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Summer Raptor Populations of a Washington Coulee

Abstract

Composition and spatial structure of a raptor community in a Washington coulee was studied for two years. Ten species totaling 41 and 38 pairs during 1978 and 1979, respectively, nested in the coulee. Red-tailed (*Buteo jamaicensis*) and Ferruginous (*Buteo regalis*) hawks were the most abundant diurnal raptors and Barn (*Tyto alba*) and Great Horned (*Bubo virginianus*) owls were the dominant nocturnal species. Analysis of intraspecific spatial relationships of nests showed that all species except the Barn Owl exhibited a uniform distribution. Interspecific distribution patterns were either uniform or random. The study area averaged 43.8 nests/100 km², suggesting good nesting habitat for Columbia Basin raptors.

Introduction

Sagebrush (*Artemisia* spp.) is estimated to have covered 58.7 to 109.3 million ha of land at one time in western America (Beetle 1960, Sturges 1973). Research on nongame wildlife species inhabiting the sagebrush community has been almost nonexistent, yet substantial parts of shrub-steppe have been, and are being, eliminated (Baker *et al.* 1976). To date, over 400,000 ha of Washington's Columbia Basin, much of which was shrub-steppe, has been irrigated with an additional 200,000 ha to be "reclaimed" to irrigated crops in the near future (USDI 1976a).

Within the Columbia Basin there exists approximately 3,900,000 ha of "channeled scablands" and "coulees." These basalt scablands consist of labyrinthine canyons, channels, basins, buttes, and coulees and were believed to have been carved by the Spokane Flood 18,000-20,000 years ago (USDI 1976b). Fitzner (1980) presented nesting densities of the raptor community for a large land area of varied topography and habitats in the Columbia Basin. Our impression was that whereas Fitzner's information accurately represented raptor nesting densities for heterogenous habitats and topography, channeled scablands and coulees provided small isolated islands of good nesting habitat, and would therefore be worth investigation. This paper presents population and productivity information of a raptor community in a coulee during 1978 and 1979.

Study Area and Methods

The study was conducted in a 6400 ha section of Esquatzel Coulee, Franklin County,

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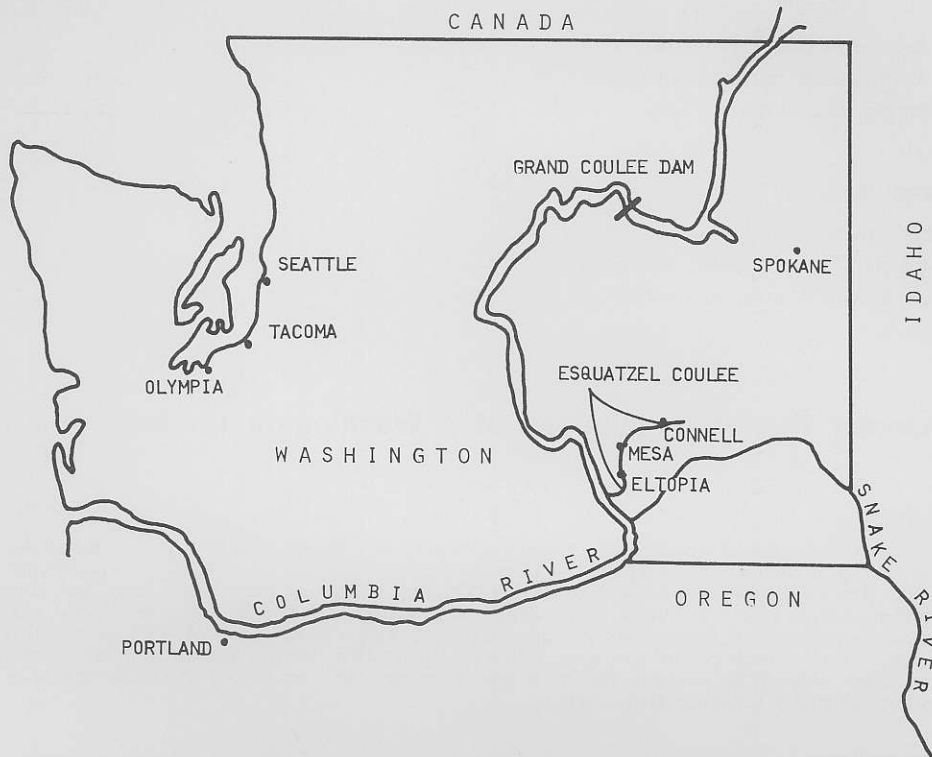


Figure 1. Location of Esquatzel Coulee study area, between Mesa and Connell, Washington.

Washington (Fig. 1). Esquatzel Coulee is 56 km long, with this study concentrating on a 13 km portion. Water on the study area consists of a pond, gravel pit, marsh, each less than 1 ha in size, and several streams formed from irrigation runoff which largely dry up during winter months.

A semiarid climate exists, with daytime summer temperatures averaging 32° C, and occasional subfreezing temperatures occurring during winter (USDI 1977). Annual mean precipitation at Eltopia (Fig. 1) is 21.1 cm. Prior to irrigation, vegetation in this area was classified as the *Artemisia tridentata*-*Agropyron spicatum* association (Daubenmire 1970). Overgrazing and farming have largely altered this plant community. At present, sagebrush and rabbitbrush (*Chrysothamnus* spp.) are the dominant shrubs, with cheatgrass (*Bromus tectorum*) the prevailing grass. In addition, mustards (*Brassica* spp.) and Russian thistle (*Salsola* sp.) are abundant.

This study was conducted from 1 October 1977 to 26 December 1979; intensive field work was performed from April to June each year. Population surveys were conducted monthly, and supplemental observations were collected at other sites. Raptor nests were found by systematically searching all potential nest sites, all of which were plotted on a map. Gaps between nests were then re-examined for possible missed nests or other signs of raptor activity.

At least two nest checks were made for each pair of raptors. The first visit was made in April to study territorial occupancy. Each observation was made as far from the

nests as possible to avoid hawk desertion during incubation and egg laying periods. Additional visits were made to obtain brood size and fledgling success.

Intraspecific and interspecific spatial patterns of raptor nests were analyzed using the Clark-Evans Nearest-Neighbor Model (1954), which compares the average minimum distance (\bar{r}_A) between nest sites with the expected distance (\bar{r}_E) assuming a uniform distribution of nests. The rates (R) of the two values are calculated as:

$$R = \frac{\bar{r}_A}{\bar{r}_E}$$

R values indicate distribution patterns with R = 0 for clumped, R = 1 for random, and R = 2.15 for uniform distribution patterns.

Results and Discussion

Including the Common Raven (*Corvus corax*) as an ecological counterpart of a raptor, there were 10 species of raptors nesting in Esquatzel Coulee (Table 1). A total of 41 and 38 pairs of raptors were located in the study area during 1978 and 1979, respectively. Diurnal raptors comprised the majority of the summer population, both in species and in overall numbers. In 1978, there were 26 pairs of seven species that were diurnal and 15 pairs of two species that were nocturnal. The situation changed little in 1979; one more nocturnal species, the Long-eared Owl (*Asio otus*), was added.

Two *Buteo* species, the Red-tailed Hawk (*Buteo jamaicensis*) and Ferruginous Hawk (*Buteo regalis*), and two nocturnal owls, the Great Horned Owl (*Bubo virginianus*) and Barn Owl (*Tyto alba*), were most abundant. Although there were marked changes in number of active nests for each species between years, there was no change in number of occupied territories, except for the Great Horned Owl (eight *vs.* six pairs). Thurow *et al.* (1980) have correctly pointed out that, whereas three species of the genus *Buteo* (Red-tailed Hawk, Ferruginous Hawk, and Swainson's Hawk (*Buteo swainsoni*)) are broadly sympatric throughout much of western North America, one species always seems to be uncommon. For example, the Red-tailed Hawk is the least common in the parkland zone of Alberta (Schmutz *et al.* 1980) and south-central Idaho (Thurow *et al.* 1980), whereas the Swainson's Hawk is least abundant in the eastern Great Basin of Idaho (Smith and Murphy 1973). Similarly, this study found that Red-tailed Hawks and Ferruginous Hawks were the common species. Although Swainson's Hawks were observed nesting outside Esquatzel Coulee, we have never observed one in the study area. Fitzner (1980), however, in an area 54 km southwest of this study, noted only one pair of Ferruginous Hawks nesting over a five-year period (pers. comm.), but Red-tailed Hawks and Swainson's Hawks were abundant. Fitzner (1980) and Schmutz *et al.* (1980) demonstrated that *Buteo* hawks showed degrees of ecological segregation by nesting sites and nesting habitats, even though they might opportunisticly use the same resources when sympatric.

Ecological segregation of Red-tailed and Ferruginous hawks in Esquatzel Coulee was evident. Although both species used cliffs as nesting sites (Table 2), the average cliff height of 14.1 m for Red-tailed Hawks was significantly higher than the average of 7.8 m for Ferruginous Hawks ($t = 4.2$; $P < 0.05$). Red-tailed Hawks did show greater flexibility in nesting sites, land-use patterns of nesting sites, distances to roads and human habitation (Table 2), and food habits (pers. obsv.).

TABLE 1. Composition and productivity of Esquatzel Coulee raptor breeding populations, 1978 and 1979.^a

Species	Territorial pairs		Number of territorial pairs of known breeding status		Total known active nests		Number of productive nests		Percentage of territorial pairs of known breeding status producing young		Number of young fledged		Number of young per territorial pair of known nesting status	
	1978	1979	1978	1979	1978	1979	1978	1979	1978	1979	1978	1979	1978	1979
Ferruginous Hawk	7	7	7	7	5	3	5	3	71.4	42.9	13	7	2.6	1.9
Red-tailed Hawk	8	8	7	8	6	5	5	4	71.4	50.0	13	6	2.2	1.9
Marsh Hawk	1	1	0	0	0	0	NK ^b	—	NK	NK	NK	NK	NK	NK
Prairie Falcon	1	1	1	1	1	0	1	0	100.0	0.0	3 ^c	0	3.0	3.0
American Kestrel ^d	5	4	4	2	1	0	1	0	25.0	0.0	3	0	3.0	0.8
Great Horned Owl	8	6	6	6	3	3	3	3	50.0	50.0	9	8	3.0	2.7
Long-eared Owl	0	1	0	0	0	0	0	NK	0	NK	0	NK	—	NK
Barn Owl ^d	7	7	2	1	2	1	2	NK	100.0	NK	6	NK	3.0	NK
Burrowing Owl ^d	2	1	0	0	0	0	NK	NK	NK	NK	NK	NK	NK	NK
Common Raven	2	2	2	2	1	2	1	2	50.0	100.0	3	6	3.0	1.5
TOTAL	41	38	29	27	19	14	18	12	62.1	44.4	50	27	2.6	1.7

^aTerminology defined in Postupalsky (1974).

^bNK = not known.

^cNest contained 5 young; two were legally taken by falconers and 3 fledged.

^dIt was not always possible to determine if nests of all burrow and cavity nesting species were active.

TABLE 2. Summary of nest site and territory characteristics of raptors in Esquatzel Coulee, 1978 and 1979.

	Nest site			Elevation (m)	Land use		Territory			
	Structure				Range	Farm	Permanent water	Average minimum distance (m)		Human habitation
	Cliff	Tree	Other					Primary road	Secondary road	
Red-tailed Hawk	9	1	1 ^a	275.7	8	3	741.2	2,196.2	516.8	1,550.6
Ferruginous Hawk	8	0	0	278.1	7	1	617.2	2,570.2	594.4	2,449.8
American Kestrel	5	0	0	253.0	4	1	1,091.2	1,859.3	390.1	2,535.9
Prairie Falcon	1	0	0	259.1	1	0	1,609.3	1,889.8	609.6	2,438.4
Barn Owl	11	0	0	278.5	10	1	989.2	1,486.6	382.4	2,554.8
Great Horned Owl	6	1	0	270.0	6	1	432.4	1,852.3	622.7	2,510.2
Burrowing Owl	0	0	2 ^b	213.4	1	1	57.1	1,767.8	609.6	1,280.2
Common Raven	1	0	1 ^c	243.8	2	0	914.5	2,249.4	244.0	2,438.4
TOTAL OR AVERAGE	41	2	4	258.9	39	8	806.5	1,983.9	496.2	2,219.8

^aTransmission tower.

^bBurrow.

^cRailroad trestle.

Barn and Great Horned owls showed very little difference in nest site structure, land-use patterns of nesting sites, and distances to roads and human habitation (Table 2). Similarly, there was no difference between average nest structure height (12.3 m vs 12.6 m) or between average nest height (8.4 m vs 5.7 m) for Barn Owls and Great Horned Owls, respectively. Barn Owls have been present in eastern Washington only since the late 1950s (Stewart 1980), which possibly explains the lack of ecological segregation evidenced (see Knight and Jackman, in prep., for a more detailed discussion). In Fitzner's (1980) study, the two dominant nocturnal raptors were Great Horned Owls and Long-eared Owls, although Burrowing Owls (*Athene cunicularis*) were the most abundant in numbers.

Spatial relationships provide another method through which ecological segregation can be achieved, specifically interspecific territoriality (Orians and Willson 1964). We measured the distances between nests within and among species in order to test this factor (Table 3). For analysis, we selected raptor species with a minimum of nine nest distances within and among species. Intraspecific distributions of all raptor species, except the Barn Owl, show significant uniform distributions, indicating territorial establishment and maintenance of minimum nearest-neighbor distances (Table 3). This pattern is most strongly exhibited by Great Horned Owls ($R = 2.2$, $P < 0.01$) and Red-tailed Hawks ($R = 1.79$, $P < 0.01$). The random intraspecific distribution exhibited by Barn Owls may reflect reaction to Great Horned Owls, but this possibility is not supported by interspecific distances between the two most common owl species.

TABLE 3. Analysis of intraspecific and interspecific nesting raptor spatial distribution using the Clark-Evans' Nearest-Neighbor model.^a

	Red-tailed Hawk	Ferruginous Hawk	American Kestrel	Barn Owl	Great Horned Owl
Red-tailed Hawk	1.79**				
Ferruginous Hawk	0.87	1.61**			
American Kestrel	0.90*	1.11	1.48**		
Barn Owl	0.89	1.46**	1.26*	1.05	
Great Horned Owl	0.95	1.13	1.58**	1.09	2.2**

^aR values denote distribution patterns as follows: $R = 1$, random; $R = 0$, clumped; and $R = 2.15$, uniform.

*Significant at 0.05.

**Significant at 0.01.

Interspecific spatial patterns of nesting raptors were also examined (Table 3). Red-tailed Hawks showed random distribution patterns with Ferruginous Hawks, Barn Owls, and Great Horned Owls. Ferruginous Hawks, on the other hand, showed uniform distribution patterns with American Kestrels (*Falco sparverius*), Great Horned Owls, and Barn Owls, but only the latter was significant ($R = 1.46$, $P < 0.01$). The uniform distribution of American Kestrels with Barn Owls and Great Horned Owls may reflect predation of kestrels by the owls (Foster 1973). Avoidance of Barn Owls from predation by Great Horned Owls may also explain the uniform, but non-significant distribution observed between those two species (Knight and Jackman, in prep.).

Fitzner (1980) listed and discussed different nesting densities of raptor communities in the western United States. Raptor nesting density in the Birds of Prey Natural Area in southern Idaho was 181.0 nests/100 km². This density is considered to be optimum nesting habitat. The Hanford site, which is 54 km southwest of our study area, had a

density of 5.8 nests/100 km². Fitzner believes these differences more accurately reflect the density of a raptor community over a large land area of varied topography. Esquatzel Coulee during the two years of this study averaged 43.8 nests/100 km². Because of its relative isolation and abundant clifflines, Esquatzel Coulee provides near optimum nesting habitat.

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