Notes on Great Horned Owls Nesting in the Rocky Mountains, with a Description of a New Subspecies

Authors: Dickerman, Robert W., and Johnson, Andrew B.

Source: Journal of Raptor Research, 42(1) : 20-28

Published By: Raptor Research Foundation

URL: https://doi.org/10.3356/JRR-06-75.1
NOTES ON GREAT HORNED OWLS NESTING IN THE ROCKY MOUNTAINS, WITH A DESCRIPTION OF A NEW SUBSPECIES

ROBERT W. DICKERMAN¹ AND ANDREW B. JOHNSON
Museum of Southwestern Biology, University of New Mexico, Albuquerque, NM 87131 U.S.A.

ABSTRACT.—The Great Horned Owls (Bubo virginianus) of the Rocky Mountains were last comprehensively reviewed by Oberholser in 1904, who resurrected the name B. v. occidentalis. With minor modifications, this has been followed to date. With the suppression of occidentalis, which proved to be a synonym of subarcticus (Stone 1897 Am. Nat. 31:236; Dickerman 1991 Auk 108:964–965), the southern Rocky Mountain population, south of the Snake River in Idaho, was left without a name. Canonical discriminant analysis of 14 color and pattern characters provided 100% separation of the southern Rocky Mountain population nesting in higher elevation pinyon/oak/pine associations from those nesting at low elevations in Arizona and New Mexico (B. v. pallescens) and from the northern Rocky Mountain population north of the Snake River (B. v. lagophonus). Pair-wise comparisons showed that the mean vectors from each of the three populations were significantly different from each other (P < 0.001). We propose that the Great Horned Owls of the southern Rocky Mountains south of the Snake River of Idaho may now be known as Bubo virginianus pinorum, a new subspecies.

KEY WORDS: Great Horned Owl; Bubo virginianus; morphometrics; population; Rocky Mountains; subspecies; taxonomy.

NOTAS SOBRE BUBO VIRGINIANUS EN LAS MONTAÑAS Rocallosas Y DESCRIPCIÓN DE UNA NUEVA SUBESPECIE

RESUMEN.—Las poblaciones de Bubo virginianus de las Montañas Rocallosas fueron revisadas de manera exhaustiva por última vez por Oberholser en 1904, quien resucitó el nombre B. v. occidentalis. Con algunas modificaciones menores, esta nomenclatura se ha mantenido hasta hoy. Con la eliminación de occidentalis, nombre que resultó ser un sinónimo de subarcticus (Stone 1897, Am. Nat. 31:236; Dickerman 1991, Auk 108:964–965), las poblaciones de las Montañas Rocallosas del sur, al sur del río Snake en Idaho, quedaron sin nombre. Un análisis discriminante canónico basado en 14 caracteres de color y patrón produjo una separación del 100% entre las poblaciones de las Montañas Rocallosas del sur que nidifican a elevaciones mayores en bosques de asociación de piñón/roble/pino, y las poblaciones que nidifican a altitudes menores en Arizona y Nuevo México (B. v. pallescens) y en las Montañas Rocallosas del norte, al norte del río Snake (B. v. lagophonus). Comparaciones pareadas mostraron que los vectores promedio de cada una de las tres poblaciones fueron significativamente diferentes entre sí (P < 0.001). Proponemos que las poblaciones de Bubo virginianus de las Montañas Rocallosas del sur, al sur del río Snake en Idaho, sean conocidas ahora como Bubo virginianus pinorum, una nueva subspecie.

¹ Email address: bobdickm@unm.edu

The Great Horned Owl (Bubo virginianus) is common, widespread, adaptable, and geographically variable throughout North America south of the arctic tundra. Phenotypic variation in Great Horned Owls has often been at least partially attributed to polymorphism or color morphs. Oberholser (1904) wrote, “With the exception of occidentalis and wapatacuthu [both are synonyms of subarcticus; Stone 1897, Browning and Banks 1990] all [populations] seem to be strictly non-migratory, and thus any record may safely be considered as based on the resident bird.” Thus he invoked “dichromatism” with light, dark, and ochraceous morphs to explain the variation within populations. That taxonomic revision of the subspecies of Great Horned Owls by Oberholser (1904) has, with minor modifications, been followed to date (AOU 1910, 1931, 1957, Ridgway 1914, Cory 1918, Peters 1940, Behle 1985, Mc Gillivray 1989). In his revision of B. virginianus, Weick (1999), following Oberholser (1904), used the tri-
nominal B. v. occidentalis which had been suppressed over a hundred years earlier (Stone 1897, Dicker-
man 1991, 2002), and mapped its range to include parts of the ranges of B. v. pallescens, B. v. subarcticus,
and the new subspecies described herein. He used the name B. v. waypouatothu (suppressed by Browning
and Banks 1990; also cf, Dickerman 1993) and left the range of the Rocky Mountain subspecies north of
the Snake River, lagophonus, undesignated.

In Arizona, Phillips et al. (1964) recognized that birds from wooded areas tended to have darker feet,
but felt that individual variation was so great that “… no violence to the facts” would be done to call all
Arizona birds by the same subspecific name. Rea (1983) reviewed the situation in Arizona, recogniz-
ing color phases within B. v. pallescens and did not mention migration, except for a dark bird considered to be B. v. saturatus by K. Parkes, but re-identified as B. v. lagophonus (R. Dickerman unpubl. data; refer-
ence number MSB 14754).

In Colorado, Bailey and Niedrach (1965) used the names occidentalis and lagophonus for light and
dark phenotypes (respectively). Burleigh (1972) recognized a light form in southern Idaho for which he used the name occidentalis and a darker form in northern Idaho for which he used lagophonus. Behle
(1985) used occidentalis for the dark birds of north-
ern Utah. These usages have thoroughly confused the subspecies taxonomy of the Great Horned Owls of the Rocky Mountains south of the Snake River.

During 1988 and 1989, the American Museum of Natural History received two shipments of winter-
salvaged Scottsdale region Great Horned Owls from the Liberty Wildlife Rehabilitation Foundation of
Scottsdale, Arizona. Included were pale gray and medium gray birds, and a single very dark bird. Sim-
ilarly, in 1989, RWD studied the Museum of Southwestern Biology (MSB) series of 20 specimens from throughout New Mexico. Nearly half of the birds were pale, nearly half were medium gray, and two were very dark. When the localities of the pale and medium gray specimens were plotted on a map of New Mexico, a pattern was evident. All the pale
birds, from various seasons, were from desert/grass-
land areas of southern and eastern parts of the state. The medium gray birds, from spring, summer and fall, were from forested regions (pinyon/oak or higher elevational plant associations) or were sal-
vaged during winter months in the lowlands (and thus may have made elevational migrations). The
two dark New Mexico winter specimens, like the dark salvaged bird from Scottsdale and the dark
specimen reported by Rea (1983), matched well the specimens of B. v. lagophonus from eastern Wash-
ington, Idaho north of the Snake River, and inte-
rior mountains north to Alaska; thus, they were long-distance migrants (Dickerman and Harden in press). This exercise was later repeated with similar results with the larger series of specimens from Colorado in the Denver Museum of Natural History; from Utah in the Utah Museum of Natu-
ral History, Salt Lake City; and from the very large New Mexico series in the MSB, which has now
grown to 224 specimens. This mapping exercise demonstrated that there was a distinct medium-
gray colored population of the Rocky Mountains from southern Idaho to the higher elevations of Arizona and New Mexico that had no subspecific designation. Having handled hundreds of Great Horned Owl specimens, we believe that there are no color morphs or polymorphism in western
North American Great Horned Owls (contra Ober-
holser 1904, Rea 1983, Weick 1999), and that col-
or variation can be explained by the mix of the various subspecies, some of which undertake ele-
vation and/or latitudinal migration.

In this report, we review geographic variation in
Great Horned Owls in the Rocky Mountains (herein
defined to include the interior ranges from Alaska
south to the sky islands of Arizona and New Mex-
ico), and we describe the medium-gray subspecies
of the dry Rocky Mountain pine forests south of the
Snake River Valley in southern Idaho.

Materials and Methods

Materials. The color standards described were used to compare specimens in the following collec-
tions: Academy of Natural Science, Philadelphia,
PA; American Museum of Natural History, New
York, NY; Bird and Mammal Museum, University of
Idaho, Moscow, ID; Charles R. Connor Museum, Wash-
ington State University, Pullman, WA; Denver
Museum of Natural History, Denver, CO; Idaho Nat-
ural History Museum, Idaho State University, Po-
catello, ID; Museum of Zoology, University of Michi-
gen, Ann Arbor, MI; Museum of Texas Tech
University, Lubbock, TX; National Museum of Nat-
ural History, Washington, DC; Texas Cooperative
Wildlife Collection, Texas A & M University, College
Station, TX; University of Alaska Museum, Fair-
hanks, AK; University of Arizona, Tucson, AZ.

Measurements were obtained on additional spec-
cimens from the following: Canadian Museum of Na-
ture, Ottawa, Canada; Field Museum of Natural His-
tory, Chicago, IL; Slater Museum of Natural History, University of Puget Sound, Tacoma, WA; Natural History Museum of Los Angeles County, Los Angeles, CA; Stoval Museum, University of Oklahoma, Norman, OK; University of Nebraska State Museum, Lincoln, NE; and Vertebrate Collections, Cornell University, Ithaca, NY.

Methods. To quantify color values, and to a lesser degree the extent of pattern differences among populations, we selected a series of five specimens from the American Museum of Natural History that spanned the gradient of color variation from the palest to the darkest populations throughout the range of the species in North America (Fig. 1). From this reference series, 14 color or pattern characters were selected a priori and assigned a value of 1–5. The Rocky Mountain populations in this study did not span this entire range, with 1 being the palest and 3 or 4 the darkest value, depending on the character. (A score of 5 was not used as only B. v. saturatus reached that darkness and that subspecies does not pertain to this study because it is outside our defined geographic area.) Each specimen examined was scored for the 14 color and pattern characters by comparison with the reference series. Wing chord and tail length were measured to the nearest millimeter. All scores and measurements were by RWD. Rocky Mountain populations from Alaska to central Idaho, and dark long-distance migrants (Dickerman and Harden in press) were considered to be lagophonus Oberholser (1904, type locality: Walla Walla, Washington). Birds from southern Idaho southward to the higher elevations of Arizona and New Mexico were considered to be the undescribed form (named below). Populations from the deserts and grasslands of Arizona and New Mexico were considered to be pallescens Stone 1897, type locality: Watson Ranch, 29 km southwest of San Antonio, TX U.S.A. Nesting-season birds from those areas, and wintering birds that matched them morphologically were analyzed as the above three populations.

Statistical Analysis. Canonical discriminant analysis (SAS 9.1.1; PROC CANDISC) was used to generalize the two canonical discriminants, which were plotted against each other to visualize this 14-character dataset in two dimensions (Fig. 2).

No assumption of normality or equal variances was made for this data set, and nonparametric statistical methods were used. To test for differences among populations, a nonparametric MANOVA was conducted using the program PERMANOVA (Anderson 2005) based on methods outlined by Anderson (2001). The analysis was performed using a Euclidian distance matrix, and 9999 iterations were permuted to calculate the P-values presented. Pair-wise comparisons between groups were also made in PERMANOVA, again using 9999 iterations to generate the P-values for the pair-wise tests. The limitations of PERMANOVA necessitated that sample sizes for each population be equal, and that there were no missing values in the data matrix. Therefore the number of pallescens and the southern Rocky Mountain population used in the analysis were reduced to the same number as lagophonus (N = 49) by generating a series of random numbers and eliminating corresponding records so that each population sample contained 49 individuals. There was no observed sexual dimorphism in color or pattern within subspecies, so data were combined (Appendix).

Results and Discussion

A plot of the first two canonical discriminants based on the 14 color and pattern characters showed good separation of lowland pallescens from montane populations of lagophonus from the new subspecies described below, but there was overlap between the two montane populations. Nine of the 14 color/pattern characters (Table 2), of which six were statistically significant, were diagnostically useful in distinguishing the three subspecies. Characters with the highest correlations for discriminant 1 were back-color, barring on flanks, and interscapular black spots; and for discriminant 2 were back-color, barring on toes, and color in outer vane of outer rectrix (Table 3).

There was a significant difference among mean vectors of the three populations (F = 42.3, df = 2,144, P < 0.001), and pair-wise comparisons showed that the mean vector for each subspecies was significantly different from the other two (t = 3.6–9.1; df = 96, P < 0.001). There were no differences in wing chord and tail measurements among the three subspecies from Arizona and New Mexico in the south through the northern Rockies (Table 4).

Because of the separability of these populations using both visual and statistical techniques, we propose that the Great Horned Owls of the Rocky Mountains south of the Snake River of Idaho may now be known as:
Figure 1. Specimens used as color standards, all from the American Museum of Natural History (from left to right): (A) B. v. subarcticus 753972, Winnipeg, Manitoba, 1900; (B) B. v. pallescens 8260141, 6.0 km SW of Lordsburg, Hidalgo Co., New Mexico, 15 January 1989; (C) B. v. pinorum 826016, Glorieta, Santa Fe Co., New Mexico, 8 March 1988; (D) B. v. lagophonus 826010, Santa Fe (airport), Santa Fe Co., New Mexico, 13 October 1988; and (E) B. v. saturatus 754056, Washington, 7 April 1894.
**Bubo virginianus pinorum**, new subspecies

**Holotype.** MSB 23728. Female. New Mexico, Bernalillo Co., Sandia Mountains, Cedar Crest (35° 6.4'N, 106° 22.6'W; elevation 2042 m). Collected by J. David Ligon on 15 December 2002. Field number RWD 26222. Ovary 9 × 16 mm, very fat, mass 1246 g.

**Diagnosis.** Similar to *B. v. pallescens*, but with heavier barring ventrally and darker gray dorsally with larger areas of sooty black in the feathers of the crown and back; paler than *B. v. lagophonus*, with lighter barring on the venter and with weaker or no barring on the tarsi and toes, which are often pure white.

**Etymology.** The name is from the Latin, meaning “of the pines.”

**Distribution.** Nests in dry coniferous forests from the plains of the Snake River of Idaho, south in the Rockies at increasing elevations, to Arizona and New Mexico. Occurs regularly at lower elevations in winter (Dickerman and Harden in press).

It is interesting that *pinorum* is morphologically more distinct from *pallescens* than it is from *lagophonus*, although the ranges of *pinorum* and *pallescens* may be only a few miles apart by air. Conversely, *pinorum* and *lagophonus* are less distinct, yet their ranges are separated, at least by the lowland plains of broad Snake River Valley in southern Idaho. Ponderosa pine (*Pinus ponderosa*) is the dominant species in the nesting range of *pinorum*, at least in Arizona, New Mexico, Utah, and Colorado. North of the Snake River is the more mesic spruce-fir-hemlock forest of the northern Rockies and the range of *lagophonus*.

During the course of this study, two specimens of *pinorum* salvaged during the nesting season were received from wildlife rehabilitators from the low-

---

**Table 1.** Fourteen color/pattern characters and the specimen upon which they were based, A–E (see Figure 1).

<table>
<thead>
<tr>
<th>CHARACTER</th>
<th>COLOR VALUE 1</th>
<th>COLOR VALUE 2</th>
<th>COLOR VALUE 3</th>
<th>COLOR VALUE 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color, back</td>
<td>Palest A</td>
<td>Pale gray B</td>
<td>Medium-gray C/D</td>
<td>Blackest E</td>
</tr>
<tr>
<td>Barring, flanks</td>
<td>Light A</td>
<td>Medium B</td>
<td>Heavy C</td>
<td>Massive D/E</td>
</tr>
<tr>
<td>Interscapular black spots</td>
<td>None – reticulate A</td>
<td>Small B</td>
<td>Medium C/D</td>
<td>Large – often confluent E</td>
</tr>
<tr>
<td>Barring, tarsus</td>
<td>None A</td>
<td>Light – spotty B</td>
<td>Medium – broken D</td>
<td>Heavy E</td>
</tr>
<tr>
<td>Barring, toes</td>
<td>None A/B</td>
<td>Light – spotty C/D</td>
<td>Medium – broken D</td>
<td>Heavy E</td>
</tr>
<tr>
<td>Barring, under-tail covers</td>
<td>None</td>
<td>Light A/B</td>
<td>Medium C</td>
<td>Heavy D/E</td>
</tr>
<tr>
<td>Color, crown</td>
<td>Palest A</td>
<td>Medium B/C</td>
<td>Darker C/D</td>
<td>Blackest E</td>
</tr>
<tr>
<td>Color, ears</td>
<td>Blackish to gray; ochraceous margins B</td>
<td>Largely black; white to ochraceous margins C</td>
<td>Massively black E</td>
<td>Massively black E</td>
</tr>
<tr>
<td>Color, basal breast</td>
<td>Pale buff to pale</td>
<td>Medium buff to ochraceous A</td>
<td>Deep buff to rich</td>
<td>Deep buff to rich</td>
</tr>
<tr>
<td>Color, tarsi and toes</td>
<td>White A/B</td>
<td>Buff B/C</td>
<td>Ochraceous D/E</td>
<td>Ochraceous E</td>
</tr>
<tr>
<td>Color, under-tail coverts</td>
<td>White A/B</td>
<td>Medium to buff B/C</td>
<td>Pale ochraceous D/E</td>
<td>Ochraceous E</td>
</tr>
<tr>
<td>Pattern, central rectrices</td>
<td>Medium - broken A/B</td>
<td>Strong bars C/D</td>
<td>Snake-pattern E</td>
<td>Snake-pattern E</td>
</tr>
<tr>
<td>Pale bars, second rectrix</td>
<td>White</td>
<td>Medium buff +/− gray C</td>
<td>Ochraceous +/− gray C/D</td>
<td>Pale to deep gray E</td>
</tr>
<tr>
<td>Outer vane, outer rectrix</td>
<td>Predominantly white A/B</td>
<td>White +/- buff and/or gray B/C</td>
<td>White and/or buff; ochraceous and gray D</td>
<td>Medium-gray E</td>
</tr>
</tbody>
</table>
lands of New Mexico: a female found 11 March 1994 at Corrales (35°14.3′N, 106°36.3′W; elevation 1530 m), Sandoval Co. (MSB 18804) and a male found at Luis Lopez (33°59.5′N, 106°53.5′W; elevation 1414 m), Socorro Co., on 18 May 2002 (MSB 23756). Both of these localities in central New Mexico are near the Rio Grande nesting habitat of *pallescens*. The Corrales specimen was a first-year bird and may simply have been a late migrant. The Luis Lopez specimen was an apparently normal male with testes measuring 5.7 mm. An Arizona specimen of *lagophonus* taken 2 August 1974 (Rea 1983) had a pre-existing pellet hole on the skull between the eyes, an injury that may have prevented migration.

Because of the uniformity of the populations here-in considered to be *B. v. pinorum*, short-distance, and may simply have been a late migrant. The Luis Lopez specimen was an apparently normal male with testes measuring 5 × 7 mm. An Arizona specimen of *lagophonus* taken 2 August 1974 (Rea 1983) had a pre-existing pellet hole on the skull between the eyes, an injury that may have prevented migration.

Because of the uniformity of the populations here-in considered to be *B. v. pinorum*, short-distance,
elevational migration cannot be distinguished from long-distance, latitudinal migration. Elevational migration was demonstrated by a bird banded as a nesting 29 April 1988 in Sandia Canyon (elevation 2286 m) in the Jemez Mountains, Sandoval Co., New Mexico and found dead 19 December 1988 ca. 25 km distant near a bridge over the Rio Grande on the south side of Espanola (elevation 1704 m), Rio Arriba Co., New Mexico. We suggest that Great Horned Owls nesting in habitats that are affected by heavy snow conditions in the winter may perform elevational and/or latitudinal migration, at least to some degree.

**Conclusions.** The Great Horned Owls of the Rocky Mountains (as geographically defined in this paper) may now be considered to consist of three populations from north to south (Fig. 3): (1) *Bubo virginianus lagophonus* of the northern Rockies inhabits the more mesic spruce/fir/hemlock forests north of the Snake River in Idaho; (2) *B. v. pinorum*

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>MALES</th>
<th>FEMALES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wing Chord (mm)</td>
<td><strong>MEAN ± SD</strong></td>
<td><strong>RANGE</strong></td>
</tr>
<tr>
<td><em>B. v. lagophonus</em></td>
<td>345.3 ± 8.69</td>
<td>330–358</td>
</tr>
<tr>
<td><em>B. v. pinorum</em></td>
<td>345.5 ± 10.83</td>
<td>324–377</td>
</tr>
<tr>
<td><em>B. v. pallescens</em></td>
<td>346.6 ± 9.04</td>
<td>327–367</td>
</tr>
<tr>
<td>Tail Length (mm)</td>
<td><strong>MEAN ± SD</strong></td>
<td><strong>RANGE</strong></td>
</tr>
<tr>
<td><em>B. v. pinorum</em></td>
<td>204.7 ± 8.66</td>
<td>178–226</td>
</tr>
<tr>
<td><em>B. v. pallescens</em></td>
<td>204.6 ± 7.6</td>
<td>190–223</td>
</tr>
</tbody>
</table>

Figure 3. Dorsal and ventral views of three subspecies of Great Horned Owls from the northern to southern Rocky Mountains (left to right): (A) *B. v. pallescens* MSB 7684, female, New Mexico (Lincoln Co., ca. 32 km south of Corona), 29 September 1991. (B) *B. v. pinorum* Type, MSB 23728, female, New Mexico (Bernalillo Co., Cedar Crest), 15 December 2002; (C) *B. v. lagophonus* MSB 7011, female, Oregon (Union Co., near Grange), 3 December 1989;
nesting in the dry coniferous forests at middle and high elevations in Arizona and New Mexico, in these habitats extending north of the southern Rocky Mountains to at least the Snake River of Idaho; (3) B. v. pallescens nests in the deserts and desert grasslands, and the lowland riparian areas of Arizona and New Mexico, extending north in suitable habitats into at least Utah and Colorado (as well as western Kansas and Oklahoma; Dickerman 1993). These three populations differ serially in color and are generally separated by habitat in the nesting season. In the winter, some individuals of pinorum and lagophonus withdraw from their nesting habitat, with pinorum undergoing elevational migration (with latitudinal migration probable but not yet demonstrated), and with lagophonus undergoing both elevational and latitudinal migration and occurring sporadically in the lowlands of Arizona, New Mexico, and Colorado (MSB specimens).

ACKNOWLEDGMENTS

We acknowledge the wildlife rehabilitators of Arizona and New Mexico, without whom this research could not have been conducted. Figure 1 was provided by the photography department of the American Museum of Natural History. Technical editing and formatting were provided by Janelle Harden. We gratefully acknowledge Maureen Leonard, Anne C. Russell, and Ernest Valdez for assistance with the statistical analysis done for this project. Lastly, this manuscript was greatly clarified by the reviews of Dwight Smith and C. Stuart Houston.

LITERATURE CITED


Received 14 November 2006; accepted 24 October 2007
Appendix. Six statistically significant color/pattern differences scored categorically from 1–5, for three subspecies of Great Horned Owls; mean and standard deviation (SD), range, median, and number (N).

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>BUBO VIRGINIANUS LAGOPHONUS</th>
<th>BUBO VIRGINIANUS PINORUM</th>
<th>BUBO VIRGINIANUS PALLESCENS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MEAN</td>
<td>SD</td>
<td>RANGE</td>
</tr>
<tr>
<td>Barring, flanks</td>
<td>2.72</td>
<td>0.42</td>
<td>2.00–3.00</td>
</tr>
<tr>
<td>Intrascapular black spots</td>
<td>3.01</td>
<td>0.25</td>
<td>2.00–4.00</td>
</tr>
<tr>
<td>Barring, tarsus</td>
<td>2.77</td>
<td>0.72</td>
<td>2.00–4.00</td>
</tr>
<tr>
<td>Barring, toes</td>
<td>2.06</td>
<td>0.73</td>
<td>1.00–4.00</td>
</tr>
<tr>
<td>Barring, under-tail coverts</td>
<td>3.02</td>
<td>0.59</td>
<td>2.00–4.00</td>
</tr>
<tr>
<td>Color, crown</td>
<td>2.63</td>
<td>0.70</td>
<td>2.00–4.00</td>
</tr>
</tbody>
</table>