on the northern breeding grounds coincident with a cyclic increase in lemmings and the subsequent wandering of the owls following the abrupt disappearance of that prime food source. Similar observations of the

particular relationships of arctic predator-prey populations have been reported for jaegers (especially *Stercorarius pomarinus*) and Short-eared Owls (*Asio flammeus*) in Alaska (Pitelka et al. 1955) and for several avian predators in Scandinavia (Hagen 1965, 1969).

This paper is partially based on work performed under United States Atomic Energy Commission Contract At(45-1)-1830.

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Accepted for publication 20 May 1970.

THE COMMON CROW, *CORVUS BRACHYRHYNCHOS*, IN THE GREAT BASIN

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Johnston (1961) in his work, "The biosystematics of American crows," presented a map showing the breeding distribution of three species of North American crows. Concerning the Common Crow (*Corvus brachyrhynchus*) it is noted that the region of North America known as the Great Basin has been left blank. Johnston purposely did this since he was unable to locate and examine a single specimen from the area. He stated that "Common Crows breed sparingly in the Great Basin region, so until sufficient numbers of specimens are available from southern Idaho, Utah and Nevada, their subspecific allocation must remain undetermined."

Common Crows inhabiting the Great Basin were reported as early as 1867 by Ridgway (1877) who collected one male from the Truckee Meadows, Nevada. Henshaw (1874) reported two crows in the vicinity of Provo, Utah, in 1872; and Hoffman (1881) reported their occurrence in Big Smoky Valley and near Bull Run Mountain, both in central Nevada. Some residents of the Great Basin contend that crows were not abundant until early in the 1930's, an observation supported by the literature. Gabrielson (1949) reported 500 Common Crows on 20 August 1933 eating buffalo berries in Paradise Valley, Nevada, and several hundred on 19 August 1938 at the head of the Humboldt River in Nevada.

Several areas within the Great Basin presently support thousands of wintering Common Crows, but reports consist primarily of brief notes scattered through various faunistic studies (Hanna 1904; Linsdale 1936, 1951; van Rossem 1936; Alcorn 1946; Richards and White 1963).

The purpose of this study was to determine the subspecies of the Common Crow nesting in the Great Basin and collect information on its distribution during the summer and winter.

PROCEDURES

Specimens were collected wherever possible throughout the Great Basin. Only adult breeding birds taken from the immediate vicinity of their nests were used to determine the subspecific identity. A sample of crows wintering in Utah Valley (central Utah) was also taken and compared with the breeding birds. As with breeding birds, only adults were selected for measurement. Separation of immature birds from adults was based on information provided by Emlen (1936), and males and females were analyzed separately. Lengths of wing chord, tail, tarsus, and bill were used to determine the subspecies. Procedures for measuring these characteristics were patterned closely after those used by Johnston (1961).

RESULTS

Subspecific identity. The data obtained from 29 adult breeding birds collected in the Great Basin (table 1) were compared with the pooled means calculated from the data on the Common Crow presented by Johnston (1961). The wing chord and tarsal lengths of Great Basin specimens are well within the range expected for eastern crows, *C. b. brachyrhynchus* (table 2). Although the tail lengths of Great Basin specimens are somewhat longer, they still fall within the upper extremes for the eastern crow. Bill lengths constitute an exception to the resemblance to the eastern race. Breeding specimens from the Great Basin in this case more closely resemble the western crow, *C. b. hesperis* (table 2). An examination of a sample of 14 adult crows wintering in the Great Basin shows that in all categories they resemble the eastern race (tables 1, 2). Despite the discrepancy in bill length in the breeding specimens, the bulk of the data indicates that Common Crows inhabiting the Great Basin represent the larger eastern race, *C. b. brachyrhynchus* rather than the smaller western race, *C. b. hesperis*.

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