



FIGURE 2. Young Prairie Falcons in abandoned raven nest on a transmission tower.

spection of the nest indicated that it was unoccupied. On tower no. 294, a Prairie Falcon was observed incubating on a stick nest. This site was in the same tower position as the 1985 nest, but was approximately 4.8 km southwest of tower no. 322. On 17 June 1986, observers climbed the tower and found two young birds (30–35 days old) in the nest. Both adults were present.

The typical falcon nest is on a cliff with some degree of overhead protection and shading (Cade 1982, Palmer 1988). The falcons found in abandoned raven nests were surrounded by the metal lattice of the tower (Fig. 2). The latticework provided shading, allowed air

movement for cooling, and was a suitable substrate for nest construction for ravens and other birds.

Both nest sites were in flat to rolling terrain of desert-shrub habitat. No suitable natural nesting sites (cliffs) were within a 5- to 10-km radius of the nesting towers. Thus, abandoned raven nests in towers have provided suitable nesting sites for Prairie Falcons where a natural site was lacking.

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DISTRIBUTION OF THE BOREAL OWL IN EASTERN WASHINGTON AND OREGON¹

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Key words: *Aegolius funereus*; *Boreal Owl*; *distribution*; *western North America*.

In its description of the southern distributional limit for the Boreal Owl (*Aegolius funereus*) in North America, the AOU (1983) noted continuous populations across southern Canada and isolated ones from northwestern Wyoming and north-central Colorado. Until the 1970s the species was singularly known in Washington State from a now misplaced specimen collected

in Whatcom County during January 1905 (Dawson 1908). Since that time the owl's presence has been verified by a specimen taken during January 1974 in Whitman County, paradoxically the heart of Washington's wheat land (Johnson and Hudson 1976). To date records from Oregon have included a number of references describing its presence during the 1800s as "not rare" in the Oregon Territory and a single specimen taken in Klamath County during March 1902 (Gabrielson and Jewett 1940). More recently Boreal Owl surveys in states along the Rocky Mountain corridor from northern New Mexico to northern Idaho and Montana have revealed a not so discontinuous pattern of breeding populations (Palmer and Ryder

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1984, Hayward et al. 1987, and Rawinski and Stahlecker in Hubbard 1987). Thus in an effort to assess the status of the species in areas along the western edge of the Rockies south of the U.S.-Canadian border, surveys were undertaken in the Kettle River and Selkirk ranges of northeastern Washington and the Blue and Wallowa mountains of southeastern Washington and northeastern Oregon.

METHODS AND RESULTS

From March to October 1985, 21 hiking surveys were conducted in five subalpine sites located on the Kettle Crest, Ferry County and the Salmo Divide, Pend Oreille County, Washington. These mixed coniferous sites were respectively dominated by multiple-aged lodgepole pine (*Pinus contorta*) or subalpine fir-Engelmann spruce (*Abies lasiocarpa*-*Picea engelmannii*) forest and were situated at elevations between 1,525 and 1,950 m. Approximately 6 km of trail or gravel road traversed each area. Two additional censuses were taken in a sixth, lower site (945 m) of similar habitat type along the Little Pend Oreille River, Stevens County, during December 1985 and January 1986. Boreal Owls were located in all seasons by response to a taped recording of the male's *staccato* call (M. B. Dickinson, Ed., *Guide to Bird Sounds*, National Geographic Society, Washington, DC, 1983) played on a small tape recorder (7.5 cm speaker diameter) at middle to high volume at approximately 200-m intervals. Interval stops averaged 5+ min. Surveys were generally conducted between waxing one-half to waning three-fourths moon phases. Responses, as described by Bondrup-Nielsen (1984), included the *staccato* call (the courtship song given exclusively by the male typically from mid-March through mid-May), the *skiew* and *moo-a* calls (aggressive, threatening, distress or alarm calls apparently given most frequently by the male), the *chuuk* and *peeping* calls (contact calls issued apparently by the female on or near the nest in response to *staccato* vocalizations from the male), and the *chatter* call (the distress call of the juvenile).

In general, visual observations of Boreal Owls were more readily accomplished when at least two observers were in the field. The quality of observations varied from those of moonlit owls aggressively flying directly at the face of the tape recorder holder or on occasion gliding immediately overhead (distances closing ultimately to less than 2 m), to those that circled the recorder (distances of 15 to 25 m), to two separate individuals viewed on unobstructed perches under full spotlight illumination for as long as 15 min (minimum distances of 2 and 4 m). Owls aggressively approaching the recorder frequently perched nearby (10 to 20 m) on open branches, however they typically would only allow brief spotlight illumination (5 to 10 sec). Those circling the recorder were usually most resistant in affording visual identification other than by size (length and wingspan about 25 and 60 cm, respectively and approximate to that of the slightly smaller Western Screech-Owl, *Otus kennicottii*), short-tailed profile, and flight style (rapid, direct, and untwisting usually swooping upward to alight). Field marks most easily discerned on perched Boreal Owls at a distance and/or under low lighting conditions were those of the face

and breast. These included bright lemon-yellow irises, whitish lores and superciliaries, whitish facial discs with prominent black borders arcing over and down through the tops and insides of the eyes and forming a "stirrup" about the base of the bill, charcoal smudge marks on the lower, outer quadrants of the discs, whitish breast vertically streaked by broad, sometimes broken, chocolate-brown bands, and a proportionately large, earless head topped by a flat or slightly concave crown. Other marks noted on nearby and/or well-illuminated birds were the straw/olive colored bill and the dense white spotting of the forehead, black disc border, and crown (finest markings reserved to the former two areas).

Of 33 contacts established over the year, a minimum of 23 individual Boreal Owls were located (Table 1) of which 14 were seen including seven perched. The first encountered was a *staccato*-calling male found on the Kettle Crest in April; such activity is indicative of potential individual breeding and the presence of breeding populations (Bondrup-Nielsen 1984, Palmer and Ryder 1984, and Hayward et al. 1987). This however was the only courting male found during 1985. Additional vocalizations given by this owl included a singular *chuuk* call and an excited, upbeat version of the *staccato* call. The third and fourth located were an apparent pair found on the Salmo Divide. One or both were contacted in the same immediate area on a monthly basis from June through September and were accompanied by at least one additional but unseen owl during the last 2 months. Whether particular to this pair or not, they would only answer the recorder within an approximate 75-m radius of what appeared to be their area center, presumably a nest site. During the August visit, both were observed intermittently over a 5-hr period. Two principal vocalizations were repeatedly elicited in response to the taped *staccato* call; these were heard individually and at times simultaneously and were recorded. The recordings were digitally analyzed by computer as sonograms (DEC PDP 11/23 computer programmed with "Interactive Laboratory Systems," May 1985 by Signal Technology, Inc., 5951 Encina Road, Goleta, CA) and were favorably matched with those for the *moo-a* and *chuuk* calls as identified by Bondrup-Nielsen (1984). In addition these vocalizations were found to be equivalent to those noted respectively as the "alarm" and "aggressive" calls in European recordings of Tengmalm's Owl (*Aegolius funereus*) from S. Palmer and J. Boswall's, *A Field Guide to the Bird Songs of Britain and Europe* (Swedish Radio). Later that same evening, an approximate 3-min-long multiple of *staccato* responses was eventually elicited from the owl giving the *chuuk* call. During the September visit, the first of the three owls contacted responded with a subdued *chuuk* followed by about 10 min of intermittent *moo-a* calls. Responses of the other two were singularly restricted to either the *chuuk* or *chatter* call. Attempts to find nests at this and the Kettle site were unsuccessful. During the ensuing springs of 1986 and 1987, these areas again hosted single calling males (Sundstrom and Scuderi in Rogers 1986a, Brokaw et al. in Rogers 1986b, Hunn 1987).

In four of the subalpine sites, the number of individual Boreal Owls found per kilometer censused approximated that found by Palmer and Ryder (1984) in

TABLE 1. Boreal Owl locations in eastern Washington and Oregon.

County, state ¹	Survey distance ² (km)	Latitude (N)	Longitude (W)	Predominant forest species ³	Date	Number	Vocalizations ⁴
Ferry, WA	11	48°43'	118°27'	SF	19 Oct 85	1 heard	<i>chuuk</i>
		48°36'	118°28'	LP	27 Apr 85	1 heard and seen	<i>staccato</i> , irritated <i>staccato</i> and <i>chuuk</i>
		48°36'	118°29'	LP	29 Apr 85	1 heard	<i>staccato</i>
		48°36'	118°29'	LP	29 Apr 85	1 heard and seen	<i>chuuk</i>
Stevens, WA	8	48°33'	117°35'	SF	15 Dec 85	2 heard	<i>chuuk</i> and <i>chatter</i>
		48°57'	117°05'	SF	25 Jun 85	1 heard and seen	<i>moo-a</i>
Pend Oreille, WA	18	48°57'	117°05'	SF	3 Jul 85	1 heard	<i>chuuk</i>
					26 Aug 85	2 heard, seen, and recorded	<i>moo-a</i> , <i>peeping</i> , <i>chuuk</i> , <i>skiew</i> and <i>staccato</i>
Columbia, WA	54	48°48'	117°08'	SF	19 Sep 85	1 or 2 heard	<i>chatter</i>
					28 Sep 85	3 heard	<i>skiew</i> , <i>moo-a</i> , <i>chuuk</i> and <i>chatter</i>
					19 Sep 85	1 heard and seen; 4 heard	<i>chuuk</i>
					28 Sep 85	5 heard and seen; 1 heard	<i>moo-a</i> , <i>skiew</i> and <i>chuuk</i>
					31 Aug 85	3 heard and seen; 2 heard	<i>chuuk</i> and <i>chatter</i>
					31 Aug 85	1 heard	<i>chuuk</i>
					2 Sep 85	1 heard and seen; 1 heard	<i>chuuk</i> , <i>moo-a</i> and <i>skiew</i>
					14 Jun 87	1 heard and seen	<i>skiew</i>
					8 Jun 87	1 heard	<i>skiew</i>
					9 Oct 87	1 heard	<i>skiew</i>
Wallowa, OR	30	46°04'	117°52'	GF, ES	2 Oct 87	1 heard	<i>skiew</i> and <i>chuuk</i>
					9 Oct 87	3 heard	<i>skiew</i> and <i>chatter</i>
					2 Oct 87	3 heard	<i>skiew</i>
					9 Oct 87	1 heard	<i>skiew</i>
					1 Oct 87	3 heard	<i>skiew</i>
					9 Oct 87	1 heard	<i>skiew</i>
					1 Oct 87	1 heard	<i>skiew</i>
					1 Oct 87	1 heard	<i>skiew</i>
					3 Oct 87	1 heard	<i>skiew</i>
					3 Oct 87	1 heard	<i>skiew</i>
Umatilla, OR	6	45°50'	117°59'	SF, GF	10 Oct 87	1 heard and seen	<i>skiew</i> and <i>chatter</i>
					31 Oct 87	1 heard	<i>skiew</i>
Unton, OR	19	45°19'	117°42'	SF	31 Oct 87	1 heard	<i>chuuk</i>
					31 Oct 87	1 heard	<i>skiew</i>
Baker, OR	14	44°57'	118°14'	WP	7 Nov 87	1 heard	<i>skiew</i>

¹ WA = Washington; OR = Oregon.² Kilometers represent single-pass, one-way distances. Surveys in Ferry and Pend Oreille counties and portions of Baker County were on foot; all others were by auto. No Boreal Owls were found in Garfield County, WA (37 km) or in Grant County, OR (3 km).³ SF = subalpine fir; LP = lodgepole pine; ES = Engelmann spruce; GF = grand fir; WP = whitebark pine.⁴ Vocalizations as identified in Bondrup-Nielsen (1984).

the Cameron Pass area of Colorado and by Hayward and Garton (1983) in the Chamberlain Basin area of Idaho (one per 3–4 km). However on the fifth site, one early fall survey revealed a minimum of 12 owls (two per km). This site was in part characterized by subalpine forest-meadow parkland, an open and mixed environment where breeding Boreal Owls have previously been found in high densities (Holmberg 1982, Palmer in Kingery 1984). Surprisingly the only other owl species found within the subalpine zone during 1985 was the Barred Owl (*Strix varia*, Table 2). Conspicuously absent was the Northern Pygmy-Owl (*Glaucidium gnoma*), normally an uncommon resident, which was encountered only below 1,110 m. At lower elevations the location of two Boreal Owls along the Little Pend Oreille River in December 1985 indicated that the species may utilize familiar habitat in its winter wanderings.

During June and October–November 1987, 16 auto surveys were conducted along U.S. Forest Service roads in the subalpine zone of the Blue and Wallowa mountains. In all 163 km were censused in seven contiguous counties from Garfield County, Washington in the northeast to Grant County, Oregon in the southwest. Minimum subalpine zone elevations varied from 1,575 to 1,900 m along the same latitudinal gradient and surveys extended upwards to a maximum of 2,390 m. Over much of the Blue Mountains, the subalpine zone is generally drier, more open and meadowed than in northeastern Washington. Forest composition, although dominated by subalpine fir and lodgepole pine, is appreciably intermixed with grand fir (*Abies grandis*), western larch (*Larix occidentalis*), and Engelmann spruce. As in the Selkirks, whitebark pine (*Pinus albicaulis*) could be found near the timberline. Boreal Owls were located as before, however the tape was played at approximately 0.4-km intervals. Of 21 contacts established, a minimum of 19 different individuals was located (Table 1) of which two were seen flying overhead. No *staccato*-calling male Boreal Owls were encountered. In addition, five other owl species were found (Table 2); with the exception of the Barred Owl, these were the same as reported by Hayward and Garton (1983) for central Idaho some 225 km directly to the east.

DISCUSSION

The success of the current survey method principally depended on finding Boreal Owls from late spring through fall when subalpine habitat was more easily accessible rather than during the earlier courtship period. In all 31 of 42 individuals were initially contacted in September or October. In no instance was an owl identified as Boreal from its *chuuk*, *moo-a*, or *skiew* call that was moments later seen and found to be another species, for example the Northern Saw-whet Owl (*Aegolius acadicus*). In general response distance from the recorder was short and interest period brief. From a total of 33 contacts during the hiking survey, only twice could Boreals be intentionally coaxed to follow the recorder, and then only for approximately 100 m. Of the remaining 21 contacts from the auto survey, only once was a Boreal considered to be a repeat respondent and that was likely due to the local hairpin nature of the road. A similar autumn survey technique utilizing

TABLE 2. Owl species and numbers found in the subalpine fir zone.¹

Species	North-eastern Washington (1985)	South-eastern Washington/north-eastern Oregon (1987)
Boreal Owl	21 ²	19
Barred Owl	6	5
Northern Saw-whet Owl	—	3
Northern Pygmy-Owl	—	5
Great Horned Owl	—	11
Flammulated Owl	—	2

¹ Minimum zone elevations ranged from 1,525 to 1,900 m north to south.

² Two additional owls were found in similar habitat at 945 m during winter (Stevens County, Table 1).

0.8-km intervals has been employed in southern Colorado since 1984 (Rawinski in Kingery 1985, Palmer and Rawinski 1986). In that area Northern Saw-whet Owls have been found to respond to the Boreal *staccato* call but not vice versa. Typical responses from these saw-whet owls included a cat's meow or a repeated single flat note whistled irregularly up, then down scale; conversely Boreal Owls apparently responded only with the *skiew* call (J. Rawinski, pers. comm.). In eastern Washington saw-whet owls responded with their spring courtship call or an excited, upbeat version thereof in addition to the two calls previously noted. Over the course of this study, all saw-whet owls and 39 of 42 Boreal Owls found answered the *staccato* call; the remaining three Boreals responded either to the male saw-whet courtship (two) or juvenile Great Gray Owl (*Strix nebulosa*) begging call. For other species listed in Table 2, seven Great Horned (*Bubo virginianus*), nine Barred, and one Northern Pygmy owl answered the Boreal call while Flammulated Owls (*Otus flammeolus*) were unresponsive. In most cases Boreal Owls responded to the taped *staccato* call with one type of vocalization over a short period of time. In a limited number of cases, particularly where contact time was longer, two or more vocalizations were heard. On different occasions and at widely separated locations, two *staccato*-calling owls were heard to give the *chuuk* call (Table 1; 27 April and 26 August 1985); under the same circumstances, two additional individuals were heard to give the *chuuk* and *moo-a* calls (Table 1; 2 September and 19 September 1985). While these combinations are not consistent with the assignment of sex to call as outlined by Bondrup-Nielsen (1984), these results suggest that most of these vocalizations except the *staccato* call are likely given by both sexes.

The findings of this study have extended the known resident range of the Boreal Owl to include subalpine areas of eastern Washington and Oregon. The species has been located in eight counties and three national forests where it had previously been unrecorded. Breeding activity has been identified in northeastern Washington. The experience of this survey and others (Berger et al. in Rogers 1986a, Holt in Rogers 1987) has been that the Boreal Owl is generally the most findable owl species at higher elevations; it may well

prove to be the most common in appropriate habitat. Surveys from northern New Mexico to the U.S.-Canadian border (37–49° N latitude) have now revealed that populations of this species are apparently not limited to isolated Pleistocene relicts as suggested by Baldwin and Koplín (1966), but rather appear to form a more continuous distribution throughout the Rocky Mountain range.

Do recent discoveries of Boreal Owls in the North Cascades (Parsons and Kragh in Mattocks 1986) suggest a link to the earlier southern specimen records; and what of the June 1985 Sierran report of a calling Boreal Owl near Echo Summit, California (approximately 39° N latitude; Green in Campbell and Bailey 1985)? Are all these incidents of true vagrancy or the disregarded indicators of other extensive, as yet undetected populations? It would appear that these last major western mountain corridors south of the Canadian border merit a thorough investigation.

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A MODIFIED JAW MUSCLE IN THE MAUI PARROTBILL (*PSEUDONESTOR*: DREPANIDIDAE)¹

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Key words: *Drepanididae*; Hawaiian Islands; jaw muscle; Maui Parrotbill; *Pseudonestor*; skull.

The Maui Parrotbill (*Pseudonestor xanthophrys*) is one of several species of Hawaiian honeycreeper (Drep-

anididae) in which the tip of the upper jaw projects well beyond that of the lower jaw. The bird's resemblance to a parrot is heightened by a deep and strongly decurved upper jaw and a recurved tip on the lower (Fig. 1). Opposite curvature of the tomia in the two jaws is unusual in birds; among passerines it is most highly developed in *Loxia* (crossbills) and *Dysmoredrepanis munroi*, a Hawaiian honeycreeper known only from the type specimen (Perkins 1919; James et al., in

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