

DISTRIBUTION AND STATUS OF FLAMMULATED OWLS
(Otus flammeolus) ON THE SALMON NATIONAL FOREST

by

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December 1990

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ABSTRACT

From early May to late July 1990, we conducted twenty nocturnal call surveys on the Salmon National Forest. Sixty-seven territorial male Flammulated Owls were located in Douglas-fir, ponderosa pine, and mixed coniferous forest stands. These stands were multi-storied with some mature trees usually present. Additionally, the territories were often adjacent to more open areas such as old burns, grassy hillsides, natural clearings, or clearcuts. Density estimates ranged from 0-1.25 singing male Flammulated Owls/40 ha ($\bar{x} = 0.41$). Densities were significantly lower on the Salmon and Cobalt Ranger Districts than densities on the North Fork Ranger District, roughly corresponding to south and north of the Main Branch Salmon River, respectively. Territorial males were clumped in their distribution with apparently suitable habitat unoccupied. Male Flammulated Owls were present on the Salmon National Forest by the second week of May. One nest cavity was discovered in a Douglas fir snag; the young fledged between 19 and 22 July. Two groups of fledglings were located, one of which was verified as Flammulated Owls. Other owls encountered included: Great-horned Owls, Long-eared Owls, Barred Owls, and Northern Saw-whet Owls. Cavity-nesters such as American Kestrels, Pileated Woodpeckers, Northern Flickers, and Lewis' Woodpeckers were also observed.

INTRODUCTION

Flammulated Owls (Otus flammeolus) are small owls breeding locally from southern British Columbia south to southern California, Arizona, New Mexico, and the mountains of Mexico (Figure 1). This highly migratory owl then vacates much of its breeding range and winters from central Mexico to the highlands of Guatemala and El Salvador.

Even though Flammulated Owls are widely distributed in western North America, relatively little is known about their breeding biology, habitat needs, and especially their migratory patterns and timing. This species is almost entirely insectivorous, preying upon various orthopterans, noctuid moths, and coleopterans (Bent 1938, Goggans 1986, Hayward 1986, Reynolds and Linkhart 1987b). Very few cases exist of Flammulated Owls taking vertebrate prey (Bent 1938).

Flammulated Owls are secondary cavity nesters that depend upon naturally occurring or excavated holes for breeding. Snags and live trees containing cavities are an important component of their breeding habitat, as well as the habitat of other secondary cavity nesters.

Nesting by Flammulated Owls is associated with old-growth (>200 yr) ponderosa pine (Pinus ponderosa)/Douglas-fir (Pseudotsuga menziesii) stands in Colorado (Reynolds and Linkhart 1987b). These old-growth stands were preferred foraging areas whereas young (<100 yr) denser stands of mixed conifers were



Figure 1. Distribution of the Flammulated Owl (from Johnsgard 1988).

avoided. Other studies have reported that this species is associated with mature stands (30-50 cm dbh) of ponderosa pine (or other yellow pine species) intermixed with other conifers and hardwoods (Marshall 1939, Bull and Anderson 1978, Goggans 1986), and that cut-over forest stands are avoided (Franzreb and Ohmart 1978). However, Howie and Ritcey (1987) found Flammulated Owls using mature old-growth Douglas-fir forests in British Columbia. A mosaic of mature forest for nesting, young dense second-growth stands for roosting, and grassy openings or edges for foraging has been suggested as necessary for successful Flammulated Owl reproduction (Goggans 1986, Reynolds and Linkhart 1987b).

The Flammulated Owl is listed as a Species of Special Concern by the Idaho Department of Fish and Game due to the limited amount of information available on this species within Idaho (Taylor and Trost 1987, Groves and Melquist 1990). The U.S. Forest Service (USFS), Region 4, has recently classified this small forest owl as a Sensitive Species.

METHODS

We surveyed areas on the Salmon National Forest for Flammulated Owls from early May to late August, 1990. We chose routes with the assistance of Dick Wenger, USFS wildlife biologist on the Salmon National Forest, and by locating areas on habitat maps that appeared to contain mature ponderosa pine, Douglas-fir, or mixed ponderosa pine/Douglas-fir stands (Marshall 1939, Reynolds and Linkhart 1984, Goggans 1986).

We conducted surveys by one of the following methods; 1) walking through chosen areas while imitating the territorial song of a male Flammulated Owl at approximately 200 m intervals or 2) driving along logging roads, stopping each 400-600 m ($\bar{x} = 510$ m) to imitate the male song (Appendix A). At each stop we listened for one to three minutes then alternated periods of calling and listening for up to eight minutes. If a Flammulated Owl responded we often attempted to walk in on the bird or, alternately, lure it closer by duetting with the bird. When a singing tree was located, we characterized the surrounding area after Goggans (1986) (Appendix B). We performed the surveys from approximately 30-45 min after sundown until 0100-0400 hrs.

The area surveyed aurally (soundscape, after Howie and Ritcey 1987) in hectares for each route was calculated by:

$$\text{Area} = 100 [n\pi r^2 - (n-1) \cdot 2985]$$

where n equals the number of stops per route and r equals the distance at which a Flammulated Owl may be heard. Howie and Ritcey (1987) estimated that owls usually are heard within 0.5 km under most weather and habitat conditions. Reynolds and Linkhart (1984) found that males could be heard as far away as 1 km on calm nights. In our study area, we believe that approximately 500 m is the average maximum distance at which we could hear a singing Flammulated Owl. The latter portion of the formula represents a correction factor for overlapping aural circles

where the average distance between stops equals 0.51 km (Charles Eyler, pers. comm.).

During daylight hours on days following successful surveys, we walked through territories searching for snags or live trees containing suitable (> 4 cm diameter) cavities (Reynolds and Linkhart 1984). One person then pounded or scratched the snag (Goggans 1986, Rita Dixon, pers. comm.) while the other stood at a distance watching the cavity for the appearance of an owl. We checked cavities in non-decayed snags by climbing the tree with spurs and visually investigating the hole. Following Goggans (1986), we characterized the snag and vegetation surrounding the nest.

RESULTS & DISCUSSION

We performed 20 nocturnal surveys from 9 May to 23 July, 1990, with follow-up surveys of selected areas for fledglings and singing males during August (Appendix C). During our surveys we located a total of 67 Flammulated Owl territories on the Salmon National Forest (Table 1). All territories were located between approximately 1270 m (4200 ft) and 2210 m (7300 ft).

Of the 67 territories located, 26 occurred in stands characterized by timber inventory crews (Table 2). Twenty-three of these territories were located in Douglas-fir (PSME) habitat types, 11 of which had understories dominated by ninebark (Physocarpus malvaceus). One territory occurred in subalpine fir (Abies lasiocarpa)/beargrass (Xerophyllum tenax)/blue huckleberry

Table 1. Locations of singing or calling Flammulated Owls observed on the Salmon National Forest.

Owl #	Date m/d/yr	Survey Rte.	Location	Habitat type*
1	5/10/90	Colson Cr.	T23N, R17E, S7, NW ✓	PSME/PHMA/PIPO ✓
2	5/10/90	Colson Cr.	T23N, R17E, S7, SW ✓	----- ✓
3	5/10/90	Colson Cr.	T23N, R17E, S7, SW ✓	----- ✓
4	5/10/90	Colson Cr.	T23N, R17E, S7, NW ✓	PSME/PHMA/PIPO ✓
5	5/10/90	Colson Cr.	T23N, R17E, S7, NW ✓	PSME/PHMA/PIPO ✓
6	5/11/90	Colson Cr.	T23N, R16E, S13, SE ✓	PIPO/FEID ✓
7	5/11/90	Colson Cr.	T23N, R16E, S24, NE ✓	PIPO/FEID ✓
8	5/11/90	Colson Cr.	T23N, R16E, S13, NE ✓	----- ✓
9	5/11/90	Colson Cr.	T23N, R17E, S7, SW ✓	----- ✓
10	5/11/90	Colson Cr.	T23N, R17E, S18, NW ✓	----- ✓
11	5/11/90	Colson Cr.	T23N, R17E, S18, NW ✓	----- ✓
12	5/11/90	Colson Cr.	T23N, R17E, S18, NW ✓	----- ✓
13	5/12/90	Colson Cr.	T23N, R16E, S14, SE ✓	----- ✓
14	5/12/90	Colson Cr.	T23N, R16E, S24, NW ✓	----- ✓
15	5/12/90	Colson Cr.	T23N, R16E, S24, NW ✓	----- ✓
16	5/12/90	Colson Cr.	T23N, R16E, S24, NW ✓	----- ✓
17	5/12/90	Colson Cr.	T23N, R16E, S13, SE ✓	PSME/PHMA/CARU ✓
18	5/12/90	Colson Cr.	T23N, R16E, S24, NE ✓	----- ✓
19	5/13/90	Big Hot Spr.	T23N, R18E, S22, SW ✓	----- ✓
20	5/13/90	Big Hot Spr.	T23N, R18E, S22, SW ✓	----- ✓
21	6/7/90	Colson Cr.	T23N, R16E, S1, NE ✓	----- ✓
22	6/8/90	Box Spring	T25N, R21E, S19, SW ✓	PSME/FEID/PIPO ✓
23	6/8/90	Box Spring	T25N, R21E, S19, NE ✓	PSME/FEID/PIPO ✓
24	6/8/90	Box Spring	T25N, R21E, S19, NE ✓	PSME/PHMA/CARU ✓
25	6/8/90	Box Spring	T25N, R21E, S19, NE ✓	PSME/PHMA/CARU ✓
26	6/8/90	Box Spring	T25N, R21E, S19, NE ✓	----- ✓
27	6/8/90	Box Spring	T25N, R21E, S18, SW ✓	----- ✓
28	6/8/90	Box Spring	T25N, R21E, S18, SW ✓	----- ✓
29	6/8/90	Box Spring	T25N, R20E, S13, SE ✓	----- ✓
30	6/8/90	Box Spring	T25N, R20E, S13, SE ✓	----- ✓
31	6/8/90	Box Spring	T25N, R20E, S15, NE ✓	----- ✓
32	6/10/90	Stein Gulch	T25N, R22E, S13, SW ✓	----- ✓
33	6/10/90	Stein Gulch	T25N, R22E, S23, NE ✓	PSME/PHMA/CARU ✓
34	6/10/90	Stein Gulch	T25N, R22E, S23, SE ✓	PSME/CARU/CARU ✓
35	6/10/90	Stein Gulch	T25N, R22E, S23, SE ✓	PSME/CARU/CARU ✓
36	6/10/90	Stein Gulch	T25N, R22E, S26, NE ✓	PSME/CARU/PIPO ✓
37	6/10/90	Stein Gulch	T25N, R22E, S26, SW ✓	PSME/CARU/PIPO ✓
38	7/4/90	Napoleon Ridge	T24N, R19E, S16, NE ✓	----- ✓
39	7/5/90	Pine Cr.	T23N, R19E, S17, SE ✓	----- ✓
40	7/7/90	Squaw Cr.	T24N, R19E, S11, SW ✓	----- ✓
41	7/7/90	Squaw Cr.	T24N, R19E, S11, SW ✓	----- ✓
42	7/7/90	Squaw Cr.	T24N, R19E, S11, NE ✓	----- ✓
43	7/7/90	Squaw Cr.	T24N, R19E, S2, NW ✓	----- ✓
44	7/7/90	Squaw Cr.	T24N, R19E, S3, SE ✓	----- ✓

Table 1 (cont).

	45	7/7/90	Squaw Cr.	T24N, R19E, S27, NE	PSME/PHMA/CARU ✓
	46	7/7/90	Squaw Cr.	T24N, R19E, S27, NE	PSME/PHMA/CARU ✓
010	47	7/7/90	Squaw Cr.	T24N, R19E, S27, SW	PSME/PHMA/PIPO ✓
	48	7/7/90	Squaw Cr.	T24N, R19E, S27, SE	-----
	49	7/7/90	Squaw Cr.	T24N, R19E, S27, SE	-----
	50	7/7/90	Squaw Cr.	T24N, R19E, S22, SW	ABLA/XETE/VAGL
	51	7/8/90	Sage Cr.	T25N, R20E, S27, SW	-----
011	52	7/8/90	Sage Cr.	T25N, R20E, S34, SE	-----
	53	7/9/90	Whiskey Spr.	T24N, R20E, S10, SE	-----
512	54	7/9/90	Whiskey Spr.	T24N, R20E, S15, SE	-----
	55	7/9/90	Whiskey Spr.	T24N, R20E, S12, SW	-----
012	56	7/10/90	Williams Lake	T19N, R20E, S5, SW	PSME/PHMA/CARU ✓
014	57	7/16/90	Peel Tree	T18N, R20E, S10, SW	PSME/SPBE/CARU ✓
	58	7/18/90	Hughes Cr. ^{probably}	T25N, R21E, S1, NE	PSME/SPBE/CARU ✓
	59	7/18/90	Hughes Cr. ^{WE}	T26N, R21E, S31, SW	PSME/SPBE/CARU ✓
015	60	7/18/90	Hughes Cr.	T26N, R21E, S31, SW	PSME/SPBE/CARU ✓
	61	7/18/90	Hughes Cr.	T26N, R21E, S31, SW	PSME/SPBE/CARU ✓
	62	7/18/90	Hughes Cr.	T26N, R21E, S31, SW	PSME/SPBE/CARU ✓
	63	7/23/90	Papoose Cr.	T24N, R19E, S1, SW	-----
	64	7/23/90	Papoose Cr.	T24N, R19E, S2, SE	-----
010	65	7/23/90	Papoose Cr.	T24N, R19E, S2, SE	----- ✓
	66	7/23/90	Papoose Cr.	T24N, R19E, S2, NE	-----
	67	7/23/90	Papoose Cr.	T24N, R19E, S2, NE	-----

* Habitat types taken from Timber Inventory Files of the Salmon National Forest

(Vaccinium globulare) habitat type whereas two were found in ponderosa pine/Idaho fescue (Festuca idahoensis) stands. These habitats appear to structurally resemble the areas occupied by Flammulated Owls in British Columbia (R. Howie, pers. comm.). However, it should be noted that habitat types may not necessarily reflect the actual vegetation on the ground. Thus, further investigation is necessary to adequately assess habitat use by Flammulated Owls on the Salmon National Forest.

Table 2. Flammulated Owl territories occurring in typed forest stands (Timber Inventory Files, Salmon National Forest).

HABITAT TYPE						
	ALBA/ XETE	PIPO/ FEID	PSME/ CARU	PSME/ FEID	PSME/ PHMA	PSME/ SPBE
# TERRS (of 26)	1	2	4	2	11	6

In the above 26 stands, the average dbh values for Douglas fir and ponderosa pine were 28.2 cm (SD= 8.1) and 38.1 cm (SD= 15.0), respectively. These values correspond to mature stages of growth (Goggans 1986). Both Douglas-fir and ponderosa pine habitats occupied by territorial Flammulated Owls were characterized by relatively open canopies and high forb diversity (pers. observ., Steele et al. 1981). An open canopy may be important for these owls as it allows for unobstructed flight and rapid drying after periods of precipitation (Goggans 1986,

Table 3. Density estimates of singing territorial male Flammulated Owls on the Salmon National Forest, 1990.

Route	Singing Males	Soundscape (ha)	Males per 40 ha	Soundscape* (ha)	Males per* 40 ha
Colson Cr. FR123	0	906	0.00	906	0.00
Colson Cr.**	5	223	0.90	223	0.90
Col. Cr. FR437**	7	304	0.92	223	1.25
Col. Cr. FR439**	6	433	0.55	384	0.62
Big Hot Spr.	2	322	0.25	273	0.29
Colson Cr. FR123	1	1004	0.04	1004	0.04
Box Spr.	10	1588	0.25	809	0.49
Stein Gulch	6	712	0.34	614	0.39
Williams Sum.	0	712	0.00	712	0.00
Napoleon Ridge	1	1198	0.03	1198	0.03
Pine Cr.	1	1052	0.04	1052	0.04
Porphyry Ridge	0	858	0.00	858	0.00
Squaw Cr.	11	1052	0.42	1052	0.42
Sage Cr.	2	809	0.10	322	0.25
Whiskey Spr.	3	1198	0.10	565	0.21
William's Lake	1	1442	0.03	1442	0.03
Peel Tree Cr.	1	1393	0.03	1393	0.03
Spring Cr.	0	677	0.00	677	0.00
Hughes Cr.	5	1052	0.19	273	0.73
Papoose Cr.	5	677	0.30	225	0.89

$\bar{x} = 0.41$

* Corrected estimates for soundscape between first and last stops at which owls were heard.

** Surveys performed on foot. All other surveys performed by vehicle.

Reynolds and Linkhart 1987b). A short drying period may decrease the time needed by arthropods before resuming their activities, an important factor for this insectivorous owl.

Densities of singing male Flammulated Owls were relatively high in this study (Table 3). Considering only surveys in which owls responded and correcting the soundscape for the area between the first and last owls heard (Howie and Ritcey 1987), we determined an average density of 0.41 singing males/40 ha. Extreme values ranged from 0 to 1.25 territories/40 ha. Method of survey may account for a portion of the variability in density estimates as the two highest estimates resulted from foot surveys. These singing male density estimates compare favorably with estimates of 0.03-1.09/40 ha for northern California (Marcot and Hill 1980), 0.72/40 ha in Oregon (Goggans 1986), approximately 0.8/40 ha (Reynolds and Linkhart 1987b) in Colorado, and from 0.4 to 1.6/40 ha in British Columbia (Howie and Ritcey 1987). Although our estimates for the Salmon National Forest are on the lower end of this range, care must be taken in making density comparisons with other areas. The highest values determined by Howie and Ritcey (1987) were based on foot surveys as were all density measures reported by Goggans (1986) and Reynolds and Linkhart (1987b). Surveys performed by driving transects may, in fact, underestimate actual densities by as much as 50 percent (Howie and Ritcey 1987). Additionally, some males remain unpaired and continue singing throughout much of the summer. Thus, densities of singing males can be higher than the

actual breeding pair densities (Goggans 1986, Reynolds and Linkhart 1987a). In several drainages, (i.e., Squaw Creek) singing males were somewhat clumped in their distribution. Areas of apparently suitable habitat separated groupings of owls; similar to the situation reported by Marcot and Hill (1980) in northern California.

Of the nine surveys with corrected density estimates of less than 0.10 males/40 ha, six occurred south of the Main Branch of the Salmon River on the Salmon and Cobalt Ranger Districts. The highest density (0.29/40 ha) on this southern portion was found in a small tract of mature Douglas-fir/ponderosa pine forest in the Big Hot Spring Creek drainage. Corrected and noncorrected densities on the North Fork Ranger District were significantly higher ($p < 0.05$) than those on the remainder of the forest.

Mature Douglas-fir stands with snags were present on the southern portion of the forest. However, in the areas surveyed, ponderosa pine was generally less common than on the North Fork Ranger District (Pat Hurt, pers. comm.; pers. observ.). Yet we did locate Flammulated Owls in stands containing little ponderosa pine on that ranger district.

Areas north of the Salmon River are composed of well-drained granitic soils, whereas volcanic soils comprise much of the forest that lies south of the Salmon River. The latter soils are more poorly drained and do not support the diversity of shrubs (especially, families such as Rosaceae) that more well-drained granitic soils can support (R. Rosentreter, pers. comm.).

Table 4. Numbers of Flammulated Owls and other species of interest observed on the Salmon National Forest.

Date	Flamm. Owls	Other Owls*	Cavity Nesters*		Insects**	Bats**	Insectivores Caprimulgidae*
			Primary	Secondary			
5/9	0	1NOSW	0	0	U	R	0
5/10	5	1GHOW	3NOFL	0	R	U	0
5/11	7	1NOSW	1NOFL	0	R	0	0
5/12	6	0	3NOFL	2AMKE	R	0	0
5/13	2	1NOSW	1PIWP	1AMKE	C	0	0
6/7	1	1GHOW	0	0	A	0	2COPO
6/8	10	0	4LEWP	0	A	R	3COPO/10+CONI
6/10	6	0	0	0	R	0	0
6/11	0	0	0	0	0	0	0
7/4	1	1GHOW+YOUNG	0	2AMKE	C	0	10+CONI
7/5	1	1GHOW	0	0	R	A	10+CONI
7/6	0	1GHOW/4BAOW	0	0	U	R	1CONI
7/7	11	0	0	0	A	A	8COPO
7/8	2	1GHOW/1LEOW	0	0	C	A	0
7/9	3	0	2NOFL	1AMKE	A	U	2COPO
7/10	1	2GHOW+YOUNG	0	0	U	U	7COPO
7/16	1	0	0	0	U	C	5COPO
7/17	0	0	0	0	U	R	0
7/18	5	0	0	0	A	R	0
7/23	5	0	0	0	R	0	0

* GHOW = Great Horned Owl (Bubo virginianus)
 LEOW = Long-eared Owl (Asio otus)
 NOSW = Northern Saw-whet Owl (Aegolius acadicus)
 CONI = Common Nighthawk (Chordeiles minor)
 COPO = Common Poorwill (Phalaenoptilus nuttallii)
 LEWP = Lewis' Woodpecker (Asyndesmus lewis)
 NOFL = Northern Flicker (Colaptes auratus)
 PIWP = Pileated Woodpecker (Dryocopus pileatus)
 AMKE = American Kestrel (Falco sparverius)

** 0 = No organisms observed.
 R = Less than three organisms observed.
 U = Four to 10 organisms observed.
 C = More than 10 but less than 25 organisms observed.
 A = More than 25 organisms observed.

Members of the family Rosaceae (as well as ponderosa pines) are often hosts for many insects. Large insects such as lepidopterans feed extensively upon these plants, whereas species such as big sagebrush (Artemisia tridentata) are preyed upon by insects much less often. Relatively few insects manage to override the chemical defenses of big sagebrush and those that do feed upon this plant are usually quite small (R. Rosentreter, pers. comm.).

Big sagebrush appeared to be much more prevalent on the Cobalt and Salmon Ranger Districts than in the areas north of the Salmon River (pers. observ.). In areas of high sage densities, forb diversity and density can be reduced (Charles Baker, pers. comm.). Forbs are an important component in the diet of orthopterans such as crickets. Thus, densities of crickets may be lower in sagebrush habitats. Orthopterans are a significant portion of the nesting Flammulated Owl diet (Goggans 1986, Hayward 1986, Reynolds and Linkhart 1987b).

We found no strong ties between relative insect numbers, other nocturnal insectivores (bats (Chiroptera), Common Nighthawks (Chordeiles minor), and Common Poorwills (Phalaenoptilus nuttallii)), and Flammulated Owl density (Table 4). Bats and caprimulgids were present in areas of low as well as high Flammulated Owl density. The former groups of insect feeders forage almost exclusively on the wing and may be preying more heavily upon flying dipterans and noctuids than do these small owls. Flammulated Owls feed by hover-gleaning and hawk-

gleaning in the treetops, drop-pouncing, and hawking (Reynolds and Linkhart 1987b); thus, the opportunity to take non-flying insects may be quite high.

We successfully walked in on two singing males which did not flush or move about their territories in response to our disturbance (Table 5). Both males were singing from high in the crowns of mature ponderosa pines on relatively open upper midslopes or ridgelines (Table 6). Tall, large diameter trees may be important in the territorial behavior of male Flammulated Owls, but our sample size is too small to be definitive.

In addition to the territories located, we also found one verified group of fledglings, one possible group of fledglings, and one Flammulated Owl nest on the Salmon National Forest (Table 5). The unverified observation of fledglings consisted of raspy begging calls followed by a flutter of wings when we imitated the territorial song. The calls were less "hissy" than those reported in the literature but we believe that they were produced by young Flammulated Owls. This observation occurred at 2306 hr, the night of 9 July, on a northeasterly facing slope of mixed conifers (Douglas-fir, predominating). We searched the area on the following day but we found no owls.

Table 6. Characteristics of singing trees and fledgling-perch trees located on the Salmon National Forest (after Goggans 1986, see text for definitions).

HABITAT	VARIABLE	PAPOOSE CR. FLEDGLING TREE	HUGHES CR. SINGING TREE	BOX SPRING SINGING TREE
TREE	SPECIES	POPI	POPI	POPI
	CONDITION	ALIVE	ALIVE	ALIVE
	HEIGHT (m)	19	31	24
	DBH (cm)	46	74	90
	DISTANCE TO CLEARING	< 5 m	< 5 m	< 5 m
GROUND COVER	TOTAL (%)	33-66	33-66	> 66
	TYPE (%)	Grass 33-66 Forb < 33 Shrub 33-66	Grass 33-66 Forb 33-66 Shrub < 33	Grass33-66 Forb < 33 Shrub33-66
	SPECIES	FEID/AGSP	FEID/BRTE	FEID/SYOR
FOREST	TYPE	DOFI/POPI	DOFI/POPI	DOFI/POPI
	LAYERS	2	2	2
	CANOPY CLOSURE (%)	70	1	5
	BOLE HT (m) (each layer)	15-20 8-15	15-31 2-15	12-25 5-12
LANDFORM	SLOPE	Upper mid	Ridgetop	Upper mid
	ASPECT	146	186	170
	GRADIENT (%)	5	4	0
CLEARING	SPECIES	FEID/AGSP	FEID/BRTE	BRTE/FEID
	LENGTH (m)	40	50	120
	WIDTH (m)	30	25	100

Table 5. Locations of reproductive effort of Flammulated Owls located on the Salmon National Forest.

DATE	OBSERVATION	SURVEY ROUTE	LOCATION
7/9/90	Begging calls*	Whiskey Spring	T24N,R20E,S10,NE
7/19/90	Nest	Hughes Creek	T26N,R21E,S31,SW
7/23/90	Begging calls	Papoose Creek	T24N,R19E,S11,NE

* Unverified as Flammulated Owls.

We located a group of at least three fledglings on the night of 23 July, between 0130 and 0230 hrs, during a survey of Papoose Creek (Table 5). We followed the raspy hisses of the young to a swale containing several ponderosa pines (Table 6). An open south-facing slope covered by Idaho fescue and cheatgrass (Bromus tectorum) was adjacent to the site. The fledglings were located high in two trees and continued begging as we approached. We imitated the male song and were occasionally answered with single notes. We returned to the area the following day and climbed the trees in which the young were perched but found no sign of Flammulated Owls in the vicinity.

On 19 July we located an active nest of Flammulated Owls along forest road 091 (Hughes Creek survey route) (Table 5). A cavity excavated by a northern flicker was chosen for the nest site. The nest cavity was approximately 15 cm deep with a west-facing entrance 5 cm high x 4.5 cm wide (Table 7). The inside diameter of the cavity was approximately 10-15 cm and it was situated in a Douglas-fir snag approximately 4.5 m from the ground. The snag itself was 6.5 m tall with a diameter at breast height (dbh) of 34 cm. The snag was at the edge of a small

Table 7. Characteristics of the Hughes Creek nest tree and cavity (after Goggans 1986, see text for definitions).

HABITAT VARIABLE	NEST TREE		CAVITY	
	TREE	SPECIES	DOFI	CAVITY TYPE
CONDITION		Dead	SHAPE	Oval
HEIGHT (m)		6.5	HEIGHT (m)	4.5
DBH (cm)		34	LOCATION	Dead wood
DISTANCE TO CLEARING (m)		0	ASPECT	225
PERCENT BARK COVERED		> 50	SURROUNDED BY BARK	Partial
GROUND COVER	TOTAL (%)	> 66		
	TYPE (%)	Grass 33-66 Forb < 33 Shrub 33-66		
	SPECIES	CARU/ Ceanothus		
FOREST	TYPE	DOFI		
	LAYERS	3		
	CLOSURE (%)	2		
	BOLE HT (m) (each layer)	> 20 10-20 < 4		
LANDFORM	SLOPE	Upper mid		
	ASPECT	82		
	GRADIENT (%)	30		
CLEARING	SPECIES	CARU/ Ceanothus		
	LENGTH (m)	70		
	WIDTH (m)	40		

clearing (a 20-30 yr old clearcut) only 12 m from FR 091 with no other snags within 30 m. The clearing was dominated by buckbrush (Ceanothus sp.), pinegrass (Calamagrostis rubescens), elk sedge (Carex geyeri), and small Douglas-fir and ponderosa pines (dbh < 10 cm).

The vegetation characteristics measured at two singing trees, one fledgling tree, and one nest tree compare favorably with similar measurements in Oregon (Goggans 1986). With the exception of the fledgling tree, all sites consisted of an open multi-layered canopy over a diverse understory. The canopy at the fledgling observation, as well as the unverified fledgling location, was considerably more closed than the canopy at the singing tree locations and nest site. High crown closure may provide greater cover for very audible young Flammulated Owls. Each site measured occurred in mature Douglas-fir/ponderosa pine or Douglas-fir forest within five meters of a clearing.

We climbed the nest tree on 23 July and found the cavity empty. Downy feathers were clinging to an adjacent perch and fecal material was at the cavity lip leading us to surmise that the young had just fledged. At dusk, our imitations of call notes and songs were answered by single note calls emanating from approximately 20 m from the nest site. We did not hear any begging calls, but weather conditions were not optimal for hearing (wind and rain).

Linkhart and Reynolds (1987) reported that Flammulated Owl broods fledge over a period of two nights before separating into

two groups, each fed by one parent. Therefore, the young in this nest may have fledged on the nights of 19 and 20, 20 and 21, or 21 and 22 July. The mean length of the nestling stage in Colorado was 23 days while the mean incubation period was 22 days (Reynolds and Linkhart 1987b). Applying these figures to the Hughes Creek nest we believe that this pair began incubation during the week of 3 June 1990. This time frame compares favorably with our encounters with fledglings as well as the chronology outlined for Colorado (Reynolds and Linkhart 1987b) and Oregon (Goggans 1986).

Flammulated Owls returned to the Salmon National Forest by at least 10 May, 1990. We did not initiate our surveys until 9 May (at which time we did hear some possible Flammulated Owl vocalizations) and may have missed their actual arrival. Hayward (1983) first heard Flammulated Owls in the Frank Church River-of-No-Return Wilderness on 1 June while Reynolds and Linkhart (1987b) reported Flammulated Owls returning to Colorado as early as 3 May.

We returned to Hughes Creek and Box Springs in August and resurveyed the routes that we had surveyed earlier in the season. At this time, male Flammulated Owls were not singing nor did they respond to our imitations. Linkhart and Reynolds (1987) reported that Flammulated Owls left their Colorado study area in early to mid-October. Owls were probably still present on the Salmon National Forest but their responsiveness may have been low. When Flammulated Owls are foraging or feeding young, 10 minutes may

elapse before a response is heard (R. Howie, pers. comm.).

During early May 1990, Flammulated Owls on the Salmon National Forest were very vocal at dusk. At this time, Flammulated Owls produced "contact" notes, resembling the calls of Long-eared Owls (Asio otus). Blowing across an empty soda-pop bottle closely matches this call. These notes carried further than the male song, approaching audible distances of 900-1000 meters (pers. observ.), and may be important during the initial settlement and spacing of male Flammulated Owls. We heard fewer of these contact notes as the season progressed.

The advertisement or territorial songs of males in this population were highly variable (pers. observ.). We were able to easily distinguish individual owls on a tape recording of six males we produced opportunistically while performing the surveys. Reynolds and Linkhart (1987a) surmised that female recognition of males based upon voice may be important in mate and/or territory selection.

We encountered four additional species of owls while performing Flammulated Owl surveys. We located seven Great Horned Owls (Bubo virginianus) including two with fledglings, one Long-eared Owl, three Northern Saw-whet Owls (Aegolius acadicus), and four Barred Owls (Strix varia) (Table 8). The Barred Owl sighting is of interest in light of the expanding range of this species in western North America.

Table 8. Locations of other owls observed on the Salmon National Forest.

Date	Species	Survey Rte.
5/9	Northern Saw-whet Owl	Colson Cr.
5/10	Great Horned Owl	Colson Cr.
5/11	Northern Saw-whet Owl	Colson Cr.
5/13	Northern Saw-whet Owl	Big Hot Sp. Cr.
6/7	Great Horned Owl	Colson Cr.
7/4	Great Horned Owl + young	Napoleon Ridge
7/5	Great Horned Owl	Pine Cr.
7/6	Great Horned Owl	Porphyry Ridge
7/6	Barred Owl	Porphyry Ridge
7/6	Barred Owl	Porphyry Ridge
7/6	Barred Owl	Porphyry Ridge
7/6	Barred Owl	Porphyry Ridge
7/8	Great Horned Owl	Sage Cr.
7/8	Long-eared Owl	Sage Cr.
7/10	Great Horned Owl + young	Williams Lake
7/10	Great Horned Owl	Williams Lake

CONCLUSIONS

Flammulated Owls are present and are successfully fledging young on the Salmon National Forest. We determined an average density of singing males of 0.41/40 ha (range= 0-1.25) in the areas surveyed. Densities were significantly higher on the North Fork Ranger District than in areas of the Cobalt and Salmon Ranger Districts that we surveyed. We found Flammulated Owls setting up territories in mature stands of Douglas-fir, ponderosa pine, and mixed Douglas-fir/ponderosa pine. We discovered one active nest cavity in a 6.5 m tall (dbh= 34 cm) Douglas-fir snag on the edge of a 20-30 yr old clearcut. This nest fledged between 19 and 22 July.

The Salmon National Forest presents an ideal situation to study the habitat and diet requirements, migration timing, and

population dynamics of Flammulated Owls in a managed forest. Territory densities are high in some areas while low in others, habitat parameters show both natural and man-caused variability, and access is relatively easy to most areas of the forest. Drainages such as Clear Creek and Garden Creek in the Frank Church River of No Return Wilderness may provide ideal controls to test hypotheses concerning the impact of timber management schemes upon this small owl.

MANAGEMENT RECOMMENDATIONS

- 1) Continue public education such as the "Wildlife Inn" program to increase knowledge and appreciation of the importance of snags in forest habitats.
- 2) Design and implement a research program to describe the breeding biology and habitat use of Flammulated Owls on the Salmon National Forest more fully. An opportunity to coordinate a study with a state university may exist. Important questions to address may be:
 - a) What are important habitat parameters necessary for adequate Flammulated Owl reproduction and recruitment?
 - b) When do Flammulated Owls return to and depart from central Idaho?
 - c) Why are densities of singing male significantly lower on the Cobalt and Salmon ranger districts than on the North Fork ranger district?

- d) Are owl densities related to prey availability? In turn, are insect abundance and diversity tied to understory composition (i.e., big sagebrush)?
 - e) What size of areas are needed for foraging? What are the habitat requirements of these foraging areas?
 - f) How do timber management practices affect the population dynamics (reproductive success, return rate, fledgling survival, etc.) of Flammulated Owls?
- 3) Continue to implement snag retention into timber harvest schemes.

AKNOWLEDGEMENTS

We would like to thank Craig Groves, IDFG, for providing direction and support throughout this study. We would also like to thank Russ Kozacek for allowing us to stay at the Colson Creek cabin and Charles Eyler for calculating the correction factor for our density estimates. For their unending help and generosity we would like to thank USFS employees including Dick Wenger, Pat Hurt, and all the folks at the North Fork Ranger District office.

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APPENDIX A

Key to the vocalizations of owls (Johnsgard 1988)

Advertisement and Other Typical Calls of North American Owls

Group 1.

Screeching, croaking, and other nonhooting or nonwhistling calls.

A long, hoarse screech. *karr-r-r-r-r-ick* lasting about 2 seconds (Figure 53A), given at intervals of 1-20 seconds, and in series of up to 50 or more times while in flight (advertising song); also various snoring, croaking, and wheezing calls but never hoots. (Croaking, hissing, and screeching calls are uttered by many other owls, but not as primary advertising songs.)..... Common Barn-owl

Group 2.

Low-pitched hooting sounds, often in prolonged series of up to about 3 per second, but not rapidly pulsed or trilled, with variations in loudness and cadence but not pitch.

A. A rather definite and consistent number of up to 9 notes that are distinctly accented or cadenced. Arranged below by increasing number of syllables in phrase.

1. Double-noted *coo-hoooo*, similar to a cuckoo clock, the second note much prolonged and sometimes rising slightly in pitch; the doublets often monotonously repeated for an hour or more (advertising call); also a mellow, fluty 5-noted *whea-woo-who-woo-who* in courtship, with the last four notes slurred together..... Burrowing Owl

2. Three or 4 low-pitched and cadenced notes, *who; who-uhoo; whooo*, lasting nearly 2 seconds, the middle portion loudest and highest, the last prolonged and sometimes downslurred similar to Barred Owl (or "Who: who are youuuu?"); sometimes lacking the introductory note, and often with the last note distinctly emphasized (Figure 53G) (advertising call). Occasionally uttered as two long notes followed by two shorter ones; also diverse barking and sirenlike whistling noises..... Spotted Owl

3. A variable series of 4-5 (rarely 3-9) low-pitched hooting notes, with no pitch variation but usually a distinct cadence, often *who*; *hoo-hoo*; *hoo-hoo*, sounding rather like "DON'T kill owls! Save owls!", to which a preliminary "Please!" and one or two additional "Save owls!" are often added (Figure 53E) (advertising call) Great Horned Owl

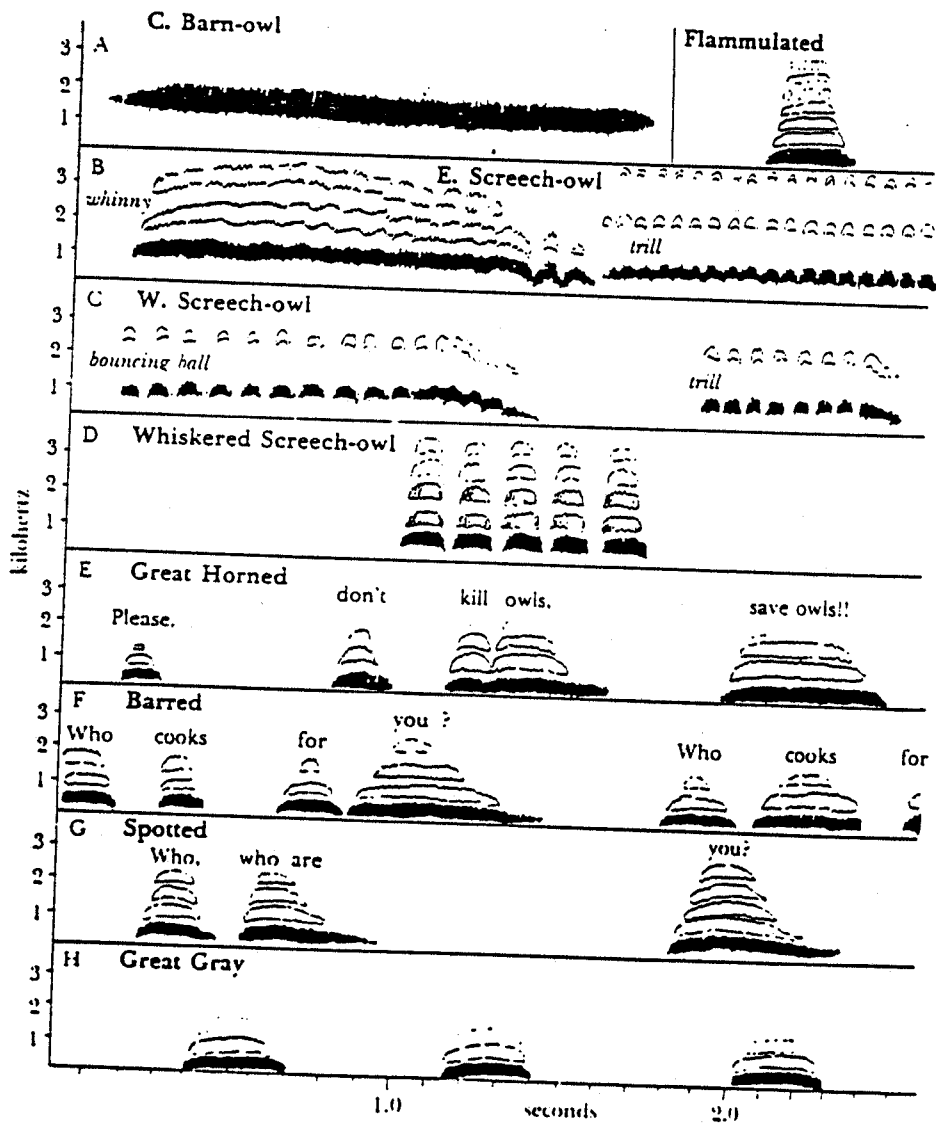


Figure 53. Diagrams of characteristic calls of nine North American owls, based on simplified sonographic representations of these calls. Major harmonics are indicated in lighter bands, minor ones are omitted.

4. A syncopated series of 2 short and closely spaced notes followed by 2-5 (usually 3) longer and equally spaced notes ("dot, dot, dash, dash, dash"), the series lasting about 1-1.5 seconds. Often repeated several times without pause, and ending with an extra long note (syncopated duet song). Also a series of about 6 notes, sometimes with a pause before the last, or the penultimate one emphasized (male song) Whiskered Screech-owl; see also 2AA6
 5. Nine hooting notes in distinct two-phrase cadence, the whole sequence lasting nearly 3 seconds and sounding like, "Who cooks for you; who cooks for you-all?" (Figure 53F) (advertising call); also diverse barking, chuckling and screaming notes Barred Owl
- AA. A variable number of single or doublet hooting notes, not so distinctly accented (see also Group 3A). Arranged below by increasing pitch.
1. A series of up to 12 regularly spaced, very low-pitched (ca. 200 Hz) *boo* (sometimes double or triple) notes of equal duration (about 0.3 seconds) and uniform interval, the single units usually uttered at about 3 per 2 seconds (Figure 53H), but often becoming more rapid, lower, and softer toward the end of a calling sequence (advertising song). The female's notes are similar but harsher and are typically uttered in shorter series Great Gray Owl
 2. Loud, hollow, and booming *hoot-hoo* notes, usually given in groups of 2 (range 1-6 or more), with 1-2 second intervals between the doublet calls (advertising song); frequency low-pitched but still unmeasured Snowy Owl
 3. An indefinite series of prolonged, low (ca. 400 Hz), cooing *boo* sounds, each lasting about 0.5 seconds, the notes uttered at spaced intervals of about 2.5 seconds (range 2-8), the first usually lower in pitch and volume (Figure 54A). Sometimes uttered in flight (advertising song) Long-eared Owl
 4. A single very low-pitched (to ca. 500 Hz) hoot, uttered monotonously and regularly 8-60 times (average about 25) per minute (Figure 53A), each hoot often preceded by 1-2 preliminary softer notes of even lower pitch (advertising song); also a similar but double *boo-hoot*, uttered about 40 per minute, with the emphasis on the second syllable (courtship song) Flammulated Owl
 5. A low-pitched (ca. 500 Hz), indefinite series of spaced cooing or *boo* notes, each lasting about 0.1 seconds and recalling a distant steam engine, given at the rate of about 2-5 per second, with from 6 to 20 or more notes in each series (Figure 54B). The series may be repeated 5-6 times an hour; often uttered in flight (advertising song) Short-eared Owl

6. A series of about 6 (4-9, rarely to 16) rather evenly spaced *boo* notes (to ca. 800 Hz), the series usually lasting about 1 second or sometimes to 1.5 seconds (Figure 53D); often slowing toward the end, sometimes with the penultimate note emphasized (advertising song)..... Whiskered Screech-owl; see also 2A4

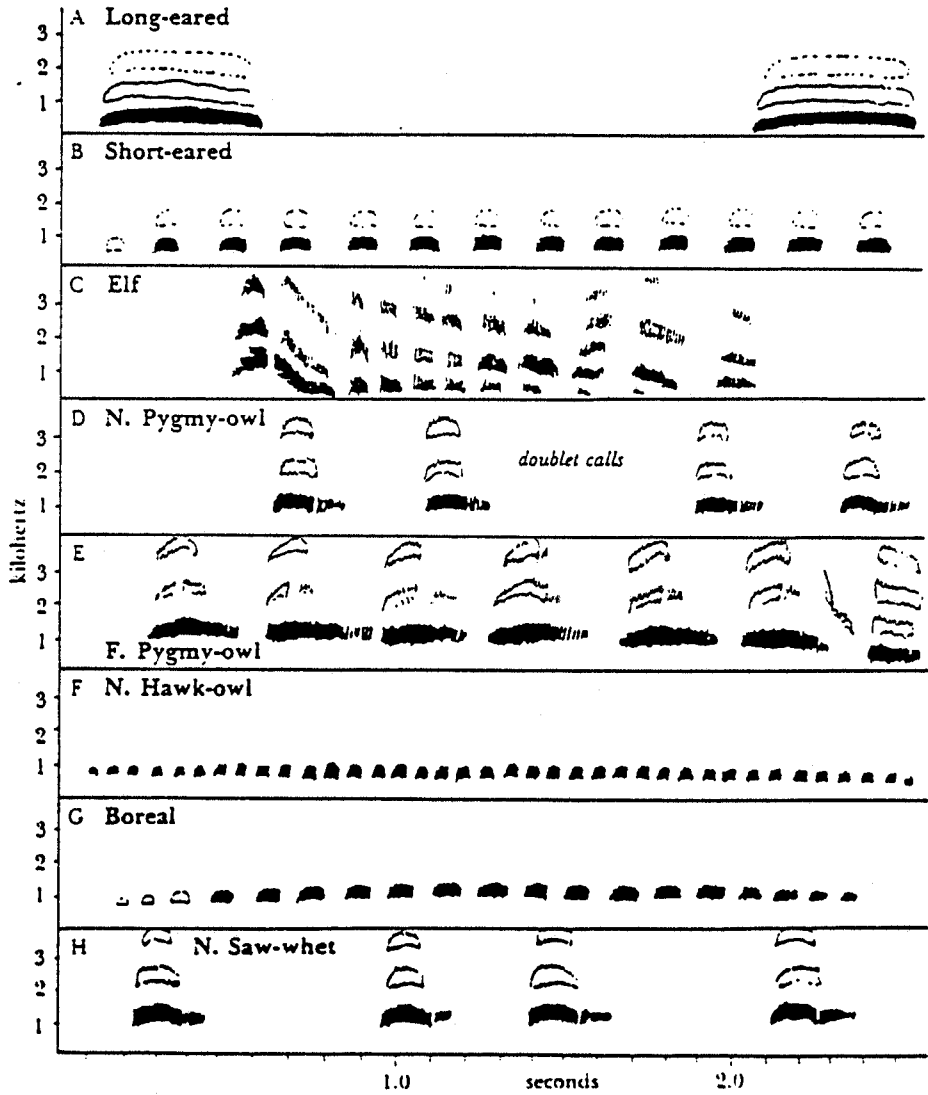


Figure 54. Diagrams of characteristic calls of eight North American owls, based on simplified sonographic representations of these calls. Harmonics shown as in Figure 53. From published sources and original sonagrams.

- 7. A variably long (6-30) series of short, mellow *took* notes, uttered at a uniform clocklike rate of about 5 every 2 seconds, each note lasting about 0.1 seconds, fairly high-pitched (ca. 1000 Hz) (advertising song) Ferruginous Pygmy-owl; see also 3A3

Group 3.

Calls given as a series of variably rapid (to about 10 per second), generally higher pitched and mellow notes that sometimes approach pure whistles; or as nearly continuous trills, the sequence often markedly rising in pitch and/or volume.

- A. A series of phrases of slower (up to about 5 per second), pulsed, single-noted (sometimes doublet) units separated at least in part by distinct intervals. (See Groups 3AA and 3AAA below for progressively faster note rates.) Pitch usually varied; arranged below by apparently increasing average pitch.
 - 1. A series of 4-20 short (about 0.1 second) notes on same pitch (to 500-650 Hz) that begin slowly (to about 3.5 per second) but terminally accelerate (to about 11 per second) while declining in volume, recalling a bouncing ball coming to a stop (Figure 53C, left) (advertising song) Western Screech-owl; see also 3AAA.1
 - 2. A series of mellow *too* notes uttered independently in a long series, at intervals of about 2 seconds (advertising song), or less often as a series of 5-8 notes that increase in speed and pitch (scale song). A low, rolling trill of numerous mellow and uninflected *to* notes, followed by a pause and then about 3 widely spaced *hoo* notes (these sounding something like, "Look, look, look!"). In southern Arizona (*gnoma*) the notes usually uttered as double *hoo-hoos* (Figure 54D), each doublet uttered about a second apart, or in groups of three with interspersed single notes (advertising song) Northern Pygmy-owl
 - 3. A long series of harsh, rapidly uttered and equally spaced "popping" or *poip* notes, each note with an upward inflection, uttered at the rate of about 2.5 notes per second and each lasting about 0.25 seconds (Figure 54E); sometimes interspersed with clear whistles. Ferruginous Pygmy-owl; see also 2AA7
 - 4. A series of 4-15 or more rapidly repeated (6-8 per second), excited, and high-pitched *chewk* notes that descend in pitch and have a cackling or vipping quality (Figure 54C); the series often uttered 3-4 times in succession. Also various other whining and barking sounds suggestive of small dogs or puppies Elf Owl

AA. A series of more rapid, usually monosyllabic toots, soft whistles, or metallic sounds uttered in extended phrases, sometimes in trilled or staccato fashion, at rates of about 1-8 notes per second. Arranged below by increasing rates of notes uttered per second.

1. An extended series of uniformly spaced and mellow *too* notes (about 1-2 per second), resembling dripping water (Figure 54H); the entire sequence lasting up to a minute or more, often becoming faster and ending quite rapidly (advertising song); also harsher *skreigh-aw* or *whurdle* notes, these often grouped in triplets, of varied pitch and cadence but recalling the filing of a saw Northern Saw-whet Owl
2. A rapid series of whistled *hu* notes (about 5 per second), in long phrases lasting several seconds; 10-15 phrases per minute (advertising song) Northern Hawk-owl; variant of 3AA.3
3. A very rapid series (about 8 per second) of mellow and hollow *po* notes (range 11-23, average 16 in N. America), in rising and falling phrases about 1-3 seconds long (Figure 54G), resembling snipe winnowing. About 2-3 seconds between successive phrases, which may go on indefinitely (advertising song) Boreal Owl

AAA. A continuous or nearly continuous trill (at least 12 pulses per second) often lasting about 2 seconds or more and usually varying in pitch or loudness. Arranged below by increasing average phrase length.

1. A short burst of rapid notes (about 12 per second), lasting about 0.5 seconds, followed by a longer similar series, lasting about 1.0 seconds, forming a double trill (Figure 53C, right) (secondary and duetting song) Western Screech-owl; see also 3A1
2. A prolonged, continuous, descending or uniformly pitched "whinny" of quavering trilled quality, lasting nearly 2 seconds (advertising song) (Figure 53B, left). Also a trilled series of very short notes (about 14 per second) on same pitch that slowly get louder and then may fade (Figure 53B, right); lasting 2-4.5 seconds (secondary and duetting song) Eastern Screech-owl
3. A sonorous, trilling, vibrant, and rolling *hu-hu-hu-u-u* usually lasting 2-10 seconds (rarely to 14 seconds), with about 12 pulses per second (Figure 54F). Sometimes uttered as a hubbling, rising ripple of comparably pulsed notes: each phrase lasting 8-9 seconds, with a similar interval between phrases (advertising song) Northern Hawk-owl; variant of 3AA2

APPENDIX B

**Habitat measurements taken at nest tree
& singing trees (Goggans 1986)**

CAVITY

Type

Pileated woodpecker

Flicker woodpecker

Natural

Shape

Oval

Round

Amorphous

Height

0-5

6-10

11-15

16-20

21-25

26-35

36-45

>45

Aspect

0-45

46-90

91-135

136-180

181-225

226-270

271-315

316-359

Diameter of tree

<2

2-10

11-30

31-50

51-70

>70

Nearest Perch to Cavity

<1

1-3

3-10

>10

Nearest Hiding Cover

<1

1-3

3-10

>10

Location in Tree

Live Wood

Dead Wood

Partial

Cavity Surrounded by Bark

Yes

No

Partial

TREE

Species

Ponderosa Pine

Douglas Fir

Grand Fir

Western Larch

Condition

Live

Dead

Partial

Height

0-5

6-10

11-15

16-20

21-25

26-35

36-45

>45

DBH (M (Succession)

<2 (Regeneration)

2-10 (Subclimax)

11-30 (Subclimax)

31-50 (Mature)

51-70 (Old Growth)

>70 (Remnant)

Percent Bark

100

>50

<50

0

Lean Direction

0-45

46-90

91-135

136-180

181-225

226-270

271-315

316-359

Distance to Clearing (0.5 acre minimum)

<5

5-10

10-30

30-65

>65

GROUND COVER

Percent

<33

33-66

>66

Type

Grass

Forb

Shrub

Grass-Forb

Grass-Shrub

Forb-Shrub

Grass-Forb-Shrub

Species

Feid-Agsp

Posa-Agsp

Posa-Feid

Ag spp

Caru

Po spp

Po spp-Feid

Height

FOREST

Cover Type

Grassland

Ponderosa Pine

Ponderosa Pine/Douglas Fir

Mixed Conifer

Layers

1

2

3

Canopy Closure

<25

26-50

51-75

>75

Bole Height (each layer)

Stringer

Yes

No

LANDFORM

Bottom

Lower midslope

Upper midslope

Slope Aspect

00-45

46-90

91-135

136-180

181-225

226-270

271-315

316-359

Slope Gradient

0-5

6-10

11-15

16-20

21-25

26-30

CLEARING Distance from nest/sample tree

<5

5-10

10-30

30-65

>65

Species Composition

Feid-Agsp

Posa-Agsp

Posa-Feid

Ag spp

Po spp

Caru

Po spp-Feid

Axis length

Axis width

WATER Distance

Source

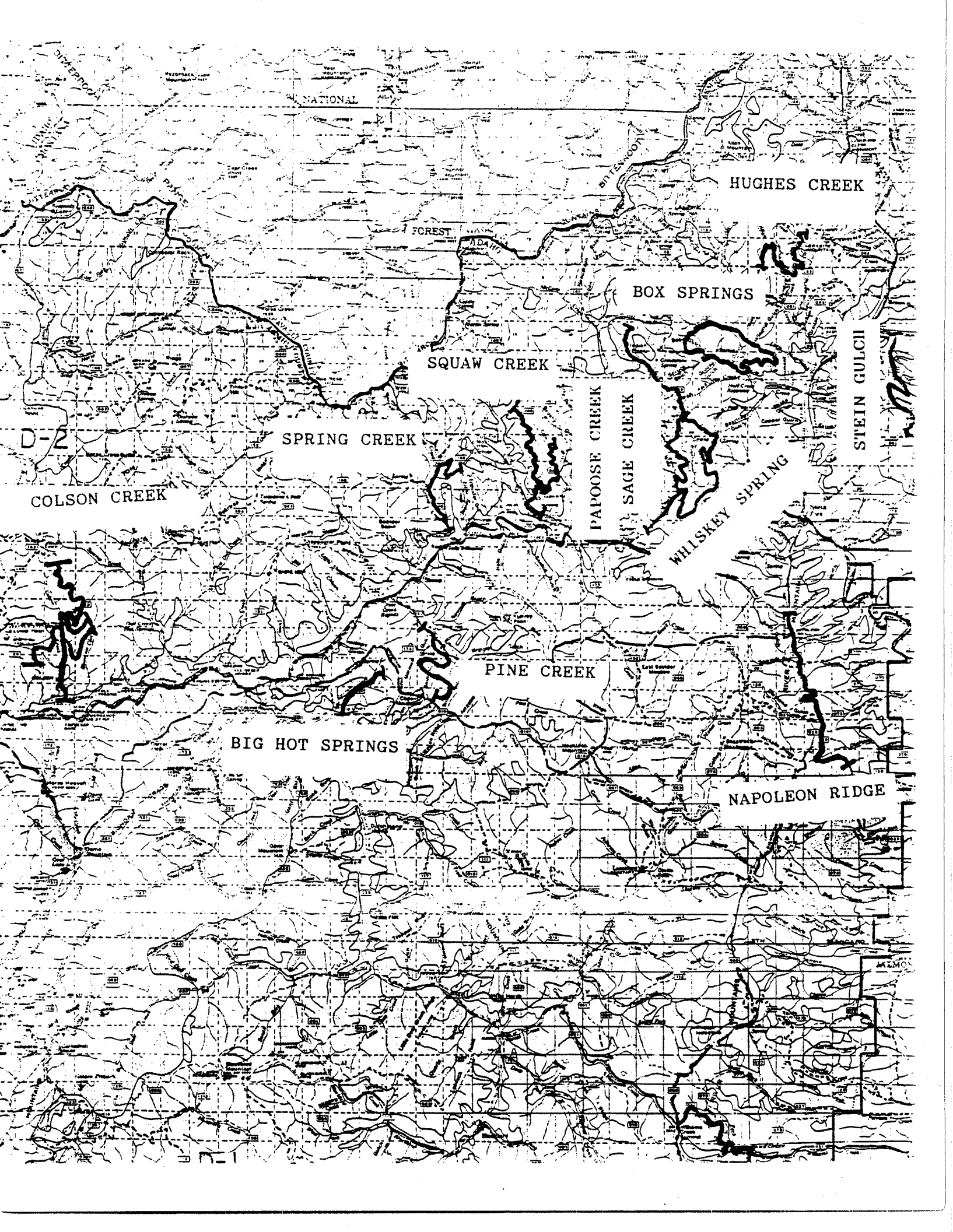
Creek

Stockpond

Other

APPENDIX C

Mapped locations of Flammulated Owl survey routes.



NATIONAL

HUGHES CREEK

FOREST

BOX SPRINGS

SQUAW CREEK

STEIN GULCH

SPRING CREEK

PAPOOSE CREEK

SAGE CREEK

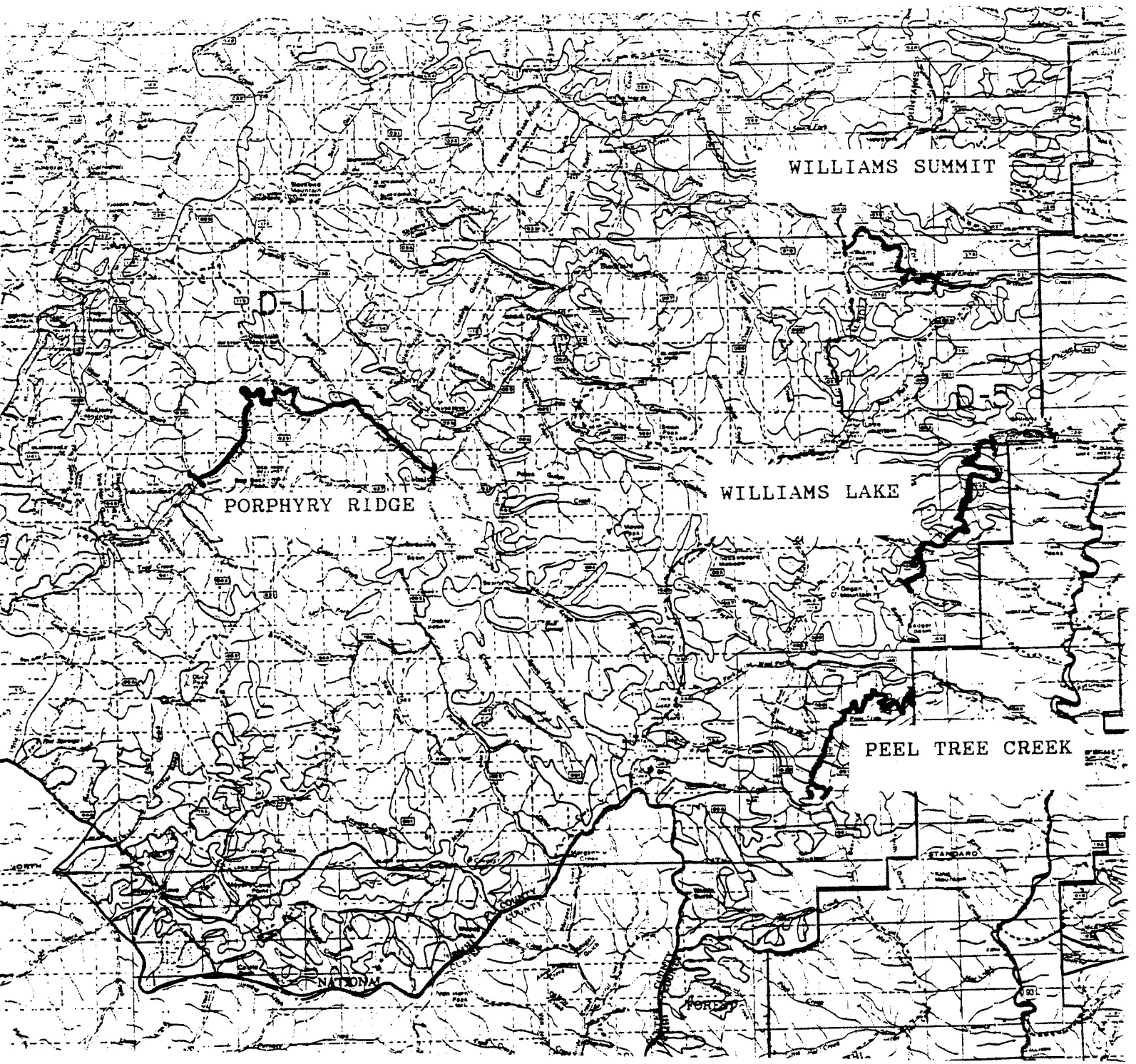
WHISKEY SPRING

COLSON CREEK

PINE CREEK

BIG HOT SPRINGS

NAPOLEON RIDGE



WILLIAMS SUMMIT

PORPHYRY RIDGE

WILLIAMS LAKE

PEEL TREE CREEK

NATIONAL

STANDARD

FORD