AN ABSTRACT OF THE THESIS OF

Robin E. Hunter for the degree of Master of Science in Wildlife Science presented on March 18, 1987

Title: Prey Selection by Peregrine Falcons during the Nestling Stage in Alaska

Redacted for Privacy

Abstract approved: John A. Crawford

Proper management of peregrine falcons (Falco peregrinus) includes management of its prey. Little quantitative data on prey selection by peregrine falcons have been collected. The objective of this study was to determine species and relative abundance of prey brought to eyries by peregrine falcons during the nestling stage and to compare these data with the relative abundance of birds along a portion of the Yukon River, Alaska. In 1985 and 1986, >55 taxa were identified during bird surveys. A total of 1536 individuals of 77 taxa were identified from prey remains. Of 47 prey taxa selected by frequency or biomass (taken in greater proportion than available), 8 were selected by frequency and biomass during both years (lesser yellowlegs; green-winged teal; solitary, upland and spotted sandpipers; Bonaparte's and mew gulls; and Bohemian waxwings). In addition gray jays and scaup, although not consistently selected, constituted a relatively large proportion of the diet. Riparian habitats (lakes, ponds, and rivers) produced the largest numbers of key prey and should be managed to maintain or enhance populations of prey.

Prey Selection by Peregrine Falcons during the Nestling Stage in Alaska

by

Robin E. Hunter

A THESIS

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Master of Science

Completed March 18, 1987

Commencement June 1987

APPROVED:

Redacted for Privacy

Associate Professor of Wildlife Ecology in charge of major

Redacted for Privacy

Head of Department of Fisheries and Wildlife

Redacted for Privacy

Dean of Graduate School

Date thesis is presented March 18, 1987

Typed by Robin E. Hunter

ACKNOWLEDGEMENTS

I am very grateful to Skip Ambrose for providing encouragement, assistance, advice, and support, which made this study possible. I thank Dr. John Crawford, my major professor, for thought-provoking discussion, editorial comments, guidance, and suggestions throughout my study. I appreciate study recommendations and critiques given to me by my committee members--Dr. Robert Anthony, Dr. Charles Henny, and Dr. Gordon Matzke. I am indebted to Paul Liedberg, U. S. Fish and Wildlife Service; Brina Kessel and Dan Gibson, University of Alaska; many U. S. Fish and Wildlife Service volunteers; and several National Park Service employees, including Mike Britten, Carol McIntyre, Ralph Moldenhauer, Bob Ratcliffe, and Steve Ulvi. All provided valuable field assistance or gave helpful suggestions on the project. I am very grateful to Kevin McGarigal and Kim Nelson for reviewing a draft of my thesis. My family also supplied much encouragement and understanding during this study. Last but certainly not least, I am very thankful to Barry Long for providing patient field assistance, encouragement when I most needed it, and constructive criticism on proposal and thesis drafts. This study was part of a co-operative education agreement between the U. S. Fish and Wildlife Service and Oregon State University.

TABLE OF CONTENTS

INTRODUCTION	1
STUDY AREA AND METHODS	3
Study Area	3
Prey Use	3
Prey Availability	6
Prey Selection	8
RESULTS AND DISCUSSION	9
Prey Use	9
Prey Availability	14
Prey Selection	15
MANAGEMENT IMPLICATIONS	19
LITERATURE CITED	20
APPENDICES	23

LIST OF TABLES

Table		Page
1.	Percent frequency and biomass of available prey and prey utilized by peregrine falcons along the Yukon River, Alaska, 1985 and 1986; prey listed in taxonomic order according to the American Ornithologists' Union (1983).	10
A.	Area (km^2) of 7 habitats within 3 km of peregrine falcon eyries that were successful in 1985 or 1986, Yukon River, Alaska.	23
B.	Number, biomass, percent, and positive selection of prey taken by peregrine falcons on the Yukon River, Alaska, 1985 and 1986.	24
C.	Bird densities in 7 habitats within 3 km of peregrine falcon eyries on the Yukon River, Alaska, 1985.	26
D.	Bird densities in 7 habitats within 3 km of peregrine falcon eyries on the Yukon River, Alaska, 1986.	28
E.	Number, biomass, and percent of birds available to peregrine falcons along the Yukon River, Alaska, 1985 and 1986.	30
F.	Bonferroni intervals and selection indices for all taxa recorded on transects or taken as prey by peregrine falcons on the Yukon River, Alaska, 1985 and 1986.	32
G.	Number of individuals of key prey utilized by peregrine falcons along the Yukon River, Alaska, 1985 and 1986; eyries listed in geographical order.	35

PREY SELECTION BY PEREGRINE FALCONS DURING THE NESTLING STAGE IN ALASKA

INTRODUCTION

Peregrine falcons (Falco peregrinus) are classified as endangered by the U. S. Fish and Wildlife Service (1986); therefore, an understanding of those factors that regulate populations is imperative to preserve the species. Food supply may regulate populations of peregrine falcons (Ratcliffe 1980) and in areas with suitable nesting sites, food supply may limit the distribution and density of nesting pairs (Bond 1936, Hickey 1942, Newton 1976). Population levels are dependent on the survival of young, hence food supply is especially important during the nestling stage.

Prey species utilized by peregrine falcons differ within and among regions (Ambrose and Riddle 1982a,b, Beebe 1960, Cade 1960, Parker 1979, Ratcliffe 1980, White 1975, White and Cade 1971). In Alaska peregrine falcons prey on more than 75 species, primarily birds (Ambrose and Riddle 1982a,b; Cade 1951, 1960; Cade et al. 1968; Ritchie 1979; White and Roseneau 1970). Although diets of peregrine falcons have been described, there is a paucity of quantitative data on prey selection (frequency or biomass of prey in the diet in relation to prey availability). Numbers of each species taken may reflect only prey abundance. In contrast, prey selection reveals those species taken in greater proportion than available.

Effective management of peregrine falcon populations includes management of adequate prey. Prey selection information provides managers with an effective method of identifying prey species towards which management may be directed. The objective of this study was to determine species and number of prey brought to eyries by peregrine falcons during the nestling stage and to compare these data with relative abundance of prey.

STUDY AREA AND METHODS

Study Area

The study was conducted along a 265-km portion of the Yukon River between the Alaska-Yukon Territory border and Circle, Alaska (Fig. 1). A large part of the study area was within the Yukon-Charley Rivers National Preserve. Land adjacent to the Yukon River ranges in elevation from 180-950m. Approximately 30 eyries existed on this section of river; eyries averaged 9 km apart.

Prey Use

In June, 1985 and 1986, active eyries (a pair of peregrine falcons present) were located by observing sites from a boat or the river bank. Successful eyries (at least 1 young surviving to fledging age) were determined in July and August.

Diets of peregrine falcons were determined from prey remains and castings (Errington 1930, 1932) collected at 16 successful eyries during each year (11 eyries were sampled in both years). To minimize loss of identifiable parts, prey remains were collected twice, once when young were approximately 3 weeks old and again after young fledged at approximately 6 1/2 weeks old. Remains accumulated during these 3-4 week periods. The 2 collections were combined to serve as a single sample of prey taken during the nestling stage. Except for 1 eyrie at which the pair nested unusually late in 1985, all first

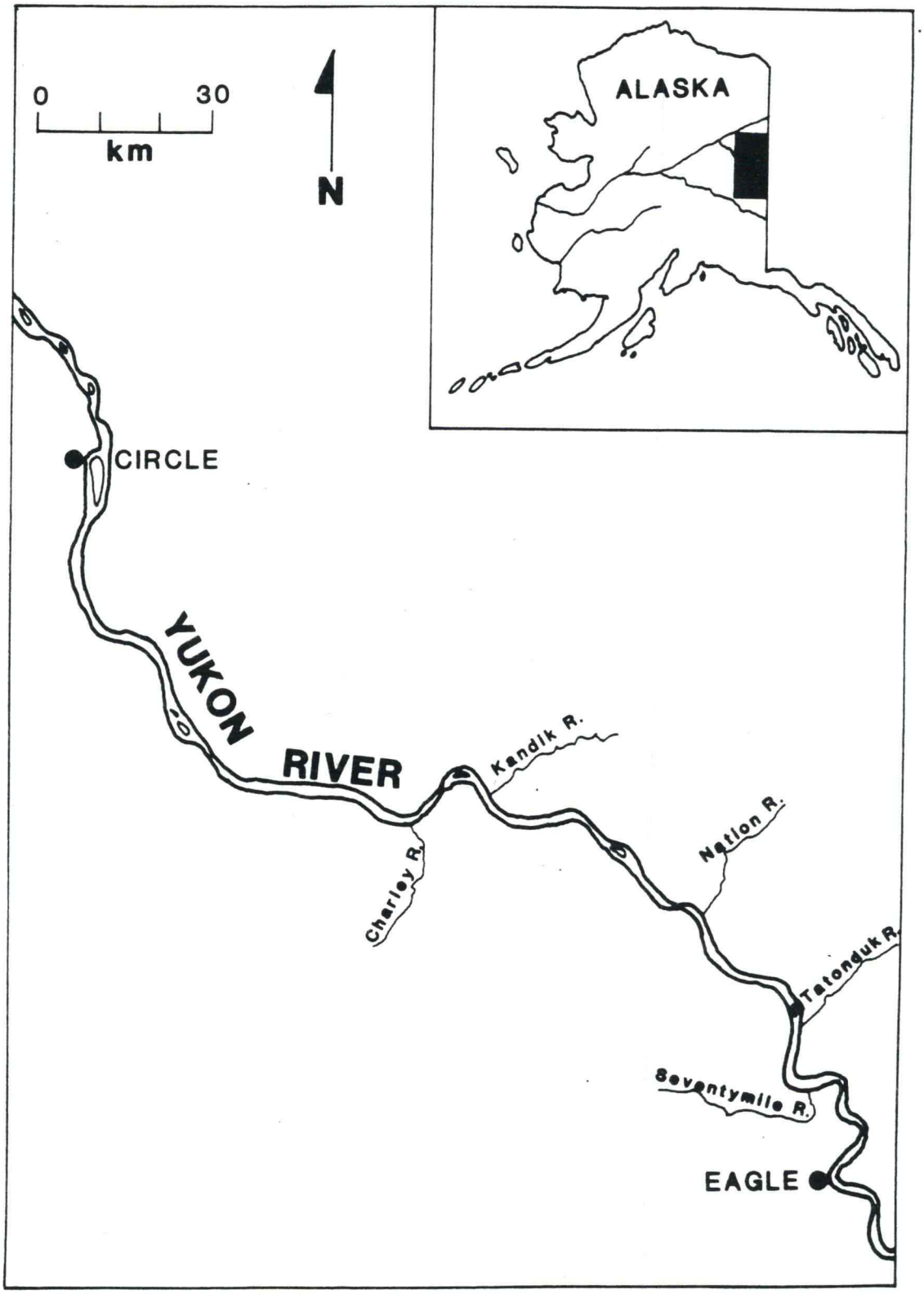

Figure 1. Map of study area.

collections were made 1-14 July and all second collections were made 1-10 August. Preliminary analyses revealed that mammalian hair (from Tamiascuirus hudsonicus, Lepus americanus, and Microtus spp.) occurred in 5% of the castings collected from two-thirds of the eyries; the bulk of the diet was birds, therefore, the study concentrated on avian prey.

Prey remains were identified by comparison of feathers, mandibles, feet, and other anatomical parts with museum specimens at the University of Alaska and the U. S. Fish and Wildlife Service collections in Fairbanks. Numbers of each species identified represented the minimum number taken. Birds that could not be identified to genus were not included in analysis except for swallows, which were represented by 2 species. In addition, 6 taxa were composed of 2 species of the same genus that could not be distinguished from the prey remains collected. Sightings of these species also were combined for availability estimates and selection values. The term "taxa" refers to individual species and groups of species. Percent biomass was estimated for all taxa; weights were obtained from Dunning (1984). Weights were averaged for combined species and for species that were sexually dimorphic in size. Pearson Chi-square goodness-of-fit tests and Mann-Whitney tests (Snedecor and Cochran 1967: 130-132) were used to test for differences in proportions and rank, respectively, of utilized prey between years. A variance ratio test (Zar 1974: 101-103) was used to test for differences in variance between years.

Prey Availability

Although peregrine falcons may forage up to 27 km from their eyries (Porter and White 1973), several investigators found that >50% of all foraging flights of peregrine falcons were within 3 km of their eyries (Ambrose pers. comm., Beebe 1974, Bird and Aubry 1982, Enderson and Kirven 1983); therefore, a sampling area around each eyrie was defined as a circular area with a radius of 3 km. To minimize variability on censuses, sampling areas were stratified into 7 habitats, adapted from descriptions by Kessel (1979) for Alaska. Classifications and percent of each habitat (1985 and 1986, respectively) were: lakes, ponds, and shorelines (1%, 2%); rivers and shorelines (19%, 18%); shrub (12%, 8%); deciduous forest (14%, 13%); coniferous forest (15%, 21%); mixed deciduous-coniferous forest (24%, 22%); and scattered woodlands (muskeg with scattered, dwarf black spruce, Picea mariana; 15%, 16%) (Appendix A). Color infrared photographs (1:63,000) were used to identify and delineate habitats in each sampling area. The area of each habitat was measured with a digitizer. Habitat maps were verified by visual inspection during June 1985.

To provide representative sampling along the river, the study area was divided into 3 sections. In each section, 1 transect was randomly located in each habitat. Transects in vegetated habitats were 1 km long and marked with wooden stakes and surveyor's flagging; river transects were 2 km long and were

censused from a drifting boat. Lakes were censused along 1-km sections of shorelines.

To quantify prey availability, bird censuses were conducted by 2 observers from 6 June to 11 August 1985 and from 2 June to 16 July 1986. The same transect lines were used in both years. Each transect was repeated 2-4 times per year. In each year, a minimum of 8 censuses were conducted in each vegetated habitat (i.e., shrubs and forests) and a minimum of 6 censuses were conducted in each open habitat (i.e., lakes and rivers). Fewer censuses were conducted in open habitats because bird counts were less variable than vegetated habitats. Censuses began at 0400 and ended by 0730 Alaska Standard Time. Birds actively using the habitat, or air space above, for activities such as foraging, display, or defense were recorded.

For vegetated habitats, the variable-width transect method (Emlen 1971) was employed to determine numbers of birds in each habitat. Birds were located by auditory and visual cues and perpendicular distances from transect lines to birds were estimated. Program TRANSECT (Burnham et al. 1980) was used to compute Fourier Series estimates of density for all taxa observed 10 or more times per habitat; taxa observed fewer than 10 times were assigned a minimum density of $0.1/km^2$. Bird counts in open habitats were considered complete censuses and densities were derived directly from the total area censused. Pearson Chi-square goodness-of-fit tests were used to test for differences in the proportions of prey available between years.

Prey Selection

To quantify prey selection by peregrine falcons, relative numbers of each prey taxon identified from all successful eyries were compared with abundance of birds within 3 km of all successful eyries in a year. Abundance of available birds was calculated by multiplying the density of a taxon in a habitat by the amount of that habitat within 3 km of each eyrie and summing the number available in all habitats in which that taxon occurred. Preliminary analyses revealed differences in prey abundance between years; therefore data from the 2 years were treated separately. Selection indices were calculated for all birds observed on bird transects or in the diet with a Bonferroni "family" of confidence intervals (Byers et al. 1984, Neu et al. 1974) from the formula:

$$\bar{p}_i \pm Z_{(\alpha/2k)}\sqrt{\bar{p}_i(1-\bar{p}_i)/n},$$

where,

p_i=proportion of the ith taxa utilized;
k=total number of taxa;
Z=standard normal table value; and
n=total number of birds utilized.

RESULTS AND DISCUSSION

Prey Use

In 1985 and 1986, 755 individuals of 65 taxa and 781 individuals of 70 taxa, respectively, were identified from prey remains collected at eyries (Table 1, Appendix B). Fifty-eight taxa were recorded in both years. Castings supplied little information because much of the material was unidentifiable and few individuals of species that could be identified from castings could be distinguished from those identified from prey remains. Thirty-five percent of the prey remains were from first collections and 65% were from second collections.

The 8 most frequently taken prey were lesser yellowlegs (22.8%, 15.4%), gray jays (13.6%, 5.1%), common snipe (5.3%, 3.8%), spotted sandpipers (4.8%, 5.0%), solitary sandpipers (3.3%, 4.0%), dark-eyed juncos (3.0%, 5.2%), Bohemian waxwings (3.0%, 3.5%), and Catharus thrushes (2.9%, 3.8%) in 1985 and 1986, respectively. Although numbers of lesser yellowlegs in the diet decreased from 1985 to 1986, the proportion of lesser yellowlegs in the diet remained greater than any other taxon.

Rank order of the 8 most frequently taken taxa did not differ significantly between years (Mann-Whitney $U = 34$, $P>0.20$), but proportions of these taxa differed significantly between years ($X^2 = 43.9$, 7 d.f., $P<0.001$). Gray jays and dark-eyed juncos contributed significantly to this difference ($X^2 = 18.8$, 1 d.f., $P<0.001$; $X^2 = 9.8$, 1 d.f, $P<0.005$, respectively).

Table 1. Percent frequency and biomass of available prey and prey utilized by peregrine falcons along the Yukon River, Alaska, 1985 and 1986; prey listed in taxonomic order according to the American Ornithologists' Union (1983).

PREY	Frequency				Biomass			
	1985		1986		1985		1986	
	% AVAILABLE	% TAKEN	% AVAILABLE	% TAKEN	% AVAILABLE	% TAKEN	% AVAILABLE	% TAKEN
Arctic Loon (Gavia arctica)	0.1	0	0.1	0	4.4	0	1.9	0
Horned Grebe (Podiceps auritus)	0.1	0.5	0.1	1.2	1.0	2.1 a	0.4	3.9 a
Red-necked Grebe (Podiceps grisegena)	0.1	0.1	0.1	0.1	0.2	1.2 a	0.1	1.0 a
Canada Goose (Branta canadensis)	0.1	0	0	0	1.4	0	0	0
Green-winged Teal (Anas crecca)	0.1	2.6 a	0.1	2.4 a	0.1	7.8 a	0.1	6.3 a
Mallard (Anas playrhynchos)	0.1	0	0.1	0.3	1.7	0	2.1	2.1
Northern Pintail (Anas acuta)	0.1	0.4	0.1	0.8	0.4	3.5 a	1.9	5.8 a
Blue-winged Teal (Anas discors)	0	0	0	0.1	0	0	0	0.4 a
Northern Shoveler (Anas clypeata)	0.1	0.5	0.1	1.2	0.5	2.8 a	0.3	5.3 a
American Wigeon (Anas americana)	0.3	0.5	0.1	0.3	5.1	3.5	1.0	1.5 a
Canvasback (Aythya valisineria)	0.1	0	0	0	0.2	0	0	0
Ring-necked Duck (Aythya collaris)	0.1	0	0.1	0	0.4	0	0.1	0
Scaup spp. (Aythya marila, A. affinis)	1.0	1.5	0.3	2.4 a	19.4	11.1	6.4	16.2
Harlequin Duck (Histrionicus histrionicus)	0	0.3	0	0	0	1.4 a	0	0
Surf Scoter (Melanitta perspicillata)	0.1	0.1	0.1	0.1	1.0	1.1	1.9	0.9
White-winged Scoter (Melanitta fusca)	0.2	0	0.1	0	4.4	0	3.2	0
Goldeneye spp. (Bucephala islandica, B. clangula)	0.1	0	0.1	0.3	0.7	0	0.8	1.7 a
Bufflehead (Bucephala albeola)	0.3	0.7	0.1	0.8	3.0	2.3	0.8	2.3 a
Bald Eagle (Haliaeetus leucocephalus)	0	0	0.1	0	0	0	0.7	0
Northern Harrier (Circus cyaneus)	0	0	0.1	0	0	0	0.1	0
Sharp-shinned Hawk (Accipiter striatus)	0.1	0.1	0	0.1	0.1	0.5 a	0	0.4 a
American Kestrel (Falco sparverius)	0.1	0.8	0.1	0.6	0.1	0.8 a	0.1	0.6 a
Spruce Grouse (Dendragapus canadensis)	0.1	0.1	0	0.1	0.2	0.5 a	0	0.5 a
Ruffed Grouse (Bonasa umbellus)	0.1	0	1.0	0	0.7	0	13.8	0
Rock Ptarmigan (Lagopus mutus)	0	0	0	0.1	0	0	0	0.4 a
American Coot (Fulica americana)	0	0.1	0	0.1	0	0.7 a	0	0.6 a
Sandhill Crane (Grus canadensis)	0	0	0.1	0	0	0	0.4	0
Black-bellied Plover (Pluvialis squatarola)	0	0.1	0	0	0	0.3 a	0	0
Lesser Golden-plover (Pluvialis dominica)	0	0.5	0	0.6	0	0.7 a	0	0.7 a
Semipalmated Plover (Charadrius semipalmatus)	0	0.5	0	0.3	0	0.2 a	0	0.1
Lesser Yellowlegs (Tringa flavipes)	0.1	22.8 a	0.1	15.4 a	0.1	15.9 a	0.1	9.4 a
Solitary Sandpiper (Tringa solitaria)	0	3.3 a	0.1	4.0 a	0	1.5 a	0.1	1.5 a
Spotted Sandpiper (Actitis macularia)	0.9	4.8 a	0.3	5.0 a	0.8	1.6 a	0.3	1.5 a
Upland Sandpiper (Bartramia longicauda)	0	2.4 a	0	2.7 a	0	3.5 a	0	3.4 a

Table. 1. Continued

PREY	Frequency				Biomass			
	1985		1986		1985		1986	
	% AVAILABLE	% TAKEN	% AVAILABLE	% TAKEN	% AVAILABLE	% TAKEN	% AVAILABLE	% TAKEN
Whimbrel (Numenius phaeopus)	0	0.1	0	0.3	0	0.4 a	0	0.7 a
Ruddy Turnstone (Arenaria interpres)	0	0	0	0.1	0	0	0	0.1 a
Surfbird (Aphriza virgata)	0	0.1	0	0.1	0	0.2 a	0	0.2 a
Semipalmated Sandpiper (Calidris pusilla)	0	0	0.1	0.1	0	0	0.1	0.1
Western Sandpiper (Calidris mauri)	0	0.1	0	0.3	0	0.1	0	0.1
Least Sandpiper (Calidris minutilla)	0	1.1	0	0.5	0	0.2 a	0	0.1
Baird's Sandpiper (Calidris bairdii)	0	0.1	0	0	0	0.1	0	0
Pectoral Sandpiper (Calidris melanotos)	0	0.7	0	0.4	0	0.4 a	0	0.2 a
Stilt Sandpiper (Calidris himantopus)	0	0.4	0	0	0	0.2 a	0	0
Long-billed Dowitcher (Limnodromus scolopaceus)	0	1.9 a	0	1.3	0	1.7 a	0	1.0 a
Common Snipe (Gallinago gallinago)	0.7	5.3 a	1.6	3.8	1.8	5.6 a	4.6	3.5
Red-necked Phalarope (Phalaropus lobatus)	0	0.1	0	0.6	0	0.1	0	0.2 a
Long-tailed Jaeger (Stercorarius longicaudus)	0	0.8	0	0.5	0	2.0 a	0	1.1 a
Bonaparte's Gull (Larus philadelphia)	0	1.6 a	0	2.2 a	0	2.9 a	0	3.5 a
Mew Gull (Larus canus)	0	1.6 a	0	2.8 a	0	5.5 a	0	8.6 a
Herring Gull (Larus argentatus)	0.1	0	0.1	0	2.8	0	0.7	0
Northern Hawk-Owl (Surnia ulula)	0	0	0.1	0	0	0	0.1	0
Boreal Owl (Aegolius funereus)	0.1	0	0	0	0.1	0	0	0
Arctic Tern (Sterna paradisaea)	0	0.4	0	0.4	0	0.4 a	0	0.3 a
Belted Kingfisher (Ceryle alcyon)	0.1	0.3	0	0.1	0.1	0.3 a	0	0.1 a
Woodpecker spp. (Picoides villosus, P. tridactylus)	0.1	0.5	0.8	1.0	0.1	0.3 a	1.2	0.5
Northern Flicker (Colaptes auratus)	0.1	0.7	0.1	1.3	0.1	0.8 a	0.1	1.4 a
Olive-sided Flycatcher (Contopus borealis)	0.1	0	0.6	0	0.1	0	0.4	0
Western Wood-Pewee (Contopus sordidulus)	0.1	0	0.1	0	0.1	0	0.1	0
Empidonax Flycatcher (E. alnorum, E. hammondii)	7.7	1.2	5.5	2.2	2.0	0.1	1.6	0.2
Say's Phoebe (Sayornis saya)	0.1	0	0.1	0.1	0.1	0	0.1	0.1
Horned Lark (Eremophila alepestris)	0	0.1	0	0	0	0.1	0	0
Swallow spp. (Tachycineta thalassina, Riparia riparia)	9.5	2.4	12.1	2.8	3.1	0.3	4.4	0.3
Gray Jay (Perisoreus canadensis)	6.3	13.6 a	6.8	5.1	9.6	8.4	11.5	2.7
Common Raven (Corvus corax)	0.1	0	0.1	0	2.0	0	0.7	0
Chickadee spp. (Parus atricapillus, P. hudsonicus)	7.8	1.2	6.6	1.2	1.9	0.1	1.7	0.1
Ruby-crowned Kinglet (Regulus calendula)	0.1	0.5	1.5	0.8	0.1	0.1	0.2	0.1
Mountain Bluebird (Sialia currucoides)	0	0.1	0	0.1	0	0.1	0	0.1
Townsend's Solitaire (Myadestes townsendi)	0.1	0.7	0.1	0.4	0.1	0.2	0.1	0.1

Table. 1. Continued

PREY	Frequency				Biomass			
	1985		1986		1985		1986	
	% AVAILABLE	% TAKEN	% AVAILABLE	% TAKEN	% AVAILABLE	% TAKEN	% AVAILABLE	% TAKEN
Catharus Thrush (C. ustulatus, C. minimus)	17.0	2.9	17.7	3.8	11.8	0.8	13.6	0.9
American Robin (Turdus migratorius)	0.8	1.5	0.1	2.7 a	1.4	1.0	0.1	1.6 a
Varied Thrush (Ixoreus naevius)	0.1	1.7	2.2	2.2	0.1	1.2 a	4.1	1.3
Bohemian Waxwing (Bombycilla garrulus)	0.1	3.0 a	0.1	3.5 a	0.1	1.5 a	0.1	1.5 a
Northern Shrike (Lanius excubitor)	0	0	0	0.4	0	0	0	0.2 a
Orange-crowned Warbler (Vermivora celata)	1.3	0.1	2.5	0.4	0.3	0.1	0.5	0.1
Yellow Warbler (Dendroica petechia)	15.9	1.5	5.0	1.8	3.4	0.1	1.2	0.1
Magnolia Warbler (Dendroica magnolia)	0	0	0	0.1	0	0	0	0.1
Yellow-rumped Warbler (Dendroica coronata)	0.1	0.3	2.4	3.3	0.1	0.1	0.7	0.3
Townsend's Warbler (Dendroica townsendi)	0.1	0	5.3	0.3	0.1	0	1.1	0.1
Blackpoll Warbler (Dendroica striata)	0.1	0	0.1	0.3	0.1	0	0.1	0.1
Northern Waterthrush (Seirus noveboracensis)	1.1	0.3	4.4	0.3	0.4	0.1	1.9	0.1
Wilson's Warbler (Wilsonia pusilla)	0.1	0	0	0	0.1	0	0	0
American Tree Sparrow (Spizella arborea)	0	0.3	0	0	0	0.1	0	0
Chipping Sparrow (Spizella passerina)	0	0	0.1	0	0	0	0.1	0
Savannah Sparrow (Passerculus sandwichensis)	3.4	0.4	5.7	0.8	1.5	0.1	2.7	0.1
Fox Sparrow (Passerella iliaca)	2.6	0.7	1.7	0.4	1.8	0.2	1.3	0.1
Lincoln's Sparrow (Melspiza lincolnii)	9.5	0	3.2	0.4	3.5	0	1.3	0.1
White-crowned Sparrow (Zonotrichia leucophrys)	4.9	1.3	6.4	1.2	2.8	0.3	4.0	0.2
Dark-eyed Junco (Junco hyemalis)	7.3	3.0	4.3	5.2	3.2	0.5	2.1	0.8
Lapland Longspur (Calcarius lapponicus)	0	0.5	0	0	0	0.1 a	0	0
Rusty Blackbird (Euphagus carolinus)	0.1	0.1	1.2	0.8	0.1	0.1	1.7	0.3
Pine Grosbeak (Pinicola enucleator)	0	0.1	0.0	0.1	0	0.1	0	0.1
White-winged Crossbill (Loxia leucoptera)	0.1	2.8 a	0.1	1.8	0.1	0.6 a	0.1	0.4 a
Common Redpoll (Carduelis flammea)	0.1	0.7	0.1	2.6 a	0.1	0.1	0.1	0.3 a
Pine Siskin (Carduelis pinus)	0	0.3	0	0.4	0	0.1	0	0.1
PERCENT TOTAL	102.2 b	100.0	102.4 b	100.0	101.0 b	100.7	101.0	100.8
TOTAL INDIVIDUALS	51592	755	124020	781				
TOTAL BIOMASS (kg)					2378.8	87.4	5182.3	103.6
OTHER:								
Anatidae		2		5				
Scolopacidae		2		12				
Laridae		3		4				
Emberizidae		0		2				
Passeridae		2		1				
Unidentified Passeriformes		3		3				

[a] Taxa taken in greater proportion than available.
[b] Rounding error resulted in totals greater than 100%.

Peregrine falcons distributed use more evenly over more taxa in 1986 than in 1985.

Estimated biomass of prey collected from eyries was greater in 1986 than in 1985 (Table 1), although numbers of young reared were similar (40 young in 1985 and 41 young in 1986). Average prey weight was slightly greater in 1986 (133 g) than in 1985 (116 g). In each year, 6 taxa composed approximately 50% of the biomass consumed by peregrine falcons. Taxa that composed a large proportion of the diet by biomass in both years included scaup (11.1%, 16.2%), green-winged teal (7.8%, 6.3%), lesser yellowlegs (15.9%, 9.4%), and mew gulls (5.5%, 8.6%). Four species that constituted a relatively large portion of the biomass in 1 year included northern pintails (3.5%, 5.8%), northern shovelers (2.8%, 5.3%), common snipe (5.6%, 3.5%), and gray jays (8.4%, 2.7%). Heavier birds such as waterfowl were taken less frequently than other taxa yet contributed greatly to biomass.

Ninety-eight percent of the prey remains were identified; in 1985 and 1986, 12 and 27 individuals, respectively, were not identified to genus. In both years, two-thirds of these were small birds (small sandpipers, warblers, sparrows, and other passerines).

Of the prey identified in the diet during the study, more than 68% of the total number of prey taxa, 77% of the total prey biomass, and 80% of the total number of individuals, were taxa that were observed on bird censuses. In both years, 26 taxa consumed by peregrine falcons were not observed on bird censuses.

Of these 26, more than one-third occurred in alpine and tundra areas that were not within 3 km of eyries. Most of the other species not detected on bird censuses but found in the diet of peregrine falcons were rare or localized species (e.g., magnolia warblers and mountain bluebirds). Average prey weight was greater for prey that occurred in alpine and tundra habitat (160 g in 1985 and 163 g in 1986), presumably taken beyond 3 km from eyries, than those taxa found in habitats closer to eyries (112 g in 1985 and 131 g in 1986). Energy gained from heavier prey, as well as the relative ease of capture in open alpine habitats, probably compensated for the energy expended in flying longer distances to obtain prey.

Prey Availability

In 1985 and 1986, 58 and 57 taxa, respectively, were identified during bird surveys (Appendices C, D). Fifty taxa (80%) were recorded in both years. A few taxa composed a large proportion of the total number of available birds (Table 1, Appendix E). The most abundant birds in both years were Catharus thrushes (17.0%, 17.7%), swallows (9.5%, 12.1%), gray jays (6.3%, 6.8%), chickadees (7.8%, 6.6%), and dark-eyed juncos (7.3%, 4.3%) (1985 and 1986, respectively). Total number of birds available to peregrine falcons was greater in 1986 than in 1985. Eight taxa (14%) were responsible for 75% of the difference in total number of available prey between years. Similarly, total biomass of available birds also was greater in 1986 than in 1985. Scaup,

American wigeon, ruffed grouse, gray jays, and Catharus thrushes were available in the largest proportions by biomass.

Prey Selection

Of 83 taxa detected in prey remains or on bird censuses during both years of study, 12 (14%) in 1985 and 11 (13%) in 1986 were taken more frequently than they occurred within 3 km of eyries (Table 1). In 1985 and 1986, 42 (51%) and 47 (57%) taxa, respectively, were taken in proportions equal to their availability, and 29 (35%) and 25 (30%) taxa, respectively, were taken in proportions less than their relative abundance (Appendix F). Many of the latter were not detected in prey remains. Sandpipers and passerines composed most of the taxa selected by frequency. Proportions of 15 taxa taken in greater proportion than available in at least 1 year were significantly different between years (X^2 = 54.7, 14 d.f., $P<0.001$) due to differences in 5 species (lesser yellowlegs, gray jay, mew gull, American robin, and common redpoll). However, proportions of the 8 taxa selected in both years (Table 1) were not significantly different (X^2 = 13.6, 7 d.f., $P<0.10$).

Selection analyses based on biomass differed from those based on frequency. In both years, approximately one-half of the taxa were taken in greater proportion than available by biomass. Proportions by biomass of 34 taxa (41%) were taken less than available; 13 to 14 taxa (16-17%) were consumed in proportion to their abundance (Appendix F). Most of the prey selected by

biomass but not by frequency were waterfowl or species not detected on bird surveys. More than two-thirds of the 26 species not detected on bird surveys were selected by biomass whereas only 3 to 5 of these species were selected by frequency. Eight taxa composed the remainder of prey selected by biomass but not frequency (belted kingfishers, woodpeckers, northern flickers, varied thrushes, white-winged crossbills, sharp-shinned hawks, American kestrels, and spruce grouse). All but two species, gray jays and scaup, that were selected by frequency also were selected by biomass. In 1985 and 1986, the average weight of prey selected by biomass (119 g and 161 g, respectively) was greater than the overall average prey weight (116 g and 133 g, respectively) and the average prey weight of species selected by frequency (100 g and 157 g, respectively).

Selection of particular prey species likely was influenced by a combination of factors that included prey habitat, susceptibility, abundance, behavior, physical characteristics of the prey, and predator characteristics such as hunting ability (Ratcliffe 1980). Prey that flew through open habitats or above forest canopy (e.g., spotted sandpipers and gray jays), nested or fed in open habitats (e.g., Bonaparte's gull, upland sandpiper, and green-winged teal), perched in tree tops (e.g., lesser yellowlegs, Bohemian waxwings, and mew gulls), or performed high aerial displays (e.g., common snipe) possibly were more susceptible to predation by peregrine falcons. Cade (1951) surmised that the frequency of woodland species in the diet of peregrine

falcons in Alaska resulted from these birds attempting to fly over open water. Prey behavior may provide additional opportunities for capture by peregrine falcons. Calling, flocking, flight speed, and escape tactics may cause certain species to be taken. Peregrine falcons may take prey with obvious flash patterns (Cade 1982, Craighead and Craighead 1956). The specula of waterfowl, white wing patches of spotted sandpipers, and overall white color of gulls may attract the attention of peregrine falcons. Also, prey size may affect selection by peregrine falcons.

This study confirmed that a wide range of species are utilized by peregrine falcons. However, principal prey species differed from those identified in other regions. For example, in Great Britain, red grouse (Lagopus lagopus) and rock doves (Columba livia) composed a large part of the diet (Ratcliffe 1980). Along the coast of British Columbia, peregrine falcons consumed mainly 4 species of seabirds (Beebe 1960). In Greenland, 4 species of passerines composed the bulk of the diet and all prey were common species (Burnham and Mattox 1984), whereas in this study many prey were not abundant species.

Results of this study revealed that 8 species of prey were selected on the basis of frequency and biomass during both years; these species contributed 38.0-42.1% of the diet by frequency and 35.7-40.2% of the diet by biomass. In addition, gray jays and scaup constituted a relatively large proportion of the diet; although they were not consistently selected, they should be considered as important prey. Frequency of occurrence in the diet

of gray jays was 13.6% and 5.1% in 1985 and 1986, respectively, and scaup contributed 11.1% and 16.2% of the diet by biomass in 1985 and 1986, respectively. The 8 selected species and gray jays and scaup were considered key prey of peregrine falcons.

There was little variation in the proportion of key prey species utilized among pairs of peregrine falcons (Appendix G). However, lesser yellowlegs composed greater than average proportions of the diets of 4 pairs in both years (35-47% of their diets compared to an average of 15% for other pairs in 1985 and 21-42% compared to an average of 8% in 1986). Also, in 1985 gray jays composed 41% of the diet of 1 pair of peregrine falcons, which was much greater than the average of 12% for other pairs. Within years, all other key prey species composed similar proportions in the diet of each peregrine falcon pair. There was no geographical relationship in prey consumed with few exceptions; similar numbers of key prey species were taken by all pairs of peregrine falcons. There was little variation between years in numbers of key prey utilized; only gray jays and spotted sandpipers differed significantly between years ($F=5.6$ and 4.2, respectively, 15 d.f., $P<0.05$). Key prey species were used consistently by peregrine falcons within and between years.

MANAGEMENT IMPLICATIONS

The U. S. Fish and Wildlife Service (1980) stated that management of peregrine falcons should include management of principal prey habitats. I concluded from the results of this study that the 8 consistently selected prey and 2 other taxa that contributed substantially to frequency or biomass should be considered key prey of peregrine falcons along the Yukon River. Seven of these taxa (lesser yellowlegs; spotted and solitary sandpipers; Bonaparte's and mew gulls; green-winged teal; and scaup) primarily or exclusively inhabit riparian areas (lakes, ponds, and rivers). Lesser yellowlegs also were found in scattered woodlands. Upland sandpipers occurred in scattered woodlands and alpine habitat, whereas Bohemian waxwings and gray jays were widely distributed in forested habitats.

Of the 7 habitats studied, the least common around peregrine falcon eyries was lakes and ponds (1-2%) and the most common was mixed coniferous-deciduous forests (22-24%). Lakes and ponds are relatively scarce, valuable to many key prey of peregrine falcons, and are especially crucial to protect from disturbances and alterations. Scattered woodlands should be managed to maintain prey populations especially lesser yellowlegs, the principal prey item of peregrine falcons along the Yukon River in Alaska.

LITERATURE CITED

Ambrose, R. E., and K. E. Riddle. 1982a. The status of peregrine falcons along the upper Yukon River, Alaska, and blood sampling of peregrine falcons in interior Alaska for toxicological analysis, 1981. Unpubl. U. S. Fish and Wildl. Serv. Rep. 19pp.

-----, and -----. 1982b. The status of peregrine falcons along the upper Yukon River, Alaska, and blood sampling of peregrine falcons in interior Alaska for toxicological analysis, 1982. Unpubl. U. S. Fish and Wildl. Serv. Rep. 20pp.

American Ornithologists' Union. 1983. Check-list of North American birds. 6th edition. Allen Press, Inc., Lawrence, Kansas. 877pp.

Beebe, F. L. 1960. The marine peregrine of the northwest Pacific coast. Condor 62:145-189.

-----. 1974. Field studies of the Falconiformes of British Columbia. B. C. Provincial Mus. Occ. Pap. No. 17. 163pp.

Bird, D. M., and Y. Aubry. 1982. Reproductive and hunting behavior in peregrine falcons, Falco peregrinus, in southern Quebec. Can. Field-Nat. 96:167-171.

Bond, R. M. 1936. Eating habits of falcons with special reference to pellet analysis. Condor 38:72-76.

Burnham, K. P., D. R. Anderson, and J. L. Laake. 1980. Estimation of density from line transect sampling of biological populations. Wildl. Monogr. 72. 202pp.

Burnham, W. A., and W. G. Mattox. 1984. Biology of the peregrine and gyrfalcon in Greenland. Meddr. Gronland, Biosci. 14, 1984. 25pp.

Byers, C. R., R. K. Steinhorst, and P. R. Krausman. 1984. Clarification of a technique for analysis of utilization-availability data. J. Wildl. Manage. 48:1050-1053.

Cade, T. J. 1951. Food of the peregrine falcon, Falco peregrinus, in interior Alaska. Auk 68:373-374.

-----. 1960. Ecology of the peregrine and gyrfalcon populations in Alaska. Univ. of Calif. Publ. in Zool., 63, no. 3. Pages 151-290.

-----. 1982. The falcons of the world. Comstock/Cornell Univ. Press. Ithaca, N. Y. 188pp.

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

Craighead, J. J., and F. C. Craighead. 1956. Hawks, owls and wildlife. Stockpole Co. and Wildl. Manage. Inst., Harrisburg, Pa. 443pp.

Dunning, J. B., Jr. 1984. Body weights of 686 species of North American birds. West. Bird Banding Assoc. Monogr. 1. 38pp.

Emlen, J. T. 1971. Population densities of birds derived from transect counts. Auk 88:323-342.

Enderson, J. H., and M. N. Kirven. 1983. Flights of nesting peregrine falcons recorded by telemetry. Raptor Res. 17:33-37.

Errington, P. L. 1930. The pellet analysis method of raptor food habits study. Condor 32:292-296.

-----. 1932. Technique of raptor food habits study. Condor 34:75-86.

Hickey, J. J. 1942. Eastern population of the duck hawk. Auk 59:176-204.

Kessel, B. 1979. Avian habitat classification of Alaska. Murrelet 60:86-94.

Neu, C. W., C. R. Byers, and J. M. Peek. 1974. A technique for analysis of utilization-availability data. J. Wildl. Manage. 38:541-545.

Newton, I. 1976. Population limitation in diurnal raptors. Can. Field-Nat. 90:274-300.

Parker, A. 1979. Peregrines at a Welsh coastal eyrie. Br. Birds 72:104-114.

Porter, R. D., and C. M. White. 1973. The peregrine falcon in Utah, emphasizing ecology and competition with the prairie falcon. Brigham Young Univ. Science Bull. 18:1-74.

Ratcliffe, D. 1980. The peregrine falcon. Buteo Books, Vermillion, S. D. 416pp.

Ritchie, R. J. 1979. Prey of the peregrine falcon (Falco peregrinus anatum) on the upper Yukon River, Alaska, 1977-78. Unpubl. rep. to U. S. Fish and Wildl. Serv. 23pp.

Snedecor, G. W., and W. G. Cochran. 1967. Statistical methods, 6th ed. Iowa State Univ. Press, Ames, Iowa. 593pp.

U. S. Fish and Wildlife Service. 1980. Recovery plan for the peregrine falcon--Alaska population. U. S. Fish and Wildl. Serv. Rep. 69pp.

-----. 1986. Endangered and threatened wildlife and plants. U. S. Gov. Printing Off., Wash. D. C. 30pp.

White, C. M. 1975. Studies on peregrine falcons in the Aleutian Islands. Raptor Res. Rep. 3:33-50.

-----, and T. J. Cade. 1971. Cliff-nesting raptors and ravens along the Colville River in arctic Alaska. Living Bird 10:107-150.

-----, and D. G. Roseneau. 1970. Observations on food, nesting, and winter populations of large North American falcons. Condor 72:113-115.

Zar, J. H. 1974. Biostatistical analysis. Prentice-Hall, Inc., Englewood Cliffs, New Jersey. 620pp.

APPENDICES

Appendix A. Area (km^2) of 7 habitats within 3 km of peregrine falcon eyries that were successful in 1985 or 1986, Yukon River, Alaska.

Eyrie Name	Area (km^2)							
	Ponds, Lakes	River	Shrub	Decid. Forest	Conif. Forest	Mixed Forest	Scattered Woodland	Total
1985 only:								
19-mile	0.3	7.5	3.1	2.9	1.9	9.8	3.0	28.3
Thanksgiving Crk.	0.0	8.0	3.1	2.5	3.3	7.5	3.8	28.3
Biederman's	0.3	5.2	0.5	8.9	2.1	6.0	5.3	28.3
Nation Bluff	0.2	3.5	13.6	2.0	1.4	4.7	3.0	28.3
Eagle Bluff	0.0	3.4	2.5	5.5	4.6	8.7	3.6	28.3
1985 and 1986:								
7-mile	1.7	6.7	5.7	1.7	1.0	9.1	2.5	28.3
10-mile	1.1	6.3	0.3	3.6	1.1	10.3	5.6	28.3
13-mile	0.4	5.9	4.5	5.2	1.7	10.3	0.4	28.3
Woodchopper+3	0.1	5.5	1.3	1.7	10.6	3.0	6.2	28.3
McGregor's	0.6	5.5	1.8	1.8	11.0	4.6	3.1	28.3
Sam Creek	1.3	5.7	1.6	4.0	5.0	4.1	6.7	28.3
Kathul	0.2	4.1	4.6	5.9	3.7	8.0	1.8	28.3
Glenn Creek	0.3	5.1	5.0	2.5	1.9	5.2	8.3	28.3
Nation Cabin	0.1	4.6	2.9	3.2	6.5	5.1	5.9	28.3
Trout Creek	0.1	4.6	2.1	3.8	6.1	7.8	3.9	28.3
Border+2	0.0	2.9	0.3	7.6	7.2	5.4	4.9	28.3
1986 only:								
Takoma Bluff	0.7	6.2	3.0	3.5	2.8	6.5	5.7	28.3
Takoma Creek	0.1	6.7	2.6	4.7	3.4	7.1	3.7	28.3
Webber Creek	0.1	5.1	1.3	1.8	11.5	6.3	2.2	28.3
Woodchopper Crk.	0.3	5.1	0.9	5.4	11.2	3.5	2.0	28.3
Seventy-mile	0.2	3.7	0.0	2.0	9.7	2.7	10.0	28.3
TOTAL--1985	6.5	84.5	52.8	62.6	69.0	109.6	67.8	452.8
TOTAL--1986	7.0	83.7	37.9	58.2	94.5	98.7	72.8	452.8
PERCENT--1985	1	19	12	14	15	24	15	100
PERCENT--1986	2	18	8	13	21	22	16	100
AVERAGE--1985	0.4	5.3	3.3	3.9	4.3	6.8	4.2	
AVERAGE--1986	0.4	5.2	2.4	3.6	5.9	6.2	4.5	

Appendix B. Number, biomass, percent, and positive selection of prey taken by peregrine falcons on the Yukon River, Alaska, 1985 and 1986.

Taxa	Frequency				Biomass			
	1985		1986		1985		1986	
	No.	%	No.	%	Grams	%	Grams	%
Horned Grebe (Podiceps auritus)	4	0.5	9	1.2	1812	2.1 a	4077	3.9 a
Red-necked Grebe (Podiceps grisegena)	1	0.1	1	0.1	1023	1.2 a	1023	1.0 a
Green-winged Teal (Anas crecca)	20	2.6 a	19	2.4 a	6820	7.8 a	6479	6.3 a
Mallard (Anas playrhynchos)	0	0.0	2	0.3	0	0.0	2164	2.1
Northern Pintail (Anas acuta)	3	0.4	6	0.8	3030	3.5 a	6060	5.8 a
Blue-winged Teal (Anas discors)	0	0.0	1	0.1	0	0.0	386	0.4 a
Northern Shoveler (Anas clypeata)	4	0.5	9	1.2	2452	2.8 a	5517	5.3 a
American Wigeon (Anas americana)	4	0.5	2	0.3	3020	3.5	1510	1.5 a
Scaup spp. (Aythya spp.)	11	1.5	19	2.4 a	9713	11.1	16777	16.2
Harlequin Duck (Histrionicus histrionicus)	2	0.3	0	0.0	1244	1.4 a	0	0.0
Surf Scoter (Melanitta perspicillata)	1	0.1	1	0.1	950	1.1	950	0.9
Goldeneye spp. (Bucephala spp.)	0	0.0	2	0.3	0	0.0	1810	1.7 a
Bufflehead (Bucephala albeola)	5	0.7	6	0.8	2015	2.3	2418	2.3 a
Sharp-shinned Hawk (Accipiter striatus)	1	0.1	1	0.1	461	0.5 a	461	0.4 a
American Kestrel (Falco sparverius)	6	0.8	5	0.6	690	0.8 a	575	0.6 a
Spruce Grouse (Dendragapus canadensis)	1	0.1	1	0.1	474	0.5 a	474	0.5 a
Rock Ptarmigan (Lagopus mutus)	0	0.0	1	0.1	0	0.0	425	0.4 a
American Coot (Fulica americana)	1	0.1	1	0.1	642	0.7 a	642	0.6 a
Black-bellied Plover (Pluvialis squatarola)	1	0.1	0	0.0	220	0.3 a	0	0.0
Lesser Golden-plover (Pluvialis dominica)	4	0.5	5	0.6	580	0.7 a	725	0.7 a
Semipalmated Plover (Charadrius semipalmatus)	4	0.5	2	0.3	184	0.2 a	92	0.1
Lesser Yellowlegs (Tringa flavipes)	172	22.8 a	120	15.4 a	13932	15.9 a	9720	9.4 a
Solitary Sandpiper (Tringa solitaria)	25	3.3 a	31	4.0 a	1275	1.5 a	1581	1.5 a
Spotted Sandpiper (Actitis macularia)	36	4.8 a	39	5.0 a	1440	1.6 a	1560	1.5 a
Upland Sandpiper (Bartramia longicauda)	18	2.4 a	21	2.7 a	3042	3.5 a	3549	3.4 a
Whimbrel (Numenius phaeopus)	1	0.1	2	0.3	379	0.4 a	758	0.7 a
Ruddy Turnstone (Arenaria interpres)	0	0.0	1	0.1	0	0.0	129	0.1 a
Surfbird (Aphriza virgata)	1	0.1	1	0.1	194	0.2 a	194	0.2 a
Semipalmated Sandpiper (Calidris pusilla)	0	0.0	1	0.1	0	0.0	28	0.1
Western Sandpiper (Calidris mauri)	1	0.1	2	0.3	23	0.1	46	0.1
Least Sandpiper (Calidris minutilla)	8	1.1	4	0.5	168	0.2 a	84	0.1
Baird's Sandpiper (Calidris bairdii)	1	0.1	0	0.0	39	0.1	0	0.0
Pectoral Sandpiper (Calidris melanotos)	5	0.7	3	0.4	365	0.4 a	219	0.2 a
Stilt Sandpiper (Calidris himantopus)	3	0.4	0	0.0	174	0.2 a	0	0.0
Long-billed Dowitcher (Limnodromus scolopaceus)	14	1.9 a	10	1.3	1456	1.7 a	1040	1.0 a
Common Snipe (Gallinago gallinago)	40	5.3 a	30	3.8	4880	5.6 a	3660	3.5
Red-necked Phalarope (Phalaropus lobatus)	1	0.1	5	0.6	33	0.1	165	0.2 a
Long-tailed Jaeger (Stercorarius longicaudus)	6	0.8	4	0.5	1782	2.0 a	1188	1.1 a
Bonaparte's Gull (Larus philadelphia)	12	1.6 a	17	2.2 a	2544	2.9 a	3604	3.5 a
Mew Gull (Larus canus)	12	1.6 a	22	2.8 a	4836	5.5 a	8866	8.6 a

Appendix B. Continued.

Taxa	Frequency				Biomass			
	1985		1986		1985		1986	
	No.	%	No.	%	Grams	%	Grams	%
Arctic Tern (Sterna paradisaea)	3	0.4	3	0.4	330	0.4 a	330	0.3 a
Belted Kingfisher (Ceryle alcyon)	2	0.3	1	0.1	296	0.3 a	148	0.1 a
Woodpecker spp. (Picoides spp.)	4	0.5	8	1.0	264	0.3 a	528	0.5
Northern Flicker (Colaptes auratus)	5	0.7	10	1.3	710	0.8 a	1420	1.4 a
Empidonax Flycatcher	9	1.2	17	2.2	108	0.1	204	0.2
Say's Phoebe (Sayornis saya)	0	0.0	1	0.1	0	0.0	21	0.1
Horned Lark (Eremophila alpestris)	1	0.1	0	0.0	32	0.1	0	0.0
Swallow spp. (Tachycineta sp., Riparia sp.)	18	2.4	22	2.8	270	0.3	330	0.3
Gray Jay (Perisoreus canadensis)	103	13.6 a	40	5.1	7313	8.4	2840	2.7
Chickadee spp. (Parus spp.)	9	1.2	9	1.2	99	0.1	99	0.1
Ruby-crowned Kinglet (Regulus calendula)	4	0.5	6	0.8	28	0.1	42	0.1
Mountain Bluebird (Sialia currucoides)	1	0.1	1	0.1	28	0.1	28	0.1
Townsend's Solitaire (Myadestes townsendi)	5	0.7	3	0.4	170	0.2	102	0.1
Catharus Thrush	22	2.9	30	3.8	704	0.8	960	0.9
American Robin (Turdus migratorius)	11	1.5	21	2.7 a	847	1.0	1617	1.6 a
Varied Thrush (Ixoreus naevius)	13	1.7	17	2.2	1014	1.2 a	1326	1.3
Bohemian Waxwing (Bombycilla garrulus)	23	3.0 a	27	3.5 a	1288	1.5 a	1512	1.5 a
Northern Shrike (Lanius excubitor)	0	0.0	3	0.4	0	0.0	198	0.2 a
Orange-crowned Warbler (Vermivora celata)	1	0.1	3	0.4	9	0.1	27	0.1
Yellow Warbler (Dendroica petechia)	11	1.5	14	1.8	110	0.1	140	0.1
Magnolia Warbler (Dendroica magnolia)	0	0.0	1	0.1	0	0.0	9	0.1
Yellow-rumped Warbler (Dendroica coronata)	2	0.3	26	3.3	24	0.1	312	0.3
Townsend's Warbler (Dendroica townsendi)	0	0.0	2	0.3	0	0.0	18	0.1
Blackpoll Warbler (Dendroica striata)	0	0.0	2	0.3	0	0.0	26	0.1
Northern Waterthrush (Seirus noveboracensis)	2	0.3	2	0.3	36	0.1	36	0.1
American Tree Sparrow (Spizella arborea)	2	0.3	0	0.0	40	0.1	0	0.0
Savannah Sparrow (Passerculus sandwichensis)	3	0.4	6	0.8	60	0.1	120	0.1
Fox Sparrow (Passerella iliaca)	5	0.7	3	0.4	160	0.2	96	0.1
Lincoln's Sparrow (Melspiza lincolnii)	0	0.0	3	0.4	0	0.0	51	0.1
White-crowned Sparrow (Zonotrichia leucophrys)	10	1.3	9	1.2	260	0.3	234	0.2
Dark-eyed Junco (Junco hyemalis)	23	3.0	41	5.2	460	0.5	820	0.8
Lapland Longspur (Calcarius lapponicus)	4	0.5	0	0.0	108	0.1 a	0	0.0
Rusty Blackbird (Euphagus carolinus)	1	0.1	6	0.8	59	0.1	354	0.3
Pine Grosbeak (Pinicola enucleator)	1	0.1	1	0.1	56	0.1	56	0.1
White-winged Crossbill (Loxia leucoptera)	21	2.8 a	14	1.8	546	0.6 a	364	0.4 a
Common Redpoll (Carduelis flammea)	5	0.7	20	2.6 a	65	0.1	260	0.3 a
Pine Siskin (Carduelis pinus)	2	0.3	3	0.4	30	0.1	45	0.1
TOTAL	755	100.0	781	100.0	87416	100.7	103629	100.8
OTHER:								
Anatidae	2		5					
Scolopacidae	2		12					
Laridae	3		4					
Emberizidae	0		2					
Passeridae	2		1					
Unidentified Passeriformes	3		3					

[a]Taxa taken in greater proportion than available.

Appendix C. Bird densities in 7 habitats within 3 km of peregrine falcon eyries on the Yukon River, Alaska, 1985.

Taxa	Density (birds/km^2)								
	Ponds, Lakes	River	Shrub	Decid. Forest	Conif. Forest	Mixed Forest	Scattered Woodland	Total	Percent
Arctic Loon	9.7	0	0	0	0	0	0	9.7	1.0
Horned Grebe	8.4	0	0	0	0	0	0	8.4	0.9
Red-necked Grebe	0.7	0	0	0	0	0	0	0.7	0.1
Canada Goose	1.5	0	0	0	0	0	0	1.5	0.2
Green-winged Teal	1.1	0	0	0	0	0	0	1.1	0.1
Mallard	3.2	0.2	0	0	0	0	0	3.4	0.4
Northern Pintail	1.5	0	0	0	0	0	0	1.5	0.2
Northern Shoveler	3.2	0	0	0	0	0	0	3.2	0.3
American Wigeon	2.7	1.7	0	0	0	0	0	4.4	0.5
Canvasback	0.7	0	0	0	0	0	0	0.7	0.1
Ring-necked Duck	2.0	0	0	0	0	0	0	2.0	0.2
Scaup spp.	80.3	0	0	0	0	0	0	80.3	8.5
Surf Scoter	0	0.3	0	0	0	0	0	0.3	0.1
White-winged Scoter	12.0	0	0	0	0	0	0	12.0	1.3
Goldeneye spp.	0.2	0.2	0	0	0	0	0	0.4	0.1
Bufflehead	27.4	0	0	0	0	0	0	27.4	2.9
Sharp-shinned Hawk	0	0	0	0	0	0	0.1	0.1	0.1
American Kestrel	0	0	0	0.1	0.1	0.1	0.1	0.4	0.1
Spruce Grouse	0	0	0	0	0	0.1	0	0.1	0.1
Ruffed Grouse	0	0	0	0.1	0.1	0.1	0.1	0.4	0.1
Sandhill Crane	0	0	0	0	0	0	0.1	0.1	0.1
Lesser Yellowlegs	1.6	0	0	0	0	0.1	0.1	1.8	0.2
Spotted Sandpiper	0	5.5	0	0	0	0	0	5.5	0.6
Common Snipe	1.3	0	0.1	0.1	0.1	0	4.9	6.5	0.7
Herring Gull	0	0.7	0	0	0	0	0	0.7	0.1
Boreal Owl	0	0	0	0	0	0.1	0	0.1	0.1
Belted Kingfisher	0.4	0	0	0	0	0	0	0.4	0.1
Woodpecker spp.	0	0	0	0	0.1	0.1	0	0.2	0.1
Northern Flicker	0	0	0.1	0.1	0	0	0.1	0.3	0.1
Olive-sided Flycatcher	0	0	0	0	0	0	0.1	0.1	0.1

Appendix C. Continued.

Taxa	Density (birds/km^2)								
	Ponds, Lakes	River	Shrub	Decid. Forest	Conif. Forest	Mixed Forest	Scattered Woodland	Total	Percent
Western Wood-pewee	0	0	1.1	0	0	0	0.1	1.2	0.1
Empidonax Flycatcher	0	0	27.8	39.4	0.1	0.1	0.1	67.5	7.1
Say's Phoebe	0	0.1	0	0	0	0	0	0.1	0.1
Swallow spp.	38.5	4.5	10.0	0	0	15.3	30.2	98.5	10.4
Gray Jay	0	0.1	1.9	0.1	0.1	9.6	30.3	42.1	4.5
Common Raven	0	0.4	0	0	0	0	0.1	0.5	0.1
Chickadee spp.	0	0	0	0	20.2	22.3	0.1	42.6	4.5
Ruby-crowned Kinglet	0	0	0	0	0.1	0.1	0.1	0.3	0.1
Townsend's Solitaire	0	0.2	0	0	0	0	0	0.2	0.1
Catharus Thrush	0	0	13.5	58.4	16.8	28.9	0.8	118.4	12.5
American Robin	0	0.9	0.1	0	0	0.1	5.1	6.2	0.7
Varied Thrush	0	0	0	0	0.1	0.1	0.1	0.3	0.1
Bohemian Waxwing	0	0	0	0	0	0	0.1	0.1	0.1
Orange-crowned Warbler	0	0	0.1	10.7	0	0.1	0.1	11.0	1.2
Yellow Warbler	0	0	110.5	37.3	0	0.1	0	147.9	15.7
Yellow-rumped Warbler	0	0	0	0	0.1	0.1	0	0.2	0.1
Townsend's Warbler	0	0	0.1	0.1	0.1	0.1	0	0.4	0.1
Blackpoll Warbler	0	0	0	0.1	0	0	0	0.1	0.1
Northern Waterthrush	0	0	0.1	0.1	0.1	5.1	0.1	5.5	0.6
Wilson's Warbler	0	0	0	0.1	0	0	0	0.1	0.1
Savannah Sparrow	0	0	23.8	0	0	0	0.1	23.9	2.5
Fox Sparrow	0	0	12.3	10.8	0	0.1	0.1	23.3	2.5
Lincoln's Sparrow	0	0	64.8	0	0	0	21.5	86.3	9.1
White-crowned Sparrow	0	0	36.4	3.3	0.1	0.1	5.7	45.6	4.8
Dark-eyed Junco	0	0.1	0.1	20.6	6.2	15.0	6.0	48.0	5.1
Rusty Blackbird	0	0	0	0	0	0	0.1	0.1	0.1
White-winged Crossbill	0	0	0	0	0.1	0.1	0.1	0.3	0.1
Common Redpoll	0	0	0.1	0	0.1	0.1	0.1	0.4	0.1
TOTAL	196.4	14.9	302.9	181.4	44.6	98.0	106.6	944.8	101.8

Appendix D. Bird densities in 7 habitats within 3 km of peregrine falcon eyries on the Yukon River, Alaska, 1986.

Taxa	Density (birds/km^2)								
	Ponds, Lakes	River	Shrub	Decid. Forest	Conif. Forest	Mixed Forest	Scattered Woodland	Total	Percent
Arctic Loon	8.7	0	0	0	0	0	0	8.7	0.4
Horned Grebe	7.3	0	0	0	0	0	0	7.3	0.4
Red-necked Grebe	0.7	0	0	0	0	0	0	0.7	0.1
Green-winged Teal	2.2	0	0	0	0	0	0	2.2	0.1
Mallard	8.5	0.5	0	0	0	0	0	9	0.4
Northern Pintail	14.1	0	0	0	0	0	0	14.1	0.7
Northern Shoveler	3.8	0	0	0	0	0	0	3.8	0.2
American Wigeon	6.2	0.3	0	0	0	0	0	6.5	0.3
Ring-necked Duck	0.7	0	0	0	0	0	0	0.7	0.1
Scaup spp.	53.9	0	0	0	0	0	0	53.9	2.7
Surf Scoter	15.1	0	0	0	0	0	0	15.1	0.7
White-winged Scoter	17.5	0	0	0	0	0	0	17.5	0.9
Common Goldeneye	6.3	0	0	0	0	0	0	6.3	0.3
Bufflehead	14.0	0	0	0	0	0	0	14.0	0.7
Bald Eagle	1.1	0	0	0	0	0	0	1.1	0.1
American Kestrel	0	0	0.1	0	0	0	0.1	0.2	0.1
Northern Harrier	0	0	0.1	0	0	0	0	0.1	0.1
Ruffed Grouse	0	0	0	0.1	0.1	12.4	0	12.6	0.6
Sandhill Crane	0	0	0	0	0	0	0.1	0.1	0.1
Solitary Sandpiper	0.9	0	0	0	0	0	0	0.9	0.1
Lesser Yellowlegs	0	0	0	0	0	0	0.1	0.1	0.1
Spotted Sandpiper	0.7	4.3	0	0	0	0	0	5.0	0.2
Semipalmated Sandpiper	0.9	0	0	0	0	0	0	0.9	0.1
Common Snipe	0.9	0	0.1	0.1	0.1	0.1	26.3	27.6	1.4
Herring Gull	2.1	0.2	0	0	0	0	0	2.3	0.1
Northern Hawk-Owl	0	0	0	0	0.1	0	0	0.1	0.1
Common Raven	0	0.3	0	0.1	0	0	0	0.4	0.1
Woodpecker spp.	0	0	0	0.1	10.1	0.1	0.1	10.4	0.5
Northern Flicker	0	0	0	0.1	0.1	0.1	0.1	0.4	0.1
Olive-sided Flycatcher	0	0	0	0	0.1	0	9.7	9.8	0.5

Appendix D. Continued.

Taxa	Density (birds/km^2)								
	Ponds, Lakes	River	Shrub	Decid. Forest	Conif. Forest	Mixed Forest	Scattered Woodland	Total	Percent
Western Wood-pewee	0	0	0	0	0.1	0	0	0.1	0.1
Empidonax Flycatcher	0	0	77.6	59.5	0.1	0.1	6.1	143.4	7.1
Say's Phoebe	0	0.1	0	0	0	0	0	0.1	0.1
Swallow spp.	21.1	6.0	57.1	0.1	0.1	69.9	73.0	227.3	11.2
Gray Jay	0	0	0	0.1	38.0	25.8	30.7	94.6	4.7
Chickadee spp.	0	0	0	0.1	65.7	19.7	0.1	85.6	4.2
Ruby-crowned Kinglet	0	0	0	0	6.9	7.9	5.6	20.4	1.0
Townsend's Solitaire	0	0.4	0	0	0	0.1	0	0.5	0.1
Catharus Thrush	0	0	0.1	60.1	102.8	82.2	9.1	254.3	12.5
American Robin	0	0.2	0	0.1	0	0.1	0.1	0.5	0.1
Varied Thrush	0	0	0	0	18.1	10.2	0	28.3	1.4
Bohemian Waxwing	0	0	0	0	0.1	0.1	0.1	0.3	0.1
Orange-crowned Warbler	0	0.1	21.2	40.0	0	0.1	0	61.4	3.0
Yellow Warbler	0	0.1	94.0	44.5	0	0.1	0	138.7	6.8
Yellow-rumped Warbler	0	0	0	0	0.1	29.8	0.1	30.0	1.5
Townsend's Warbler	0	0	0	0	22.1	45.4	0	67.5	3.3
Blackpoll Warbler	0	0	0	0.1	0	0.1	0	0.2	0.1
Northern Waterthrush	0	0	1.2	17.9	29.2	16.7	0.1	65.1	3.2
Savannah Sparrow	0	0.1	184.8	0	0.1	0	0.1	185.1	9.1
Chipping Sparrow	0	0	0.1	0	0	0	0	0.1	0.1
Fox Sparrow	0	0	33.1	15.0	0	0	0	48.1	2.4
Lincoln's Sparrow	0	0	55.8	0.1	0	0	25.2	81.1	4.0
White-crowned Sparrow	0	0.4	153.7	0.1	0	0.1	28.5	182.8	9.0
Dark-eyed Junco	0	0.5	0.1	0.1	21.3	12.8	27.9	62.7	3.1
Rusty Blackbird	3.0	0	0	0	0	0	20.4	23.4	1.2
White-winged Crossbill	0	0	0	0	0	0.1	0	0.1	0.1
Common Redpoll	0	0	0	0	0.1	0	0.1	0.2	0.1
TOTAL	189.7	13.5	679.1	238.3	315.4	334.0	263.7	2033.7	101.7

Appendix E. Number, biomass, and percent of birds available to peregrine falcons along the Yukon River, Alaska, 1985 and 1986.

Taxa	Frequency				Biomass			
	1985		1986		1985		1986	
	No.	%	No.	%	Grams	%	Grams	%
Arctic Loon (Gavia arctica)	63	0.1	61	0.1	104519	4.4	100990	1.9
Horned Grebe (Podiceps auritus)	55	0.1	51	0.1	24715	1.0	23138	0.4
Red-necked Grebe (Podiceps grisegena)	5	0.1	5	0.1	4651	0.2	5011	0.1
Canada Goose (Branta canadensis)	10	0.1	0	0.0	33758	1.4	0	0.0
Green-winged Teal (Anas crecca)	7	0.1	15	0.1	2436	0.1	5249	0.1
Mallard (Anas platyrhynchos)	38	0.1	101	0.1	40767	1.7	109652	2.1
Northern Pintail (Anas acuta)	10	0.1	99	0.1	9840	0.4	99644	1.9
Northern Shoveler (Anas clypeata)	21	0.1	27	0.1	12741	0.5	16299	0.3
American Wigeon (Anas americana)	161	0.3	69	0.1	121652	5.1	51719	1.0
Canvasback (Aythya valisineria)	5	0.1	0	0.0	5542	0.2	0	0.0
Ring-necked Duck (Aythya collaris)	13	0.1	5	0.1	9158	0.4	3453	0.1
Scaup spp. (Aythya spp.)	522	1.0	377	0.3	460527	19.4	333013	6.4
Surf Scoter (Melanitta perspicillata)	25	0.1	106	0.1	24073	1.0	100372	1.9
White-winged Scoter (Melanitta fusca)	78	0.2	122	0.1	105219	4.4	165304	3.2
Goldeneye spp. (Bucephala spp.)	18	0.1	44	0.1	16464	0.7	39893	0.8
Bufflehead (Bucephala albeola)	178	0.3	98	0.1	71719	3.0	39477	0.8
Bald Eagle (Haliaeetus leucocephalus)	0	0.0	8	0.1	0	0.0	36051	0.7
Northern Harrier (Circus cyaneus)	0	0.0	4	0.1	0	0.0	1671	0.1
Sharp-shinned Hawk (Accipiter striatus)	7	0.1	0	0.0	3127	0.1	0	0.0
American Kestrel (Falco sparverius)	31	0.1	11	0.1	3554	0.1	1273	0.1
Spruce Grouse (Dendragapus canadensis)	11	0.1	0	0.0	5194	0.2	0	0.0
Ruffed Grouse (Bonasa umbellus)	31	0.1	1240	1.0	17832	0.7	715294	13.8
Sandhill Crane (Grus canadensis)	0	0.0	7	0.1	0	0.0	23046	0.4
Lesser Yellowlegs (Tringa flavipes)	28	0.1	7	0.1	2279	0.1	590	0.1
Solitary Sandpiper (Tringa solitaria)	0	0.0	6	0.1	0	0.0	321	0.1
Spotted Sandpiper (Actitis macularia)	465	0.9	365	0.3	18583	0.8	14598	0.3
Semipalmated Sandpiper (Calidris pusilla)	0	0.0	6	0.1	0	0.0	176	0.1
Common Snipe (Gallinago gallinago)	359	0.7	1950	1.6	43830	1.8	237858	4.6
Herring Gull (Larus argentatus)	59	0.1	31	0.1	67108	2.8	35685	0.7
Northern Hawk-Owl (Surnia ulula)	0	0.0	9	0.1	0	0.0	3042	0.1
Boreal Owl (Aegolius funereus)	11	0.1	0	0.0	1468	0.1	0	0.0
Belted Kingfisher (Ceryle alcyon)	3	0.1	0	0.0	385	0.1	0	0.0
Woodpecker spp. (Picoides spp.)	18	0.1	977	0.8	1179	0.1	64494	1.2

Appendix E. Continued.

Taxa	Frequency				Biomass			
	1985		1986		1985		1986	
	No.	%	No.	%	Grams	%	Grams	%
Northern Flicker (Colaptes auratus)	18	0.1	32	0.1	2602	0.1	4603	0.1
Olive-sided Flycatcher (Contopus borealis)	7	0.1	716	0.6	217	0.1	22897	0.4
Western Wood-pewee (Contopus sordidulus)	65	0.1	9	0.1	843	0.1	123	0.1
Empidonax Flycatcher	3959	7.7	6864	5.5	47504	2.0	82369	1.6
Say's Phoebe (Sayornis saya)	8	0.1	8	0.1	177	0.1	176	0.1
Swallow spp. (Tachycineta sp., Riparia sp.)	4883	9.5	15045	12.1	73248	3.1	225668	4.4
Gray Jay (Perisoreus canadensis)	3229	6.3	8378	6.8	229276	9.6	594854	11.5
Common Raven (Corvus corax)	41	0.1	31	0.1	48643	2.0	37093	0.7
Chickadee spp. (Parus spp.)	4048	7.8	8165	6.6	44532	1.9	89820	1.7
Ruby-crowned Kinglet (Regulus calendula)	25	0.1	1840	1.5	173	0.1	12877	0.2
Townsend's Solitaire (Myadestes townsendi)	17	0.1	43	0.1	574	0.1	1475	0.1
Catharus Thrush	8750	17.0	21991	17.7	279986	11.8	703704	13.6
American Robin (Turdus migratorius)	438	0.8	40	0.1	33741	1.4	3058	0.1
Varied Thrush (Ixoreus naevius)	25	0.1	2717	2.2	1922	0.1	211943	4.1
Bohemian Waxwing (Bombycilla garrulus)	7	0.1	27	0.1	380	0.1	1490	0.1
Orange-crowned Warbler (Vermivora celata)	693	1.3	3148	2.5	6236	0.3	28332	0.5
Yellow Warbler (Dendroica petechia)	8179	15.9	6168	5.0	81790	3.4	61678	1.2
Yellow-rumped Warbler (Dendroica coronata)	18	0.1	2959	2.4	214	0.1	35511	0.7
Townsend's Warbler (Dendroica townsendi)	29	0.1	6571	5.3	265	0.1	59138	1.1
Blackpoll Warbler (Dendroica striata)	6	0.1	16	0.1	81	0.1	204	0.1
Northern Waterthrush (Seiurus noveboracensis)	584	1.1	5502	4.4	10514	0.4	99029	1.9
Wilson's Warbler (Wilsonia pusilla)	6	0.1	0	0.0	50	0.1	0	0.0
Chipping Sparrow (Spizella passerina)	0	0.0	4	0.1	0	0.0	45	0.1
Savannah Sparrow (Passerculus sandwichensis)	1731	3.4	7026	5.7	34623	1.5	140529	2.7
Fox Sparrow (Passerella iliaca)	1343	2.6	2126	1.7	42980	1.8	68048	1.3
Lincoln's Sparrow (Melspiza lincolnii)	4879	9.5	3954	3.2	82943	3.5	67222	1.3
White-crowned Sparrow (Zonotrichia leucophrys)	2533	4.9	7947	6.4	65846	2.8	206618	4.0
Dark-eyed Junco (Junco hyemalis)	3782	7.3	5359	4.3	75642	3.2	107173	2.1
Rusty Blackbird (Euphagus carolinus)	7	0.1	1506	1.2	400	0.1	88851	1.7
White-winged Crossbill (Loxia leucoptera)	25	0.1	10	0.1	641	0.1	257	0.1
Common Redpoll (Carduelis flammea)	30	0.1	17	0.1	389	0.1	217	0.1
TOTAL	51592	102.0	124020	102.3	2378752	101.2	5182315	101.1

Appendix F. Bonferroni intervals and selection indices for all taxa recorded on transects or taken as prey by peregrine falcons on the Yukon River, Alaska, 1985 and 1986.

Taxa	Frequency				Biomass			
	1985		1986		1985		1986	
	Bonferroni Interval	Selection[a]	Bonferroni Interval	Selection	Bonferroni Interval	Selection	Bonferroni Interval	Selection
Arctic Loon	0	-	0	-	0	-	0	-
Horned Grebe	0-1.5	o	0-2.5	o	1.9-2.2	+	3.7-4.1	+
Red-necked Grebe	0-0.6	o	0-0.6	o	1.0-1.3	+	0.9-1.1	+
Canada Goose	0	-			0	-		
Green-winged Teal	0.6-4.7	+	0.5-4.4	+	7.5-8.1	+	6.0-6.5	+
Mallard	0	-	0-0.9	o	0	-	1.9-2.2	o
Northern Pintail	0-1.2	o	0-1.9	o	3.3-3.7	+	5.6-6.1	+
Blue-winged Teal			0-0.6	o			0.3-0.4	+
Northern Shoveler	0-1.5	o	0-2.5	o	2.6-3.0	+	5.1-5.6	+
American Wigeon	0-1.5	o	0-0.9	o	3.2-3.7	-	1.3-1.6	+
Canvasback	0	-			0	-		
Ring-necked Duck	0	-	0	-	0	-	0	-
Scaup spp.	0-3.0	o	0.5-4.4	+	10.7-11.5	-	5.8-16.5	o
Harlequin Duck	0-0.9	o			1.3-1.6	+		
Surf Scoter	0-0.6	o	0-0.6	o	1.0-1.2	o	0.8-1.0	-
White-winged Scoter	0	-	0	-	0	-	0	-
Goldeneye spp.	0	-	0-0.9	o	0	-	1.6-1.9	+
Bufflehead	0-1.7	o	0-1.9	o	2.1-2.5	-	2.2-2.5	+
Bald Eagle			0	-			0	-
Northern Harrier			0	-			0	-
Sharp-shinned Hawk	0-0.6	o	0-0.6	o	0.4-0.6	+	0.4-0.5	+
American Kestrel	0-1.9	o	0-1.6	o	0.7-0.9	+	0.5-0.6	+
Spruce Grouse	0-0.6	o	0-0.6	o	0.5-0.6	+	0.4-0.5	+
Rock Ptarmigan			0-0.6	o			0.3-0.5	+
Ruffed Grouse	0	-	0	-	0	-	0	-
Sandhill Crane			0	-			0	-
American Coot	0-0.6	o	0-0.6	o	0.6-0.8	+	0.5-0.7	+
Black-bellied Plover	0-0.6	o			0.2-0.3	+		
Lesser Golden-plover	0-1.5	o	0-1.6	o	0.6-0.8	+	0.6-0.8	+
Semipalmated Plover	0-1.5	o	0-0.9	o	0.2-0.3	+	0-0.1	o
Lesser Yellowlegs	17.5-28.1	+	10.9-19.9	+	15.5-16.4	+	9.1-9.7	+
Solitary Sandpiper	1.1-5.6	+	1.5-6.4	+	1.3-1.6	+	1.4-1.7	+

Appendix F. Continued.

Taxa	Frequency				Biomass			
	1985		1986		1985		1986	
	Bonferroni Interval	Selection	Bonferroni Interval	Selection	Bonferroni Interval	Selection	Bonferroni Interval	Selection
Spotted Sandpiper	2.1-7.5	+	2.3-7.7	+	1.5-1.8	+	1.4-1.6	+
Upland Sandpiper	0.5-4.3	+	0.7-4.7	+	3.3-3.7	+	3.2-3.6	+
Whimbrel	0-0.6	o	0-0.9	o	0.4-0.5	+	0.6-0.8	+
Ruddy Turnstone			0-0.6	o			0.1-0.2	+
Surfbird	0-0.6	o	0-0.6	o	0.2-0.3	+	0.1-0.2	+
Semipalmated Sandpiper			0-0.6	o			0-0.1	o
Western Sandpiper	0-0.6	o	0-0.9	o	0.0-0.1	o	0-0.1	o
Least Sandpiper	0-2.4	o	0-1.4	o	0.1-0.2	+	0-0.1	o
Baird's Sandpiper	0-0.6	o			0-0.1	o		
Pectoral Sandpiper	0-1.7	o	0-1.2	o	0.3-0.5	+	0.2-0.3	+
Stilt Sandpiper	0-1.2	o			0.2-0.3	+		
Long-billed Dowitcher	0.2-3.6	+	0-2.7	o	1.5-1.8	+	0.9-1.1	+
Common Snipe	2.5-8.1	+	1.4-6.2	o	5.3-5.9	+	3.3-3.7	-
Red-necked Phalarope	0-0.6	o	0-1.6	o	0-0.1	o	0.1-0.2	+
Long-tailed Jaeger	0-1.9	o	0-1.4	o	1.9-2.2	+	1.0-1.3	+
Bonaparte's Gull	0.1-3.2	+	0.4-4.0	+	2.7-3.1	+	3.3-3.7	+
Mew Gull	0.1-3.2	+	0.8-4.9	+	5.3-5.8	+	8.3-8.9	+
Herring Gull	0	-	0	-	0	-	0	-
Arctic Tern	0-1.2	o	0-1.2	o	0.3-0.5	+	0.3-0.4	+
Northern Hawk-Owl			0	-			0	-
Boreal Owl	0	-			0	-		
Belted Kingfisher	0-0.9	o	0-0.6	o	0.3-0.4	+	0.1-0.2	+
Woodpecker spp.	0-1.5	o	0-2.3	o	0.2-0.4	+	0.4-0.6	-
Northern Flicker	0-1.7	o	0-2.7	o	0.7-0.9	+	1.2-1.5	+
Olive-sided Flycatcher	0	-	0	-	0	-	0	-
Western Wood-pewee	0	-	0	-	0	-	0	-
Empidonax Flycatcher	0-2.6	-	0.4-4.0	-	0.1-0.2	-	0.1-0.2	-
Say's Phoebe	0	-	0-0.6	o	0	-	0-0.1	o
Horned Lark	0-0.6	o			0-0.1	o		
Swallow spp.	0.5-4.3	-	0.8-4.9	-	0.2-0.4	-	0.3-0.4	-
Gray Jay	9.3-18.0	+	2.4-7.9	o	8.0-8.7	-	2.6-2.9	-
Common Raven	0	-	0	-	0	-	0	-
Chickadee spp.	0-2.6	-	0-2.5	-	0.1-0.2	-	0-0.1	-

Appendix F. Continued.

Taxa	Frequency				Biomass			
	1985		1986		1985		1986	
	Bonferroni Interval	Selection	Bonferroni Interval	Selection	Bonferroni Interval	Selection	Bonferroni Interval	Selection
Ruby-crowned Kinglet	0-1.5	o	0-1.9	o	0-0.1	o	0-0.1	-
Mountain Bluebird	0-0.6	o	0-0.6	o	0-0.1	o	0-0.1	o
Townsend's Solitaire	0-1.7	o	0-1.2	o	0.1-0.3	o	0-0.1	o
Catharus Thrush	0.8-5.0	-	1.4-6.2	-	0.7-0.9	-	0.8-1.0	-
American Robin	0-3.0	o	0.7-4.7	+	0.9-1.1	-	1.4-1.7	+
Varied Thrush	0.1-3.4	o	0.4-4.0	o	1.0-1.3	+	1.2-1.4	-
Bohemian Waxwing	0.9-5.2	+	1.2-5.7	+	1.3-1.6	+	1.3-1.6	+
Northern Shrike			0-1.2	o			0.1-0.2	+
Orange-crowned Warbler	0-0.6	-	0-1.2	-	0-0.1	-	0-0.1	-
Yellow Warbler	0-3.0	-	0.1-3.4	-	0.1-0.2	-	0.1-0.2	-
Magnolia Warbler			0-0.6	o			0-0.1	o
Yellow-rumped Warbler	0-0.9	o	1.1-5.6	o	0-0.1	o	0.2-0.4	-
Townsend's Warbler	0	-	0-0.9	-	0	-	0-0.1	-
Blackpoll Warbler	0	-	0-0.9	o	0	-	0-0.1	o
Northern Waterthrush	0-0.9	-	0-0.9	-	0-0.1	-	0-0.1	-
Wilson's Warbler	0	-			0	-		
American Tree Sparrow	0-0.9	o			0-0.1	o		
Chipping Sparrow			0	-			0	-
Savannah Sparrow	0-1.2	-	0-1.9	-	0-0.1	-	0.1-0.2	-
Fox Sparrow	0-1.7	-	0-1.2	-	0.1-0.2	-	0-0.1	-
Lincoln's Sparrow	0	-	0-1.2	-	0	-	0-0.1	-
White-crowned Sparrow	0-2.8	-	0-2.5	-	0.2-0.4	-	0.2-0.3	-
Dark-eyed Junco	0.9-5.2	-	2.5-8.0	o	0.4-0.6	-	0.7-0.9	-
Lapland Longspur	0-1.5	o			0.1-0.2	+		
Rusty Blackbird	0-0.6	o	0-1.9	o	0-0.1	o	0.3-0.4	-
Pine Grosbeak	0-0.6	o	0-0.6	o	0-0.1	o	0-0.1	o
White-winged Crossbill	0.7-4.9	+	0.1-3.4	o	0.5-0.7	+	0.3-0.4	+
Common Redpoll	0-1.7	o	0.6-4.5	+	0-0.1	o	0.2-0.3	+
Pine Siskin	0-0.9	o	0-1.2	o	0-0.1	o	0-0.1	o

[a] + Taxon taken in greater proportion than available.
- Taxon taken in smaller proportion than available.
o Taxon taken in proportion to availability.

Appendix G. Number of individuals of key prey utilized by peregrine falcons along the Yukon River, Alaska, 1985 and 1986; eyries listed in geographical order.

YEAR	EYRIE	COLLECTION PERIOD	Lesser Yellowlegs	Gray Jay	Spotted Sandpiper	Solitary Sandpiper	Bohemian Waxwing	Green-winged Teal	Upland Sandpiper	Mew Gull	Bonaparte's Gull	Scaup
1985	7-mile	1	11	0	1	3	0	0	3	2	0	0
		2	18	3	2	3	0	1	2	1	0	0
	10-mile	1	3	0	1	0	0	0	0	0	0	0
		2	13	16	3	1	1	1	1	1	4	0
	13-mile	1	5	0	1	0	0	0	0	1	0	0
		2	8	2	1	0	0	1	1	1	0	0
	19-mile	1	9	1	1	2	0	1	0	0	0	0
		2	18	7	1	1	0	0	0	2	1	0
	Thanksgiving	1	2	0	1	0	0	0	1	0	1	0
		2	4	5	1	1	1	1	1	0	0	1
	Woodchopper+3	1	1	0	1	0	1	2	0	1	0	0
		2	3	19	1	0	0	1	0	1	0	0
	McGregor's	1	4	4	0	0	1	1	1	0	1	0
		2	1	1	0	1	1	0	0	0	0	0
	Sam Creek	1	0	0	1	0	0	1	0	0	0	0
		2	2	4	1	0	0	1	0	0	1	2
	Biedermann's	1	2	1	1	0	1	1	0	0	0	0
		2	1	2	1	0	1	1	0	0	1	0
	Kathul	1	7	1	0	0	5	1	0	0	0	1
		2	6	2	3	2	3	0	2	0	0	2
	Glenn Creek	1	5	0	0	0	1	0	0	0	0	0
		2	11	4	1	0	1	0	0	0	1	0
	Nation Cabin	1	5	2	1	1	0	1	0	1	1	1
		2	5	6	1	1	0	0	1	0	0	1
	Nation Bluff	1	1	1	1	1	0	1	0	0	0	1
		2	6	5	1	0	0	1	0	0	0	0
	Trout Creek	1	1	0	1	0	1	1	0	0	0	0
		2	4	1	0	1	1	1	0	0	0	0
	Eagle Bluff	1	4	0	1	0	1	0	0	0	0	1
		2	8	12	4	5	1	0	3	0	0	1
	Border+2	1	1	1	1	1	1	0	1	1	0	0
		2	3	3	2	1	1	1	1	0	1	0
1986	7-mile	1	2	0	1	0	0	0	0	1	0	0
		2	1	1	2	1	2	1	1	1	0	0
	10-mile	1	6	1	1	4	0	1	3	0	0	0
		2	5	0	1	1	0	2	1	2	1	0
	13-mile	1	4	1	0	1	0	0	0	0	0	0
		2	12	2	0	2	2	0	0	1	1	1
	Takomma Bluff	1	4	1	0	0	1	0	0	0	1	0
		2	10	1	1	1	2	1	2	3	1	0
	Takomma Creek	1	1	0	1	0	1	0	0	0	0	0
		2	0	0	1	0	1	0	0	1	0	1
	Webber	1	3	1	2	1	2	1	0	0	0	1
		2	4	1	2	1	1	0	2	0	0	1
	Woodchopper+3	1	1	4	1	1	0	0	0	0	0	0
		2	1	2	0	1	1	0	2	5	2	0
	Woodchopper	1	1	5	2	1	1	1	0	0	0	0
		2	2	3	2	2	2	1	1	0	0	0
	McGregor's	1	2	2	1	1	1	1	0	0	0	0
		2	3	2	8	1	3	1	1	3	5	1
	Sam Creek	1	0	1	0	0	0	0	0	1	0	1
		2	0	1	0	0	0	0	0	0	0	0
	Kathul	1	4	2	0	2	1	0	0	0	0	0
		2	10	1	1	1	1	1	1	0	0	1
	Glenn Creek	1	8	1	0	0	0	0	0	0	0	0
		2	14	1	0	2	0	1	2	0	1	0
	Nation Cabin	1	1	1	1	1	1	0	1	1	0	1
		2	1	0	1	1	1	1	1	0	1	3
	Trout Creek	1	1	0	0	0	0	0	0	0	0	1
		2	0	0	1	1	0	0	0	0	0	0
	70-mile	1	2	1	1	2	0	1	0	0	0	0
		2	6	0	5	0	1	3	1	2	4	4
	Border+2	1	4	2	2	0	0	0	0	1	0	0
		2	7	2	1	2	2	2	2	0	0	3