

Supplementary material

Appendix 1

Table A1 Diet breadth and distance to species distribution boundary of nesting Golden Eagle populations based on international literature accounts from the Palearctic and Nearctic region. n: number of examined prey individuals, Nests: number of observed nests; B: diet breadth as a measure for foraging generalism; distance: minimum distance to eagles distribution boundary.

Region	Source	n	Nests	B (-)	distance (km)
Palearctic (52 studies)					
Norway (Fimark fjord)	Johnsen et al. (2007)	144	12	3.64	40
Norway (Finmark inland)	Johnsen et al. (2007)	325	25	2.77	272
Finland (north)	Sulkava et al. (1984)	3766	500	3.3	133
Finland (south)	Sulkava et al. (1984)	1796	50	2.7	33
Finland (south)	Sulkava et al. (1999)	1595	?	2.8	46
Finland (south)	Sulkava et al. (1999)	3387	?	4.2	130
Finland (central)	Sulkava et al. (1999)	1049	?	3.5	336
Finland (north)	Sulkava et al. (1999)	873	?	4.0	336
Sweden (Gotland)	Högström and Wiss (1992)	645	3	3.7	27
Sweden	Tjernberg (1981)	2792	105	2.9	288
Sweden	Nytröm et al. (2006)	410	23	1.9	230
Estonia	Zastrow (1946)	133	4	6.2	153
Belarus	Ivanosky (1990)	749	10	3.4	123
Scotland (south)	Marquiss et al. (1985)	302	4	3.69	21
Scotland (north-west)	Watson et al. (1992)	345	?	3.2	31

Scotland (Inner Hebrides N)	Watson (2010)	85	23	4.7	9
Scotland (Inner Hebrides S)	Watson (2010)	143	29	3.5	15
Scotland (Highlands N)	Watson (2010)	274	29	7.2	54
Scotland (Highlands NW)	Watson (2010)	148	38	5.9	43
Scotland (Highlands W-Centr)	Watson (2010)	17	25	7.3	17
Scotland (Highlands SW)	Watson (2010)	47	16	5.4	21
Scotland (Highlands E)	Watson (2010)	161	28	2.4	92
Scotland (SW Agryll)	Watson (2010)	109	3	7.4	19
Switzerland	Stemmler (1955)	298	65	3.8	77
Switzerland (Graubünden)	Haller (1996)	249	4	3.0	131
Switzerland (Bern/Pre-Alps)	Haller (1988)	126	2	4.7	46
Austria (Kalkalpen)	Steiner (2006)	21	1	8.3	38
Germany (Allgäuer Hochalpen)	present study	82	10	6.9	68
Germany (Werdenfels)	present study	384	28	7.1	52
Germany (Berchtesgaden)	present study	411	39	8.2	49
France (Pyrenees)	Clouet (1981)	114	10	11.2	1
France (Pyrenees)	Nebel et al. (1996)	28	?	5.9	1
France (Alps)	Huboux (1987)	424	17	2.1	83
France (Alps)	Huboux (1987)	198	6	5.1	18
France (Alps)	Mathieu and Choisy (1982)	109	7	3.2	24
France (Massif Central)	Austruy and Cugnasse (1981)	83	5	6.2	43
Italy (Apennines)	Magrini et al. (1987)	149	7	4.7	5
Italy (Sicily)	Seminara et al. (1987)	74	10	4.9	4
Italy (Apennines)	Noveletto and Petretti (1980)	160	5	3.4	5
Italy (Alps)	Pedrini and Sergio (2001)	195	27	5.8	16
Spain (north-east)	Fernandez (1987)	104	30	2.1	99

Spain (north-west)	Delibes et al. (1975)	247	3	3.9	105
Spain (central)	Delibes et al. (1975)	229	2	3.1	64
Spain (south-west)	Delibes et al. (1975)	167	3	2.0	46
Spain (south-east)	Sánchez-Zapata et al. (2010)	99	3	3.6	41
Macedonia	Grubac (1987)	85	19	3.2	30
Hungary (Zemplen-Mts.)	Janos (1998)	58	4	8.8	32
Russia (Perm-Region)	Shepel (1992)	382	9	2.59	1542
Russia (Altai-Sayan)	Karyakin et al. (2010)	372	?	7.8	566
Kazakhstan (Aral-Caspian)	Karyakin et al. (2011)	420	115	5.6	1312
Turkmenia	Varshavski (1986)	188	5	3.2	296
Mongolia	Ellis et al. (1999)	63	1	3.6	96

Nearctic (15 studies)

Alaska	Hatler (1974)	53	1	2.8	125
Alaska	Murie (1944)	690	?	1.4	367
Alaska	Ritchie and Curatolo (1982)	66	17	2.3	232
Alberta	Boag (1977)	200	2	1.4	782
Oregon	Thompson et al. (1982)	34	7	4.5	495
Montana	McGahan (1968)	980	38	2.0	631
Idaho	Kochert (1972)	1297	28	1.8	437
Idaho	Collopy (1983)	456	8	1.9	437
Washington	Knight and Erickson (1978)	311	74	4.4	348
Arizona	Eakle and Grubb (1986)	47	2	4.5	375
Nevada	Bloom and Hawks (1982)	1154	119	1.4	268
California	Carnie (1954)	503	17	5.3	12

California (Santa Rosa island)	Collins and Latta (2009)	242	4	5.7	7
California (Santa Cruz island)	Collins and Latta (2009)	181	6	2.1	5
New Mexico	Mollhagen et al. (1972)	993	41	2.1	300

Study site description for the Bavarian Golden Eagles

In our study on the feeding behaviour of breeding Golden Eagles in the Bavarian Alps (Southern Germany), we examined three subpopulations located in the very eastern parts (Berchtesgaden), the central parts (Werdenfels) and the western-most parts (Allgäuer Hochalpen) of Bavaria over a 10-year period (1998-2008). All three study sites, each covering an area of about 1400 km², are dominated by calcareous parent material. Altitude varies between 600 and 2900 m a.s.l. On mountain slopes, forests are characterized by coniferous trees (mainly Norway spruce, *Picea abies*). The tree line ranges between 1700 and 1900 m a.s.l. Above the tree line, the vegetation is dominated by alpine meadows. Mean annual temperature varies between 5 to 7°C in the valleys and 0 to -2°C in the summit regions. Annual precipitation ranges from 1500 up to 2600 mm (Bay. StMLU 2001, Bay. StMUGV 2007, LfU 2007).

Prey collection and analyses for the Bavarian Golden Eagles

The diets of nesting eagles were determined for the three Bavarian populations by analysing food remains and pellets from N = 77 nests and their close vicinity, with 10 nests in the Allgäuer Hochalpen, 28 nests in Werdenfels and 39 nests in Berchtesgaden. Nests with recorded breeding activity were sampled after fledglings left the nests (mainly between August and October 1998-2008) or breeding was abandoned. In order to get a complete picture of the foraged prey, the uppermost layer was removed from the nests and checked for small prey remains such as claws or skin from small mammals or birds (cf. Ellis et al. 1999). Prey remains were determined to the lowest possible taxonomic level by considering the age and sex of prey items by using reference collections and literature (e.g. Boye 1981, März 1987). For each prey species, the minimum number of foraged individuals was determined by considering side of the body, degree of ossification and grade of bone weathering (cf. Sulkava et al. 1999). Based on this information, a total of 877 preyed

individuals from 68 species could be determined for the study period of 10 years (1998-2008, see Tab. A.2). However, these records for foraged individuals have to be seen as minimum numbers. The number of prey remains within the observed nests might be biased by different intensities of prey removal by scavengers or by different degree of cleanliness observed by the adult eagles. Biomass was estimated for each foraged individual from the literature (e.g. Bauer et al. 2005, Niethammer and Krapp 1968, 1978, 1990). As the living biomass especially of large prey, such as ungulates is not fully usable for the eagles (e.g. bones), biomass values from the literature were corrected to prevent overestimating the prey weight (cf. Högström and Wiss 1992).

Table A2: Prey species of Bavarian Golden Eagles during the nestling period between 1998 and 2008 within the three study sites Allgäuer Hochalpen (AH, 10 nests), Werdenfels (WF, 28 nests) and Berchtesgaden (BG, 39 nests). Depicted is the number of identified prey individuals per study site (* = determined individuals were almost unexceptional juveniles > 1 year).

Prey species		AH	WF	BG	Total
Chamois*	<i>Rupicapra rupicapra</i>	13	90	86	189
Ibex	<i>Capra ibex</i>			1	1
Domestic sheep	<i>Ovis ammon f. domestica</i>	1	3	2	6
Red deer	<i>Cervus elaphus</i>		2	1	3
Roe deer	<i>Capreolus capreolus</i>		3	18	21
Red fox	<i>Vulpes vulpes</i>	4	27	29	60
Badger	<i>Meles meles</i>			1	1
Beech marten	<i>Martes foina</i>		2	2	4
Pine marten	<i>Martes martes</i>		1	3	4
Marten sp.	<i>Martes sp.</i>	2	3	4	9

Stoat	<i>Mustela erminea</i>		2	3	5
Domestic cat	<i>Felis sylvestris f. catus</i>			1	1
Mountain hare	<i>Lepus timidus</i>	6	38	21	65
European hare	<i>Lepus europaeus</i>		4	4	8
Hare sp.	<i>Lepus sp.</i>	2	14	23	39
Domestic hare	<i>Leporidae sp.</i>		1		1
Hedgehog	<i>Erinaceus europaeus</i>		1		1
European mole	<i>Talpa europaea</i>	1			1
Shrew sp.	<i>Soricidae sp.</i>		2	3	5
Yellow-necked mouse	<i>Apodemus flavicollis</i>			1	1
Long-tailed mouse sp.	<i>Muridae sp.</i>		2		2
Common vole	<i>Microtus arvensis</i>		3	1	4
Brown vole	<i>Microtus agrestis</i>		2	1	3
Vole sp.	<i>Microtus sp.</i>			3	3
Alpine marmot	<i>Marmota marmota</i>	16	10	18	44
Red squirrel	<i>Sciurus vulgaris</i>	4	25	12	41
Edible dormouse	<i>Glis glis</i>			1	1
Mallard	<i>Anas platyrhynchos</i>			2	2
Common buzzard	<i>Buteo buteo</i>	1	5	4	10
Goshawk	<i>Accipites gentilis</i>			1	1
Sparrow hawk	<i>Accipiter nisus</i>			1	1
Kestrel	<i>Falco tinnunculus</i>	3	7	12	22
Peregrine	<i>Falco peregrinus</i>			2	2
Woodcock	<i>Scolopax rusticola</i>		5	1	6
Yellow-legged gull	<i>Larus michahellis</i>			1	1
Eurasian jay	<i>Garrulus glandarius</i>		1	4	5

Eurasian nutcracker	<i>Nucifraga caryocatactes</i>			2	2
Balck-billed magpie	<i>Pica pica</i>			1	1
Alpine chough	<i>Pyrrhocorax pyrrhocorax</i>	1	1	3	5
Carrion crow	<i>Corvus corone</i>	1	1	7	9
Common raven	<i>Corus corax</i>	1	4	12	17
Common cuckoo	<i>Cuculus canorus</i>			1	1
Tawny owl	<i>Strix aluco</i>			4	4
Boreal owl	<i>Aegolius funereus</i>			2	2
Pygmy owl	<i>Glaucidium passerinum</i>		1		1
Owl sp.	<i>Strigidae sp.</i>			1	1
Black woodpecker	<i>Dendrocopus martius</i>			1	1
Great spotted woodpecker	<i>Dendrocopus major</i>		3	1	4
Common wood pigeon	<i>Columba palumbus</i>		1	1	2
Feral pigeon	<i>Columba livia f. domestica</i>	1		1	2
Pigeon sp.	<i>Columba sp.</i>		5	4	9
Capercaillie	<i>Tetrao urogallus</i>	1	14	15	30
Black grouse	<i>Tetrao tetrix</i>	11	47	52	110
Rock ptarmigan	<i>Lagopus muta</i>	4	4	9	17
Hazel grouse	<i>Tetrastes bonasia</i>		8	1	9
Grouse sp.	<i>Tetraoninae sp.</i>		3	2	5
Gamefowl	<i>Galliformes sp.</i>			3	3
Barn fowl	<i>Gallus gallus f. domesticus</i>	1			1
Sky lark	<i>Alauda arvensis</i>			1	1
Blackbird	<i>Turdus merula</i>	1	1		2
Ring ouzel	<i>Turdus torquatus</i>		7	2	9
Song thrush	<i>Turdus philomelos</i>	1	4	3	8

Mistel thrush	<i>Turdus viscivorus</i>	14	4	18
Thrush sp.	<i>Turdus</i> sp.		2	2
Black redstart	<i>Phoenicurus ochruros</i>	1		1
Snowfinch	<i>Montifringilla nivalis</i>	1		1
Chaffinch	<i>Fringilla coeleps</i>	1		1
Red crossbill	<i>Loxia curvirostra</i>	1		1
Citril finch	<i>Serinus citrinella</i>	2		2
Dunnock	<i>Prunella modularis</i>	1		1
Lizard sp.	<i>Lacerta</i> sp.	2		2
Slowworm	<i>Anguis agillis</i>	2		2
Common frog	<i>Rana temporaria</i>	1	1	2
Sterlet	<i>Acipenser ruthenus</i>		1	1
Dung beetle sp.	<i>Geotrupidae</i> sp.	1	1	2
Weevil sp.	<i>Curculionidae</i> sp.		2	2
Beetle sp.	<i>Coleoptera</i> sp.	3	3	10
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Total		82	384	411
				877

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