PREY WEIGHTS FOR COMPUTING PERCENT BIOMASS IN RAPTOR DIETS

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Researchers have been assessing the relative importance of prey species in raptor diets for many years. Early in this century, biologists attempted to document the number of pest species consumed by raptors (e.g., Kalmbach et al. 1964). More recently, biologists have studied raptor diets to understand the effects of land use changes and environmental contaminants (e.g., Cade et al. 1968).

Frequency of an individual prey species in the diet is not always directly related to its nutritional importance (Southern 1954, Morris 1979). Raptors may consume several small items that provide less weight and energy than a single large prey item. To account for this, raptor diets are now usually reported in terms of biomass: frequency of a prey item multiplied by its average weight (e.g., McGahan 1966, 1967; Porter and White 1973; Smith and Murphy 1973; Marti 1974).

Accuracy of a biomass estimate depends on the accuracy of the weight assigned to a prey item. To ensure accuracy, weights for each prey species should be categorized by age and sex when appropriate. An average adult weight will distort relative importance of a prey species if raptors are consuming juveniles. Similarly, an average weight will distort results if one sex of a sexually diomorphic prey species is more vulnerable to raptor predation. Unfortunately, few studies have considered size classes in computing biomass in the diet.

Prey weights can rarely be obtained directly from pellet remains, partially consumed prey, or decomposed food items found in nests or under perches. Snout-vent lengths may be reliable indicators of snake weights (BLM unpublished data), and Morris (1979) and Hamilton (1980) reported a useful relationship between rodent jaw lengths and body weights. Unfortunately, similar relationships are not available for most prey species, and in most cases, weights of freshly collected animals or average weights reported in the literature must be used. During studies of raptor ecology in the Snake River Birds of Prey Area in southwestern Idaho, I compiled information on weights of 116 raptor prey species taken by 9 species of raptors (Table 1). These weights may be useful to others investigating predator-prey relations.

When possible, I used prey weights obtained in the area by BLM research project personnel. Nestling raptors and Common Ravens (*Corvus corax*) of various ages were weighted by BLM researchers in the nests; live cottontails (*Sylvilagus nuttallii*); woodrats (*Neotoma* spp.), and Townsend ground squirrels (*Spermophilus townsendii*) were weighted during trapping activities by BLM contractors from the University of Idaho; dead rodents captured in snap traps were weighed by contractors from Utah State University; and reptiles were weighed by L. Diller, University of Idaho. Weights of prey species not measured during the study were obtained from published literataure. In addition, C. Robbins and M. Fuller kindly provided weights for several birds from banding records, L.C. Stoddart provided weights for black-tailed jackrab-

bits (*Lepus californicus*), and M.R. Browning provided Say's Phoebe (*Sayornis saya*) weights from files at the National Museum. I calculated weights for prey items that could be identified only to class or genus by using the mean weight of identified individuals within that class or genus that were taken by raptors.

Size classes of prey were assigned either at the time remains were collected or when they were analyzed. Neonates included very small mammals just emerging from nests or burrows. Most other young of the year birds and mammals that were smaller than adults were classed as juveniles. An intermediate class was used for fledging-age birds, second year marmots (*Marmota flaviventris*) and rabbits less than approximately 3 months old but older than 1 month. Adults included any fully grown prey, and an average class was used for any prey item that could not be aged. Averages were calculated using relative proportions of known size classes in raptor diets. Juvenile weights for prey species that show large weight gains over a short period of time (e.g., Canada Goose (*Branta canadensis*); badger (*Taxidea taxus*), and mule deer (*Odocoileus hemionus*)) were estimated by considering the typical size of a young animal available to raptors during the nesting season. Because of large seasonal changes, weights assigned to Townsend ground squirrels depended on the months ground squirrels were found in nests.

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Table 1. Weights of Prey Species Captured by Raptors

Species	Size Class & Sex	Wt(g)	N	Reference
MAMMALS:				
Shrew-unid. (*Sorex* spp.)	Average	6	(1)	BLM Data
Pallid Bat (*Antrozous pallidus*)	Average	32		Burt & Grossenheider 1964
Bat-unid. (*Myotis* spp.)	Average	10	(2)	Porter & White 1973
Long-tailed Weasel (*Mustela frenata*)	Juvenile Adult	85 178		Palmer 1954 Smith & Murphy 1973
Badger (*Taxidea taxus*)	Neonate	2833		Estimated
Coyote (*Canis latrans*)	Juvenile	2043		Estimated
Domestic Cat (*Felis domesticus*)	Average	1800		Estimated

Table 1. Weights of Prey Species Captured by Raptors (cont.)

Species	Size Class & Sex	Wt(g)	N	Reference
Yellow-bellied Marmot	Neonate	500		Armitage et al. 1976
(*Marmota flaviventris*)	Juvenile	1000		" " " "
	Intermediate	2346	(38)	" " " "
	♂	2530	(10)	" " " "
	♀	2280	(28)	" " " "
	Adult	3222	(99)	" " " "
	♂	3900	(38)	" " " "
	♀	2800	(61)	" " " "
	Average	1808	(147)	BLM Data
Townsend Ground Squirrel	Juvenile:April	79	(480)	BLM Data
(*Spermophilus townsendii*)	Juvenile:May	120	(1282)	" "
	♂	127	(646)	" "
	♀	114	(636)	" "
	Juvenile:	199	(1331)	" "
	June-July ♂	184	(751)	" "
	♀	164	(580)	" "
	Adult:April	205	(1188)	" "
	♂	254	(440)	" "
	♀	178	(748)	" "
	Adult:May-June	222	(750)	" "
	♂	277	(285)	" "
	♀	188	(465)	" "
	Average:April	176	(3053)	" "
	Average:May-July	177	(4501)	" "
White-tailed Antelope Squirrel	Juvenile	40		Estimated
(*Ammospermophilus leucurus*)	Adult	106	(12)	Hall 1946
	♂	111	(6)	" "
	♀	101	(6)	" "
	Average	105	(40)	BLM Data
Ground squirrel-unid.	Juvenile	127		Calculated
	Adult	225		"
	Average	181		"
Least Chipmunk	Average	32	(108)	Schreiber 1973
(*Eutamias minimus*)				
Townsend Pocket Gopher	Juvenile	100		Estimated
(*Thomomys townsendii*)	Adult	248	(4)	Hall 1946
	♂	261	(3)	" "
	♀	236	(1)	" "
	Average	200		Calculated
Great Basin Pocket Mouse	Juvenile	10		Estimated
(*Perognathus parvus*)	Adult	17	(508)	BLM Data
Ord Kangaroo Rat	Juvenile	28		Estimated
(*Dipodomys ordii*)	Adult	53	(31)	Schreiber 1973
Harvest Mouse	Adult	11	(43)	Schreiber 1973
(*Reithrodontomys megalotis*)				
Deer Mouse	Juvenile	10		Estimated
(*Peromyscus maniculatus*)	Adult	19	(145)	Schreiber 1973

Table 1. Weights of Prey Species Captured by Raptors (cont.)

Species	Size Class & Sex	Wt(g)	N	Reference
Grasshopper Mouse (*Onychomys leucogaster*)	Adult	26	(76)	BLM Data
Mouse-unid.	Juvenile	10		Calculated
	Adult	17		"
Desert Woodrat (*Neotoma lepida*)	Juvenile	75		Estimated
	Adult	124	(10)	BLM Data
	♂	137	(6)	" "
	♀	105	(4)	" "
Bushy-tailed Woodrat (*Neotoma cinerea*)	Juvenile	155	(7)	Martin 1973
	Adult	338	(32)	" "
	♂	405	(16)	" "
	♀	271	(16)	" "
	Average	277		" "
Woodrat-unid. (*Neotoma* spp.)	Juvenile	195	(45)	BLM Data
	Adult	326	(87)	" "
	♂	335	(70)	" "
	♀	275	(16)	" "
	Average	281		" "
Muskrat (*Ondatra zibethica*)	Juvenile	1065		Donahoe 1966
	♂	1097		" "
	♀	1032		" "
	Adult	1277		" "
	♂	1298		" "
	♀	1256		" "
	Average	1171	(1895)	" "
House Mouse (*Mus musculus*)	Average	19	(16)	BLM Data
Montane Vole (*Microtus montanus*)	Juvenile	15		*
	Adult	50		"
	♂	60		"
	♀	40		"
	Average	35		"
Sagebrush Vole (*Lagurus curtatus*)	Average	30		Burt & Grossenheider 1964
Rodent-unid.	Juvenile	10		Estimated
	Adult	50		Estimated
	Average	50		"
Porcupine (*Erethizon dorsatum*)	Adults	5800		Smith pers. comm.
Black-tailed jackrabbit (*Lepus californicus*)	Fetus	20		
	Neonate	100		Stoddart pers. comm.
	Juvenile	500	"	" "

Table 1. Weights of Prey Species Captured by Raptors (cont.)

Species	Size Class & Sex	Wt(g)	N	Reference
Black-tailed Jackrabbit (*Lepus californicus*)	Intermediate	1000		Stoddart pers. comm.
	Adult	2114		" " "
	♂	1885		" " "
	♀	2344		" " "
	Average	1536		Calculated
Mountain Cottontail (*Sylvilagus nuttallii*)	Neonate	100		BLM Data
	Juvenile	215		" "
	Intermediate	500		" "
	Adult	650	(92)	" "
	♂	590	(45)	" "
	♀	720	(47)	" "
Pygmy Rabbit (*Sylvilagus idahoensis*)	Adult	340		Burt & Grossenheider 1964
Rabbit-unid.	Neonate	100		Calculated
	Juvenile	404		"
	Intermediate	1087		"
	Adult	1550		"
	Average	927		"
Mule Deer (*Odocoileus hemionus*)	Juvenile	3780		McGahan 1966
Pronghorn Antelope (*Antilocapra americana*)	Neonate	2700		Beuchner 1950
BIRDS:				
Great Blue Heron (*Ardea herodias*)	Average	1905	(1)	Poole 1938
Canada Goose (*Branta canadensis*)	Juvenile	450		Estimated
Mallard (*Anas platyrhynchos*)	Adult	1185	(3226)	Bellrose 1976
	♂	1248	(1809)	" "
	♀	1107	(1417)	" "
Northern Pintail (*Anas acuta*)	Adult	976	(556)	Bellrose 1976
	♂	1025	(390)	" "
	♀	866	(166)	" "
American Green-winged Teal (*Anas crecca*)	Adult	316	(192)	Bellrose 1976
	♂	322	(113)	" "
	♀	309	(79)	" "
Blue-winged Teal (*Anas discors*)	Adult	395	(164)	Bellrose 1976
	♂	463	(35)	"
	♀	377	(129)	"

Table 1. Weights of Prey Species Captured by Raptors (cont.)

Species	Size Class & Sex	Wt(g)	N	Reference
Cinnamon Teal	Adult	347	(24)	Bellrose 1976
(*Anas cyanoptera*)	♂	340	(13)	"
	♀	354	(11)	"
Teal-unid.	Average	361		Bellrose 1976
American Wigeon	Adult	794	(152)	Bellrose 1976
(*Anas americana*)	♂	821	(84)	" "
	♀	767	(68)	" "
	Intermediate	751	(731)	" "
	♂	794	(358)	" "
	♀	708	(373)	" "
Northern Shoveler	Adult	658	(41)	Bellrose 1976
(*Anas clypeata*)	♂	680	(21)	" "
	♀	635	(20)	" "
Duck-unid.	Nestling	100		Calculated
	Juvenile	425		"
	Adult	899		"
	♂	1003		"
	♀	659		"
	Average	767		"
Red-tailed Hawk	Juvenile	800		Estimated
(*Buteo jmaicensis*)	Adult	1049	(39)	BLM Data
	♂	957	(90)	" "
	♀	1154	(113)	" "
Ferruginous Hawk	Intermediate	1110	(49)	BLM Data
(*Buteo regalis*)	♂	1040	(20)	" "
	♀	1228	(13)	" "
Prairie Falcon	Intermediate	701	(87)	BLM Data
(*Falco mexicanus*)	♂	570	(195)	" "
	♀	810	(172)	" "
American Kestrel	Juvenile	57		Estimated
(*Falco sparverius*)	Adult	114	(117)	Craighead & Craighead 1956
Northern Bobwhite	Adult	171	(1591)	Johnsgard 1973
(*Colinus virginianus*)	♂	173	(899)	" "
	♀	170	(692)	" "
California Quail	Juvenile	70	(54)	Lewin 1963
(*Callipepla californica*)	Adult	170	(374)	" "
Ring-necked Pheasant	Juvenile	600		Estimated
(*Phasianus colchicus*)	Adult	1138	(361)	Robertson 1958
	♂	1362	(77)	" "
	♀	1078	(284)	" "
Chukar	Juvenile	300		Estimated
(*Alectoris chukar*)	Adult	602	(50)	Galbreath & Moreland 1953

Table 1. Weights of Prey Species Captured by Raptros (cont.)

Species	Size Class & Sex	Wt(g)	N	Reference
Gray Partridge (*Perdix perdix*)	Adult	389	(144)	Nelson & Martin 1953
Domestic Chicken	Bantam	908		Estimated
	Adult	3120		Welty 1962
Gallinceous bird-unid (Galliformes)	Juvenile	444		Calculated
	Adult	940		"
	Average	727		"
Rail-unid.	Adult	70	(2)	Poole 1938
American Coot (*Fulica americana*)	Adult	654	(47)	Fredrickson 1969
Killdeer (*Charadrius vociferus*)	Adult	104	(2)	Robbins pers. comm.
Shorebird-unid. (*Charadriiformes*)	Adult	497		Estimated
Ring-billed Gull (*Larus delawarensis*)	Juvenile	497	(39)	Vermeer 1970
Gull-unid. (*Larus* spp.)	Adult	633	(78)	" "
Rock Dove (*Columba livia*)	Adult	332	(9)	BLM Data
Mourning Dove (*Zenaida mcroura*)	Juvenile	131	(10)	Ivacic & Labisky 1973
	Average	134	(10)	" " "
Common Barn Owl (*Tyto alba*)	Adult	525	(78)	Marti pers. comm.
	♂	461	(28)	" " "
	♀	561	(50)	" " "
Great Horned Owl (*Bubo virginianus*)	Adult	1310	(188)	Earhart & Johnson 1970
	♂	1110	(94)	" " " "
	♀	1509	(94)	" " " "
Burrowing Owl (*Athene cunicularia*)	Average	170	(22)	Thomsen 1971
Short-eared Owl (*Asio flammeus*)	Juvenile	200		Clark 1975
	Adult	348	(4)	" "
	♂	304	(2)	" "
	♀	393	(2)	" "
Common Poorwill (*Phalaenoptilus nuttallii*)	Adult	43	(1)	Lasiewski et al. 1971
Common Nighthawk (*Chordeiles minor*)	Average	83	(2)	Esten 1931

Table 1. Weights of Prey Species Captured by Raptors (cont.)

Species	Size Class & Sex	Wt(g)	N	Reference
Say's Phoebe (*Sayornis saya*)	Adult	23	(16)	USFWS files
Horned Lark (*Eremophila alpestris*)	Juvenile	17	(14)	Beason & Franks 1973
	Adult	26		Trost 1972
Cliff Swallow (*Hirundo pyrrhonata*)	Adult	25	(10)	Withers 1977
Northern Rough-winged Swallow (*Stelgidopteryx serripennis*)	Adult	16	(2)	Poole 1938
Swallow-unid.	Adult	25	(10)	Withers 1977
Blue Jay (*Cyanocitta cristata*)	Adult	74	(1)	Esten 1931
Pinyon Jay (*Gymnorhinus cyanocephalus*)	Adult	108	(1)	Poole 1938
Black-billed Magpie (*Pica pica*)	Adult	170	(28)	Linsdale 1937
Common Raven (*Corvus corax*)	Adult	1234		White & Cade 1971
	Juvenile	650		BLM Data
	Average	876	(175)	" "
Common Crow (*Corvus brachyrhynchos*)	Adult	460	(6)	Balwin & Kendeigh 1938
Red-breasted Nuthatch (*Sitta canadensis*)	Adult	11	(19)	Mugaas & Templeton 1970
Marsh Wren (*Cistothorus palustris*)	Adult	11	(76)	Robbins pers. comm.
Canyon Wren (*Catherpes mexicanus*)	Adult	10	(2)	Johnson 1965
Rock Wren (*Salpinctes obsoletus*)	Adult	17	(1)	Easterla & Ball 1973
Sage Thrasher (*Oreoscoptes montanus*)	Adult	37	(2)	Killpack 1970
American Robin (*Turdus migratorius*)	Adult	79	(1781)	Robbins pers. comm.
Hermit Thrush (*Catharus guttatus*)	Adult	31	(4)	Baldwin & Kendeigh 1938
Mountain Bluebird (*Sialia currucoides*)	Adult	35		Balda et al. 1972

Table 1. Weights of Prey Species Captured by Raptors (cont.)

Species	Size Class & Sex	Wt(g)	N	Reference
Water Pipit (*Anthus spinoletta*)	Adult	19	(1)	Poole 1938
Loggerhead Shrike (*Lanius ludovicianus*)	Adult	51	(4)	Robbins pers. comm.
European Starling (*Sturnus vulgaris*)	Adult	79	(18)	Robbins pers. comm.
Yellow Warbler (*Dendroica petechia*)	Adult	10	(366)	Robbins pers. comm.
Yellow-breasted Chat (*Icteria virens*)	Adult	26	(4)	Stewart
Western Meadowlark (*Sturnella neglecta*)	Juvenile	40		Estimated
	Adult	95	(11)	Lanyon 1962
Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*)	Adult	74		Willson 1966
	♂	91		" "
	♀	56		
Red-winged Blackbird (*Agelaius phoeniceus*)	Adult	48	(203)	Robbins pers. comm.
	♂	62	(28)	" " "
	♀	42	(18)	" " "
Northern Oriole (*Icterus galbula*)	Adult	33	(7)	Baldwin & Kendeigh 1938
Brewers Blackbird (*Euphagus cyanocephalus*)	Adult	65	(10)	Balph 1975
Brown-headed Cowbird (*Molothrus ater*)	Adult	41	(25)	Robbins pers. comm.
Lazuli Bunting (*Passerina amoena*)	Adult	15		Bock & Lynch 1970
House Finch (*Carpodacus mexicanus*)	Adult	22	(32)	Robbins pers. comm.
Rufous-sided Towhee (*Pipilo erythrophthalmus*)	Adult	41	(1116)	Robbins pers. comm.
Grasshopper Sparrow (*Ammodramus savannarum*)	Adult	16	(2)	Stewart 1937
Vesper Sparrow (*Pooecetes gramineus*)	Adult	27	(1)	Poole 1938
Lark Sparrow (*Chondestes grammacus*)	Adult	28	(1)	Robbins pers. comm.

Table 1. Weights of Prey Species Captured by Raptors (cont.)

Species	Size Class & Sex	(Wt(g)	N	Reference
Sage Sparrow	Juvenile	10		Estimated
(*Amphispiza belli*)	Adult	18	(77)	Moldenhauer & Wiens 1970
White-crowned Sparrow	Adult	27	(90)	Morton et al. 1973
(*Zonotrichia leucophrys*)				
Song Sparrow	Adult	21	(1553)	Baldwin & Kendeigh 1938
(*Melospiza melodia*)				
Sparrow-unid.	Juvenile	10		Calculated
	Adult	26		"
Passerine-unid.	Juvenile	28		Calculated
	Adult	56		"
AMPHIBIANS:				
Spadefoot Toad	Adult	12		Seymour 1973
(*Scaphiopus intermontanus*)				
Woodhouse's Toad	Adult	20		Diller pers. comm.
(*Bufo woodhousei*)				
Toad-unid.	Adult	20		Diller pers. comm.
Leopard Frog	Adult	38		Seymour 1973
(*Rana pipiens*)				
Bullfrog	Juvenile	250		Diller pers. comm.
(*Rana catesbeiana*)	Adult	500		" " "
Frog-unid.	Average	30		Estimated
REPTILES:				
Collared Lizard	Adult	34	(18)	BLM Data
(*Crotaphytus collaris*)	Average	23	(38)	" "
Leopard Lizard	Adult	26	(31)	BLM Data
(*Gambelia wislizenii*)	Average	23	(38)	" "
Western Fence Lizard	Adult	18	(40)	BLM Data
(*Sceloporus occidentalis*)	Average	17	(44)	" "
Side-blotched Lizard	Average	4	(69)	BLM Data
(*Uta stansburiana*)				
Horned Lizard	Adult	24	(42)	BLM Data
(*Phrynosoma platyrhinos*)	Average	18	(77)	" "
Whiptail Lizard	Adult	17	(39)	BLM Data
(*Cnemidophorus tigris*)	Average	15	(44)	" "

Table 1. Weights of Prey Species Captured by Raptors (cont.)

Species	Size Class & Sex	Wt(g)	N	Reference
Lizard-unid.	Juvenile	8		Calculated
	Adult	21		"
	Average	17		"
Racer (*Coluber constrictor*)	Average	77	(24)	BLM Data
Striped Whipsnake (*Masticophis taeniatus*)	Adult	111	(223)	BLM Data
	Average	102	(246)	" "
Gopher Snake (*Pituophis melanoleucus*)	Juvenile	19		BLM Data
	Adult	226	(355)	" "
	Average	202	(405)	" "
Long-Nosed Snake (*Rhinocheilus lecontei*)	Adult	85	(29)	BLM Data
		73	(35)	" "
Garter Snake (*Thamnophis elegans*)	Average	109	(8)	BLM Data
Ground Snake (*Sonora semiannulata*)	Juvenile	2		BLM Data
	Adult	9	(26)	" "
	Average	8	(31)	" "
Nightsnake (*Hypsiglena torquata*)	Adult	15	(45)	BLM Data
	Average	14	(52)	" "
Western Rattlesnake (*Crotalus viridis*)	Juvenile	19		BLM Data
	Adult	425	(319)	" "
	Average	393	(352)	" "
Snake-unid.	Average	190		Calculated
Reptile-unid.	Average	111		Calculated

* Weight values derived from a variety of sources including Hall (1946), Frenzel (1979), Marti (pers. comm.), unpublished BLM data and specimens examined at Boise State University.

Literature Cited

Armitage, K.B., J.F. Downhower, and G.E. Svendson. 1976. Seasonal change in weights of marmots. *Am. Midl. Nat.* 96:36-51.

Balda, R.P., G.C. Bateman, and G.F. Foster. 1972. Flocking associates of the Pinyon Jay. *Wilson Bull.* 84:60-76.

Baldwin, S.P. and S.C. Kendeigh. 1938. Variations in the weight of birds. *Auk* 55:416-467.

Balph, M.H. 1975. Development of young Brewer's Blackbirds. *Wilson Bull.* 87:207-230.

Beason, R.C. and E.C. Franks. 1973. Development of young Horned Larks. *Auk* 90:359-363.

Bellrose, F.C. 1976. Ducks, geese, and swans of North America. Harrisburg, PA.:Stackpole Books. 543 pp.

Beuchner, H.K. 1950. Life history, ecology, and range use of the pronghorn antelope in trans-Pecos Texas. *Am. Midl. Nat.* 43:257-354.

Bock, C.E. and J.F. Lynch. 1970. Breeding bird populations of burned and unburned conifer forest in the Sierra Nevada. *Condor* 72:182-189.

Burt, W.H. and R.P. Grossenheider, 1964. A field guide to the mammals. Boston: Houghton Mifflin Co. 289 pp.

Cade, T.J., C.M. White, and J.R. Haugh. 1968. Peregrines and pesticides in Alaska. *Condor* 70:170-178.

Clark, R.J. 1975. A field study of the Short-eared Owl *Asio flammeus* Pontoppidan in North America. *Wildl. Monogr.* 47:1-67.

Craighead, J.J. and F.C. Craighead, Jr. 1956. Hawks, owls, and wildlife. Dover Public., New York, N.Y. 443 pp.

Donahoe, R.W. 1966. Muskrat reproduction in areas of controlled and uncontrolled water-level units. *J. Wildl. Manage. 30.320-326.*

Earhart, C.M. and N.K. Johnson. 1970. Size dimorphism and food habits of North American owls. *Condor* 72:251-264.

Easterla, D.A. and R.E. Ball. 1973. The Rock Wren in Missouri. *Wilson Bull.* 85:479-480.

Esten, S.R. 1931. Bird weights of 52 species of birds (taken from notes of Wm. Van Gorder). *Auk* 48:572-74.

Fredrickson, L.H. 1969. Mortality of coots during severe spring weather. *Wilson Bull.* 81:450-453.

Frenzel, R.W. 1979. The effects of prescribed burning on small mammal communities in Lava Beds National Monument, California. M.S. Thesis. Oregon State Univ., Corvallis. 79 pp.

Galbreath, D.S. and R. Moreland. 1953. The Chukar Partridge in Washington. Wash. State Game Dept. Bio. Bull. 11. 54 pp.

Hall, E.R. 1946. Mammals of Nevada. Berkeley:Univ. Calif. Press. 710 pp.

Hamilton, K.L. 1980. A technique for estimating Barn Owl prey biomass. *Raptor Res.* 14:52-55.

Ivacic, D.L. and R.F. Labisky. 1973. Metabolic responses of Mourning Doves to short term food and temperature stresses in winter. *Wilson Bull.* 85:182-196.

Johnsgard, P.A. 1973. Grouse and quails of North America. Lincoln: Univ. Nebraska. 553 pp.

Johnson, N.K. 1965. The breeding avifaunas of the sheep and spring ranges in southern Nevada. *Condor* 67:93-124.

Killpack, M.L. 1970. Notes on Sage Thrasher nestlings in Colorado. *Condor* 72:486-488.

Kalmbach, E.R., R.H. Imler, and L.W. Arnold. 1964. The American eagles and their economic status. U.S. Dept. Inter. Fish and Wildl. Serv. Circ. 27 & 30.

Lanyon, W.E. 1962. Specific limits and distribution of meadowlarks on the desert grassland. *Auk* 79:183-207.

Lasiewski, R.C., M.H. Bernstein, and R.D. Ohmart. 1971. Cutaneous water loss in the Roadrunner and Poor-will. *Condor* 73:470-471.

Lewin, V. 1963. Reproduction and development of young in a population of California Quail. *Condor* 65:249-272.

Linsdale, J.M. 1937. The natural history of magpies. Cooper Ornithological Club, *Pacific Coast Avifauna* No. 25. 234 pp.

Marti, C.D. 1974. Feeding ecology of four sympatic owls. *Condor* 76:45-61.

Martin, R.J. 1973. Growth curves for bushy-tailed woodrats based upon animals raised in the wild. *J. Mammal.* 54:517-518.

McGahan, J. 1966. Ecology of the Golden Eagle. M.S. Thesis. Univ. of Montana. 78 pp.

McGahan, J. 1967. Quantified estimates of predation by a Golden Eagle population. *J. Wildl. Manage.* 31:496-501.

Moldenhauer, R.R. and J.A. Wiens. 1970. The winter economy of the Sage Sparrow, *Amphispiza belli nevadensis. Condor* 72:265-275.

Morris, P. 1979. Rats in the diet of the Barn Owl (*Tyto alba*). *J. Zool. Lond.* 189:540-545.
Morton, M.L., J.L. Horstmann, and C. Carey. 1973. Body weights and lipids of summering mountain White-crowned Sparrows in California. *Auk.* 90:83-93.
Mugaas, J.N. and J.R. Templeton. 1970. Thermoregulation in the Red-breasted Nuthatch. *Condor* 72:125-132.
Nelson, A.L. and A.C. Martin. 1953. Gamebird weights. *J. Wildl. Manage.* 17:36-42.
Palmer, R.S. 1954. The mammal guide. Garden City, NY: Doubleday and Co. 384 pp.
Poole, E.L. 1938. Weights and wing areas in North American birds. *Auk* 55:511-517.
Porter, R.D. and C.M. White. 1973. The Peregrine Falcon in Utah, emphasizing ecology and competition with the Prairie Falcon. Brigham Young Univ. Sci. Bull. 18:1-74.
Robertson, W.B., Jr. 1958. Investigations of Ring-necked Pheasants in Illinois. Ill. Dept. Conserv. Tech. Bull. 1. 137 pp.
Schreiber, R.K. 1973. Bioenergetics of rodents in the northern Great Basin desert. Ph.D. Thesis. Univ. of Idaho. 133 pp.
Seymour, R.S. 1973. Physiological correlates of forced activity and burrowing in the spadefoot toad *Scaphiopus hammondi*. *Copeia* 1973:103-115.
Smith, D.G. and J.R. Murphy. 1973. Breeding ecology of raptors in the eastern Great Basin of Utah. Brigham Young Univ. Sci. Bull. Biol. Ser. 18:1-76.
Southern H.N. 1954. Tawny Owls and their prey. *Ibis* 96:384-410.
Stewart, P.A. 1937. A preliminary list of bird weights. *Auk* 54:324-332.
Thomsen, L. 1971. Behavior and ecology of Burrowing Owls on the Oakland Municipal Airport. *Condor* 73:177-192.
Trost, C.H. 1972. Adaptations of Horned Larks *Eremophila alpestris* to hot environments. *Auk* 89:506-527.
Vermeer, K. 1970. Breeding biology of California and Ring-billed Gulls. Can. Wildl. Serv. Rep. 12. 52 pp.
Welty, J.C. 1962. The life of birds. Philadelphia: W.B. Lander Co. 546 pp.
White, C.M. and T.J. Cade. 1971. Cliff-nesting raptors and ravens along the Colville River in Arctic Alaska. *Living Bird* 10:107-150.
Willson, M.F. 1966. Breeding ecology of the Yellow-headed Blackbird. *Ecol. Monogr.* 36:51-77.
Withers, P.C. 1977. Energetic aspects of reproduction by the Cliff Swallow. *Auk.* 94:718-725.

NEST SITE SELECTION BY PEREGRINE FALCONS

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The Peregrine Falcon (*Falco peregrinus*) is known to use different nest sites (nest ledges) at a particular cliff, either in successive years, or in response to the loss of a clutch of eggs (Herbert and Herbert, 1965; Porter and White, 1973; Ratcliffe, 1980). In Great Britain, at least 4 alternative nest sites are used at most eyries, and one had 8 (one involving a repeat clutch) in 9 seasons (Ratcliffe, 1980).

A peregrine eyrie in northern New Mexico is unusual in that 10 different nest sites were used in 10 consecutive seasons. The nest sites are eroded potholes in volcanic tuff along 1 km of cliff, where approximately 150 similar holes are available.