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The Food Habits of North American Golden Eagles

ABSTRACT: A compilation of 7094 prey items of North American golden eagles, *Aquila chrysaetos*, shows a diet consisting of 83.9% mammals, 14.7% birds, 1.0% reptiles and 0.4% fish. No evidence of predation on amphibians or invertebrates was found.

INTRODUCTION

Golden eagle, *Aquila chrysaetos*, food habits have been widely studied in recent years, particularly in the ranching country of western North America. Considerable controversy has surrounded the efforts of sheepmen to exterminate eagles from lambing pastures by routine destruction of nests, shooting and poisoning. The following synthesis of golden eagle food habits studies, continent-wide, shows that eagles do, in fact, kill domestic livestock. Nevertheless, the level of predation on sheep is probably inconsequential compared to the golden eagle's preference for natural herbivorous competitors of livestock. Prairie dogs, ground squirrels, other rodents, hares and rabbits, all of which eat grass and seeds, constitute 77.9% of the golden eagle's diet, and of the other 20.1% only a minor portion is livestock or domestic fowl. Anyone who castigates eagles for their misdeeds ignores the eagle's place in the food webs of western prairies.

METHODS

All papers known to list prey of golden eagles in North America were searched, resulting in a compilation of 7094 prey items (Table 1). Prey were

TABLE 1.—Prey of North American golden eagles. Total number of individuals is given following the taxon

Mammals	5953
Marsupalia—Opossum	3
Opossum (<i>Didelphis marsupialis</i>)	3
Insectivora—Moles	1
California mole (<i>Scapanus latimanus</i>)	1
Carnivora—Mammalian Predators	87
Raccoon (<i>Procyon lotor</i>)	3
Ringtail (<i>Bassariscus astutus</i>)	13
Shorttail weasel (<i>Mustela erminea</i>)	1
Longtail weasel (<i>M. frenata</i>)	22
Badger (<i>Taxidea taxus</i>)	1
Striped skunk (<i>Mephitis mephitis</i>)	25
Hognose skunk (<i>Conepatus leuconotus</i>)	2
Unidentified skunks	3
Coyote (<i>Canis latrans</i>)	4
Kit fox (<i>Vulpes macrotis</i>)	1
Gray fox (<i>Urocyon cinereoargenteus</i>)	2
Bobcat (<i>Lynx rufus</i>)	2
Domestic cat (<i>Felis domesticus</i>)	8
Rodentia—Marmots	301
Woodchuck (<i>Marmota monax</i>)	3
Yellowbelly marmot (<i>M. flaviventris</i>)	261
Hoary marmot (<i>M. caligata</i>)	37
Rodentia—Ground squirrels and prairie dogs	1251
Blacktail prairie dog (<i>Cynomys ludovicianus</i>)	42
Whitetail prairie dog	

TABLE 1.—(continued)

(C. gunnisoni) 54; unidentified prairie dogs 87; California ground squirrel (<i>Spermophilus beecheyi</i>) 159; Rock squirrel (<i>S. variegatus</i>) 101; Townsend ground squirrel (<i>S. townsendi</i>) 55; Richardson ground squirrel (<i>S. richardsoni</i>) 132; Arctic ground squirrel (<i>S. undulatus</i>) 544; Thirteen-lined ground squirrel (<i>S. tridecemlineatus</i>) 5; Whitetail antelope squirrel (<i>Ammospermophilus leucurus</i>) 12; Texas antelope squirrel (<i>A. interpres</i>) 1; Unidentified ground squirrels 59	
Rodentia—Chipmunks and tree squirrels	17
Unidentified chipmunks 1; Western gray squirrel (<i>Sciurus griseus</i>) 10; Eastern fox squirrel (<i>S. niger</i>) 6	
Rodentia—Pocket Gophers	9
Valley pocket gopher (<i>Thomomys bottae</i>) 3; Northern pocket gopher (<i>T. talpoides</i>) 1; Townsend pocket gopher (<i>T. townsendi</i>) 2; Mexican pocket gopher (<i>Cratogeomys castanops</i>) 1; Unidentified pocket gophers 2	
Rodentia—Mice and Rats	38
Longtail pocket mouse (<i>Perognathus formosus</i>) 1; Ord kangaroo rat (<i>Dipodomys ordi</i>) 5; Unidentified (<i>Peromyscus</i>) 7; Desert Woodrat (<i>Neotoma lepida</i>) 5; Dusky-footed woodrat (<i>N. fuscipes</i>) 5; Bushytail woodrat (<i>N. cinerea</i>) 7; Unidentified woodrats 8	
Rodentia—Voles	50
California vole (<i>Microtus californicus</i>) 3; Unidentified <i>Microtus</i> 41; Unidentified voles 6	
Rodentia—Muskrat	17
Muskrat (<i>Ondatra zibethica</i>) 17	
Rodentia—Procupine	2
Porcupine (<i>Erethizon dorsatum</i>) 2	
Unidentified Rodents	13
Lagomorpha—Hares and Rabbits	3828
Whitetail jackrabbit (<i>Lepus townsendi</i>) 542; Snowshoe hare (<i>L. americanus</i>) 6; Blacktail jackrabbit (<i>L. californicus</i>) 1736; Unidentified hares 126; Desert cottontail (<i>Sylvilagus auduboni</i>) 338; Unidentified cottontails 805; Unidentified lagomorphs 275	
Artiodactyla—Even-toed Hoofed Mammals	315
Mule deer (<i>Odocoileus hemionus</i>) 127; White tail deer (<i>O. virginianus</i>) 2; Barren ground caribou (<i>Rangifer arcticus</i>) 24; Unidentified deer 7; Pronghorn (<i>Antilocapra americana</i>) 21; Cow (calves) 4; Bighorn sheep (<i>Ovis canadensis</i>) 18; Dall sheep (<i>Ovis dalli</i>) 15; Domestic sheep 13; Domestic sheep and goats 84	
Unidentified Mammals	21

TABLE 1.—(continued)

Birds	1043
Ciconiiformes—Hérons	6
Great Blue Heron (<i>Ardea herodias</i>)	6
Anseriformes—Waterfowl	39
Trumpeter swan (<i>Olor buccinator</i>)	3; Mallard (<i>Anas platyrhynchos</i>) 14;
Pintail (<i>A. acuta</i>)	4; Green-winged teal (<i>A. carolinensis</i>) 1; Cinnamon
teal (<i>A. cyanoptera</i>)	1; Unidentified waterfowl 16
Falconiformes—Diurnal Birds of Prey	22
Turkey vulture (<i>Cathartes aura</i>)	5; Cooper's hawk (<i>Accipiter cooperi</i>) 1;
Red-tailed hawk (<i>Buteo jamaicensis</i>)	2; Red-shouldered hawk (<i>B.</i>
<i>lineatus</i>)	1; Swainson's hawk (<i>B. swainsoni</i>) 2; Unidentified hawks 2;
Prairie falcon (<i>Falco mexicanus</i>)	2; American sparrowhawk (<i>F. sparverius</i>) 7
Galliformes	576
Blue grouse (<i>Dendragapus obscurus</i>)	32; Ruffed grouse (<i>Bonasa umbellus</i>)
7; Unidentified ptarmigan	21; Sharp-tailed grouse (<i>Pedioecetes phasianellus</i>) 11;
Sage grouse (<i>Centrocercus urophasianus</i>)	177; Unidentified
grouse	18; Domestic chicken (<i>Gallus domesticus</i>) 5; California quail
(<i>Lophortyx californicus</i>)	6; Ring-necked pheasant (<i>Phasianus colchicus</i>)
219; Chukar (<i>Alectoris graeca</i>)	29; Gray partridge (<i>Perdix perdix</i>) 48;
Turkey (<i>Meleagris gallopavo</i>)	3
Gruiformes	3
American coot (<i>Fulica americana</i>)	3
Charadriiformes—Shorebirds, etc.	1
Willet (<i>Catoptrophorus semipalmatus</i>)	1
Columbiformes—Pigeons and Doves	53
Rock dove (<i>Columba livia</i>)	49; Mourning dove (<i>Zenaidura macroura</i>) 4
Cuculiformes	2
Roadrunner (<i>Geococcyx californianus</i>)	2
Strigiformes—Owls	44
Barn owl (<i>Tyto alba</i>)	10; Great horned owl (<i>Bubo virginianus</i>) 27; Long-
eared owl (<i>Asio otus</i>)	2; Short-eared owl (<i>A. flammeus</i>) 5
Caprimulgiformes	2
Common nighthawk (<i>Chordeiles minor</i>)	2
Piciformes—Woodpeckers	10
Red-shafted flicker (<i>Colaptes cafer</i>)	8; Lewis' woodpecker (<i>Asyndesmus lewis</i>) 2

TABLE 1.—(continued)

Passeriformes—Perching Birds	227
Horned lark (<i>Eremophila alpestris</i>) 3; Steller's jay (<i>Cyanocitta stelleri</i>) 2; Scrub jay (<i>Aphelocoma coerulescens</i>) 1; Black-billed magpie (<i>Pica pica</i>) 141; Yellow-billed magpie (<i>P. nuttalli</i>) 30; Common raven (<i>Corvus corax</i>) 2; Common crow (<i>C. brachyrhynchos</i>) 18; Robin (<i>Turdus migratorius</i>) 5; Varied thrush (<i>Ixoreus naevius</i>) 1; Townsend's solitaire (<i>Myadestes townsendi</i>) 1; Starling (<i>Sturnus vulgaris</i>) 2; Western meadowlark (<i>Sturnella neglecta</i>) 14; Lark sparrow (<i>Chondestes grammacus</i>) 1; Unidentified passerines 6	
Unidentified Birds	58
Reptiles	72
Lizards	1
Unidentified horned lizard 1	
Snakes	71
Racer (<i>Coluber constrictor</i>) 2; Coachwhip (<i>Masticophis flagellum</i>) 1; Gopher snake (<i>Pituophis melanoleucus</i>) 52; Common kingsnake (<i>Lampropeltis getulus</i>) 1; Western rattlesnake (<i>Crotalus viridis</i>) 1; Unidentified rattlesnake 1; Unidentified snakes 13	
Fish	26
Sacramento sucker (<i>Castostomus occidentalis</i>) 1; Sacramento perch (<i>Archoplites interruptus</i>) 17; Unidentified perch 1; Unidentified fish 7	
Grand total	7094

listed under the most precise heading possible. For example, categories for unidentified mammals, rodents and ground squirrels appear, although the preferred classification was to species.

Whenever percent occurrences of prey in pellets or nest collections were given (but not actual determinations of numbers of individual prey items), minimum numbers of each species per pellet or per collection were calculated and then totaled for inclusion in Table 1.

If detected, carrion was deleted, although carrion is a major source of food for eagles. Thus, Table 1 is an indication of the active predation of golden eagles. However, with domestic livestock and large herbivores, if a report presented data as "suspected kills" with some supportive evidence, the kills were included in the list, though many may have been carrion.

Over 94% of the prey items listed in Table 1 were collected during the nesting season, in or near eyries. One bias that results from the "seasonality" of golden eagle research is that the percentage of domestic livestock in the diet as herein reported is probably low. Eagles are most prone to sheep predation in early spring when natural prey populations are at their lowest levels and when lambing occurs. It is understandable that the remains of lambs and kids are seldom found in eagle eyries; when large nestling eagles are being fed, lambs are too large, and natural prey usually abounds.

Also, a continent-wide summary leads to some distortion depending on

where and how intensively golden eagles are studied. Since most data come from ranching country, a bias toward overrepresentation of the take of domestic livestock may exist, counter to the "seasonality" bias discussed above. Species such as the sage grouse, *Centrocercus urophasianus*, and the arctic ground squirrel, *Spermophilus undulatus*, definitely occur more often in the "published" diet of golden eagles than in the actual diet simply because of where studies have been conducted. Likewise, many species have been noted as prey but not recorded in the literature. Perhaps this paper will stimulate others to report their findings to give us a still better assessment of the economic impact of golden eagles.

RESULTS

The prey of North American golden eagles as reported in the literature is 83.9% mammals, 14.7% birds, 1.0% reptiles and 0.4% fish. No evidence of predation on amphibians or invertebrates was found. The numbers of recognized prey species include: mammals, 52; birds, 48; reptiles, five; and fish, two. The 10 most commonly reported species (and the percent of the total each represents) are as follows: black-tailed jackrabbit (24.5%), arctic ground squirrel (7.7%), white-tailed jackrabbit (7.6%), desert cottontail (4.8%), yellow-bellied marmot (3.7%), ring-necked pheasant (3.1%), sage grouse (2.5%), California ground squirrel (2.2%), black-billed magpie (2.0%) and Richardson ground squirrel (1.9%).

Major groupings of prey with widespread public interest (and the percent of the total each group represents) include the following: rabbits and hares (54.0%); marmots, ground squirrels and prairie dogs (21.8%); game birds (8.0%); hoofed mammals (4.4%); passerine birds (3.2%); deer (1.9%); domestic livestock (1.4%); mammalian predators (1.2%); avian predators (0.9%), and waterfowl (0.5%).

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Use of the Diatom *Terpsinoë musica* Ehrenb. (Biddulphiaceae) as Casemaking Material by *Nectopsyche* Larvae (Trichoptera: Leptoceridae)

ABSTRACT: The diatom *Terpsinoë musica* composed nearly the entire case, particularly of early instar larvae of *Nectopsyche* in the Altamaha River of S. Georgia and the Oklawaha River in Florida.