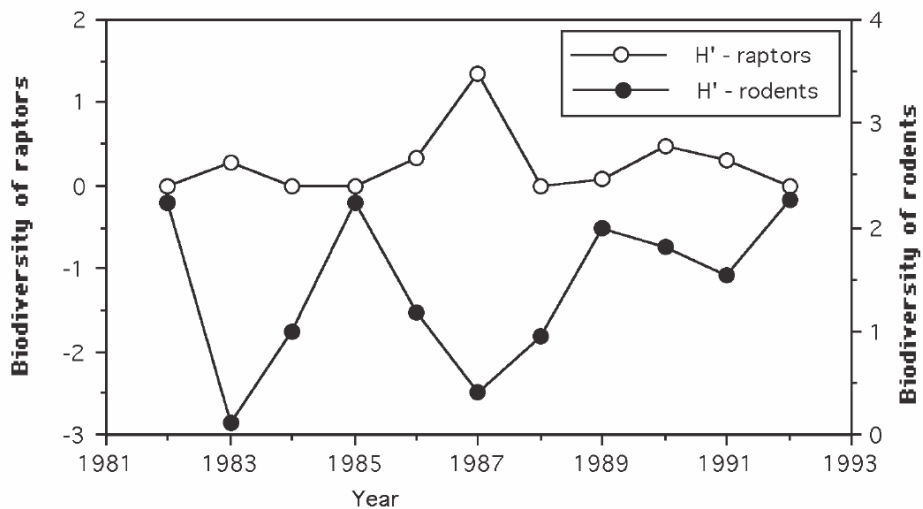


# Inter-specific competition within Arctic rodent-eating avian predators: who rules and at what costs

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Eugene Potapov  
 ??????? ???????  
 Bryn Athyn College, PA, USA

## Diversity of small mammals and avian predators ?????????????? ??????? ??? ?????? ? ??? ?? ? ?????









- The Institute of the Biological Problems of the North, Russian Academy of Sciences
- ????????? ?????????????????? ?????????  
????????, ???
- Edward Grey Institute of the Field Ornithology, University of Oxford
- ????????? ?????????? ?????????????? ?????????  
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Study Areas ??????? ???????



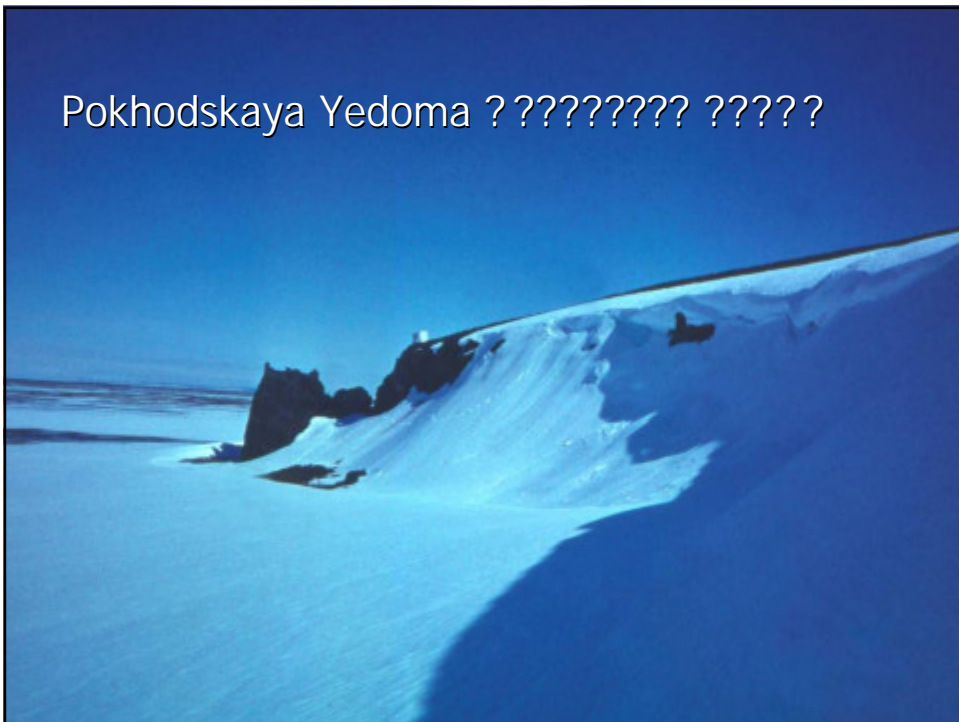


Chukochya

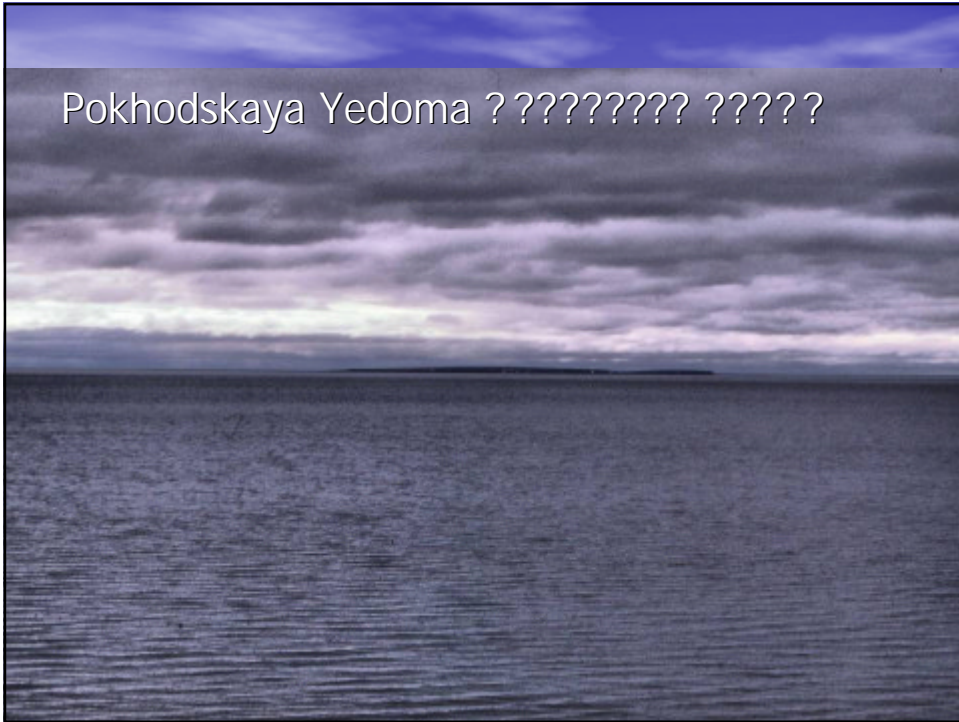
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Pokhodskaya Yedoma ????????? ??????



Pokhodskaya Yedoma ? ????????? ? ?????



Malaya Konkovaya ? ???? ?????????

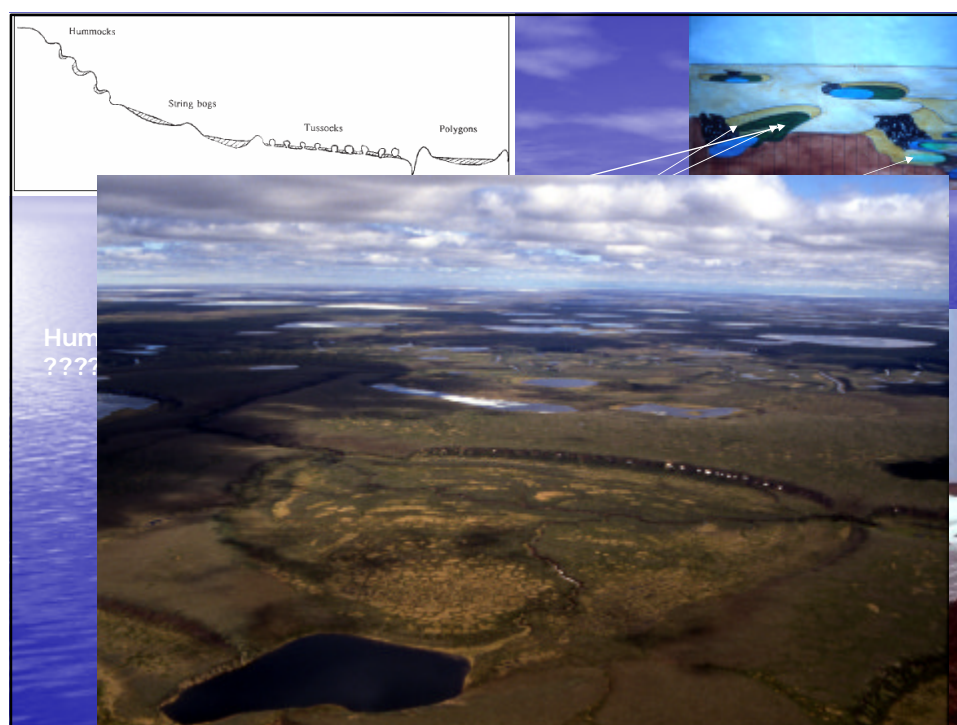




## General ecological Information



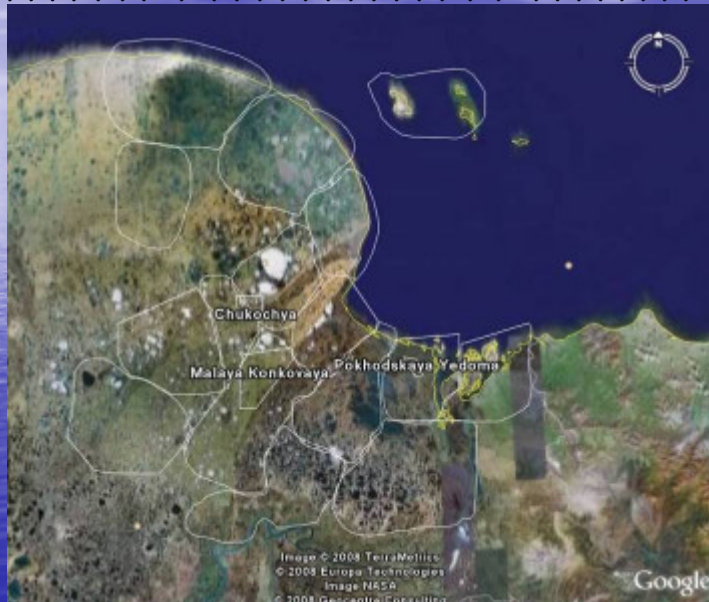






Professional trappers areas

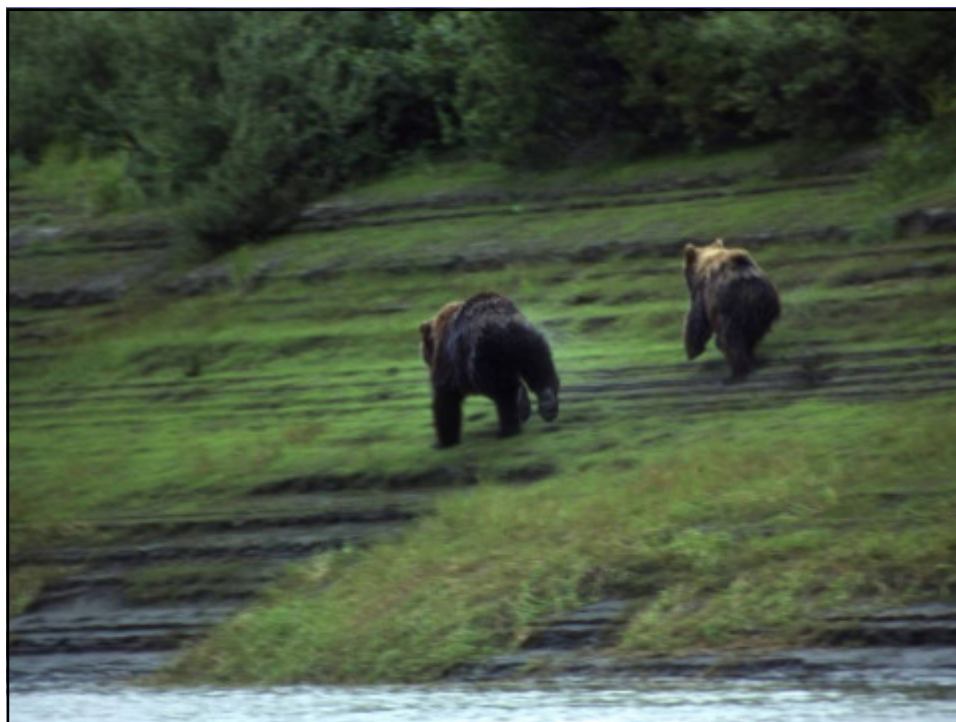
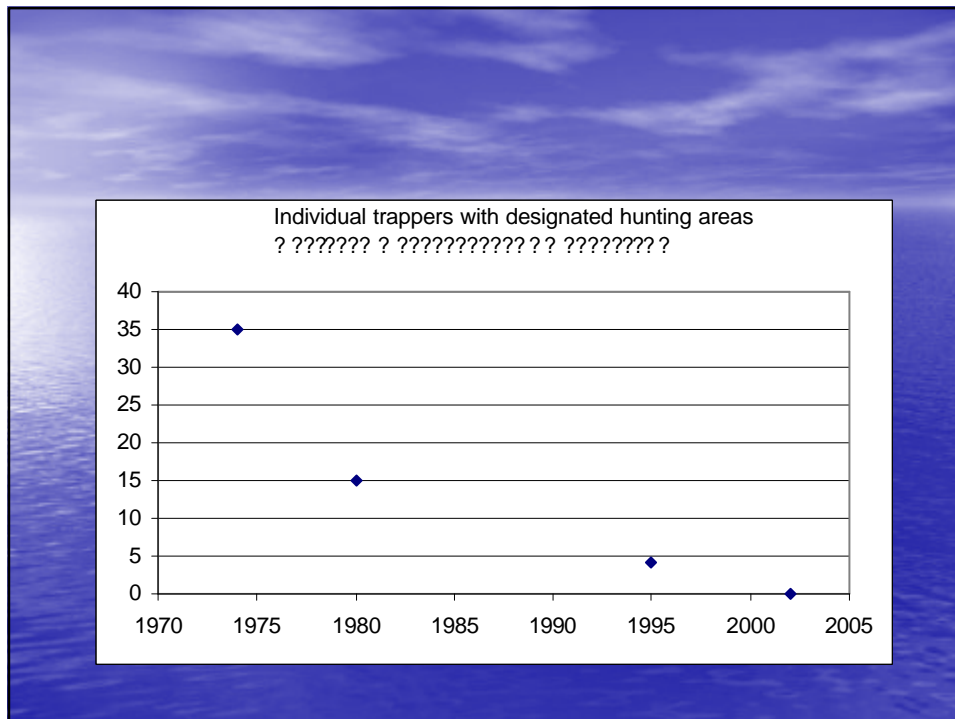
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Stanovaya

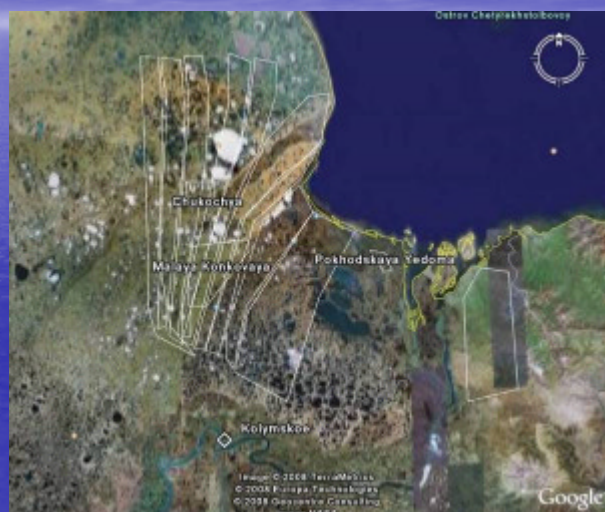
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Reindeer herders ?????????????? ???????

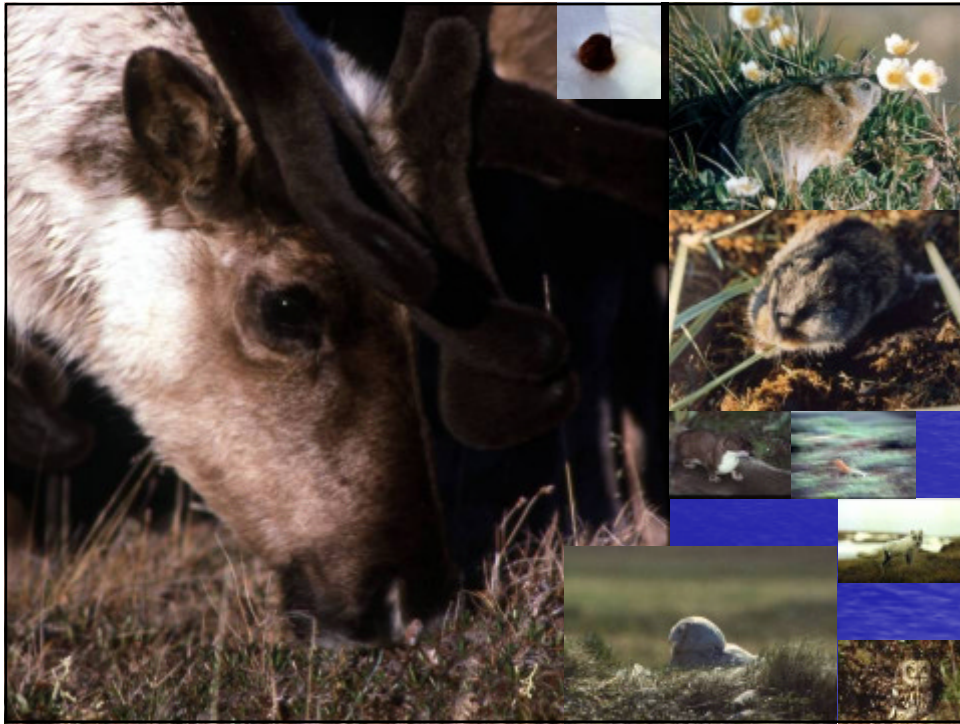












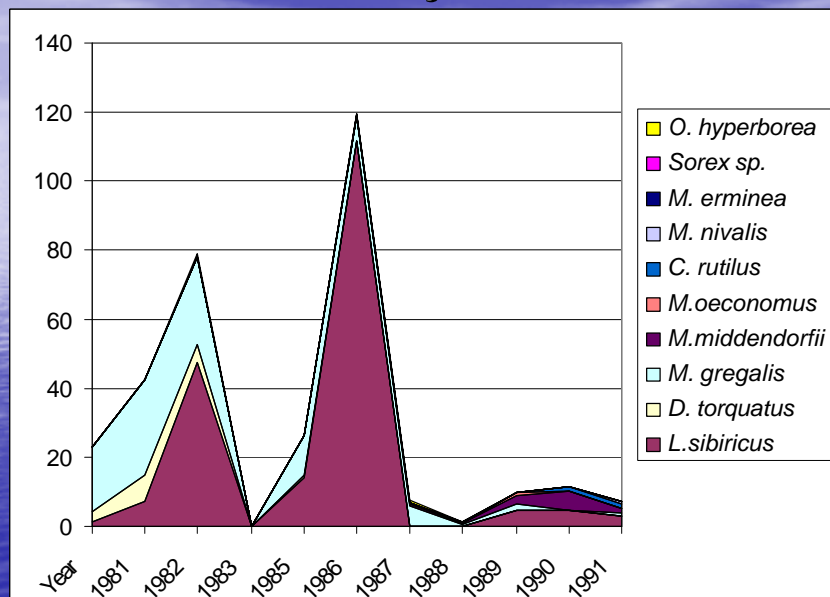


## Density of small mammals

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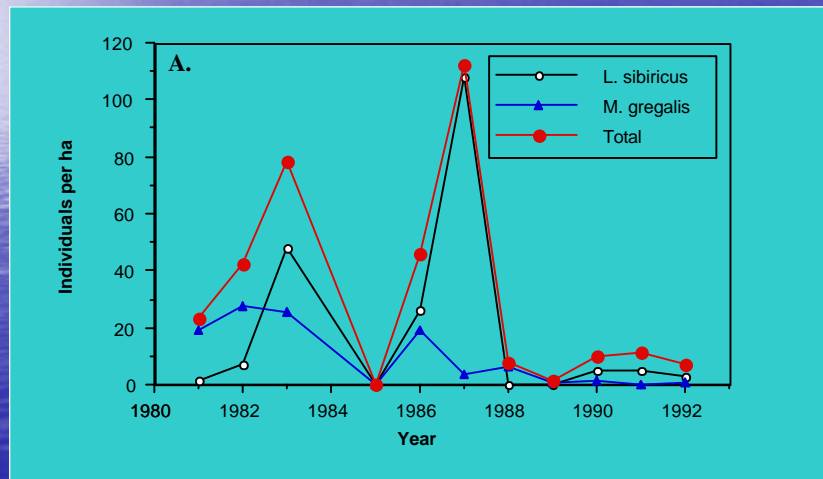
Year	<i>L.sibiricus</i>	<i>D.torquatus</i>	<i>M.gregalis</i>	<i>M.middendorffii</i>	<i>M.oecnomus</i>	<i>C.rutilus</i>	<i>M.nivalis</i>	<i>M.erminea</i>	<i>Sorex sp.</i>	<i>O.hyperborea</i>	SMD	Number of trap-nights
1981*	1.10	3.00	18.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.00	?
1982	7.03	8.00	27.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.33	1300
1983	47.70	5.00	25.30	0.00	0.00	0.00	0.00	0.00	0.00	0.85	78.85	1955
1985	0.08	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	420
1986	13.94	0.97	11.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.22	54910
1987	111.68	0.00	6.94	0.07	0.04	0.11	0.29	0.02	0.00	0.37	119.51	110580
1988	0.05	0.00	6.04	0.10	0.42	0.00	0.00	0.00	0.00	0.83	7.44	36864
1989	0.16	0.00	0.43	0.14	0.00	0.04	0.00	0.00	0.41	0.00	1.18	185220
1990	4.86	0.00	1.71	2.32	0.77	0.05	0.00	0.00	0.05	0.00	9.76	16068
1991	4.68	0.00	0.06	5.41	0.00	1.34	0.03	0.00	0.07	0.04	11.62	14008
1992	3.02	0.00	0.65	1.61	0.00	1.15	0.62	0.00	0.06	0.22	7.32	22840

## Small Mammals Dynamics (SMD)



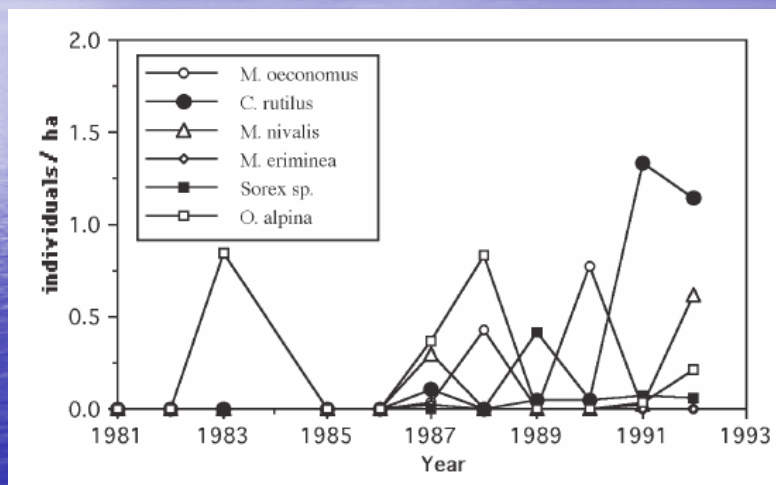
## Small mammals density

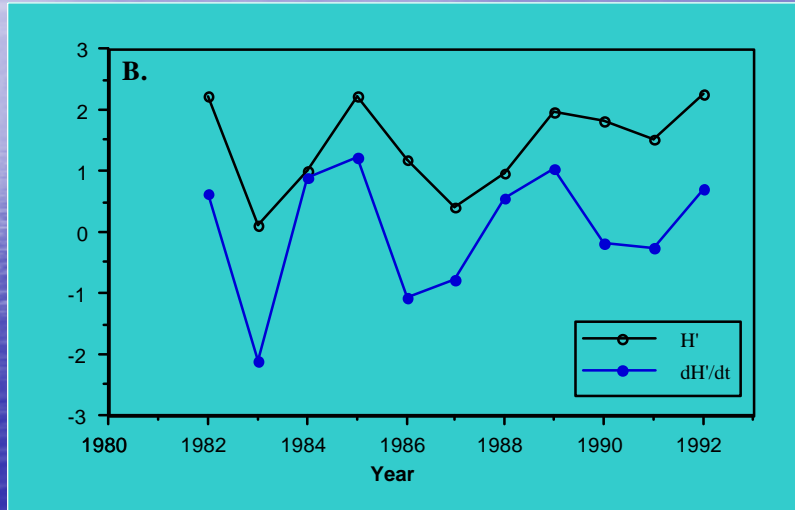
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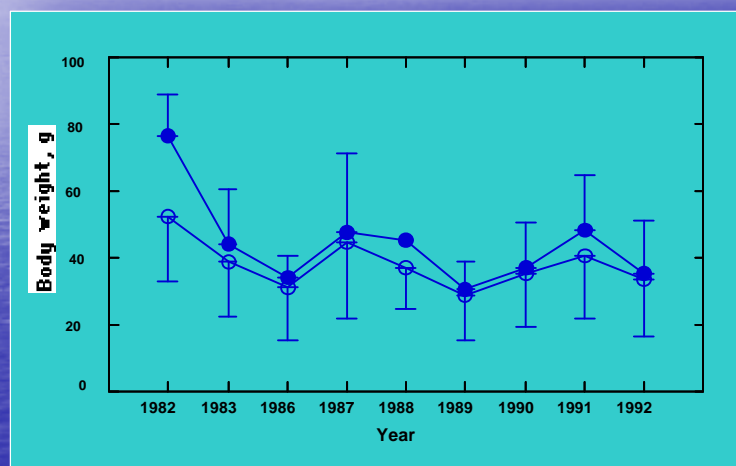
## Small mammals

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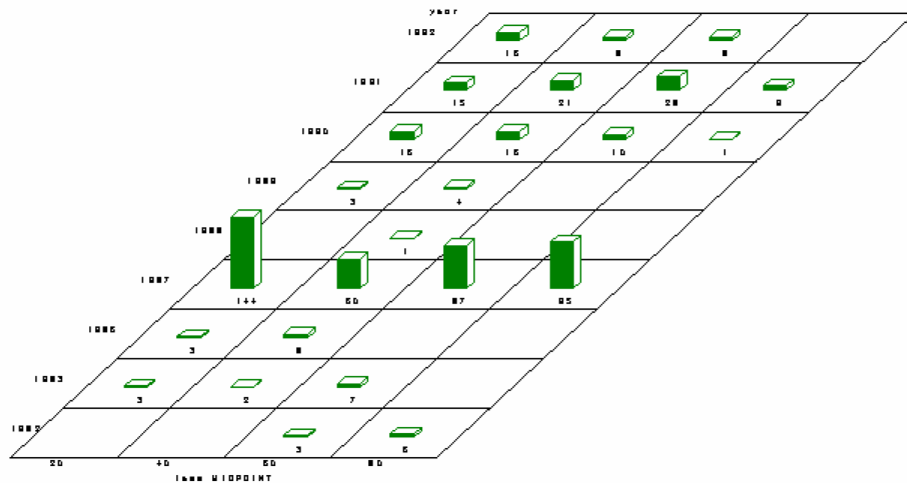
Siberian Lemming weight (above)  
 Total average weight of all species (below)  
 ??????? ??? ?????????? ???????? (????) ? ??????? ??? ???? ??????  
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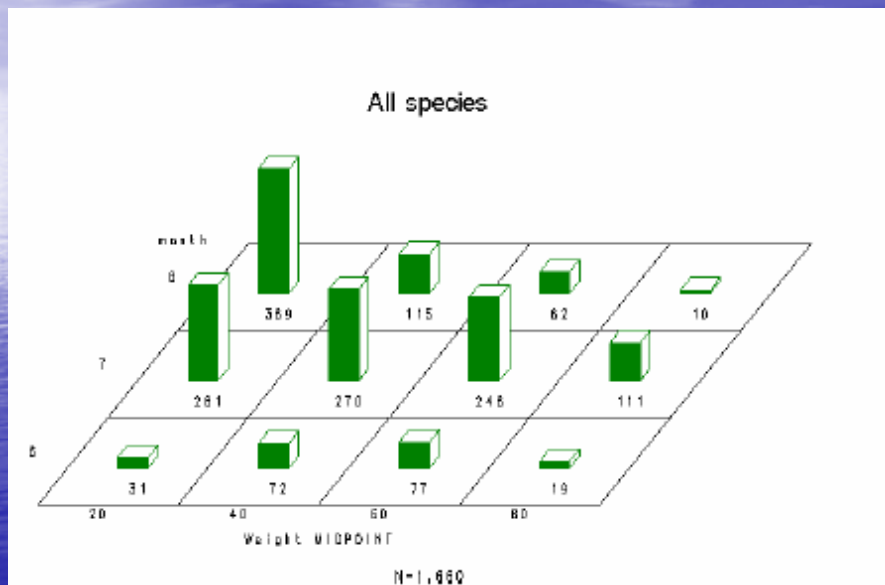
## Body weight distribution

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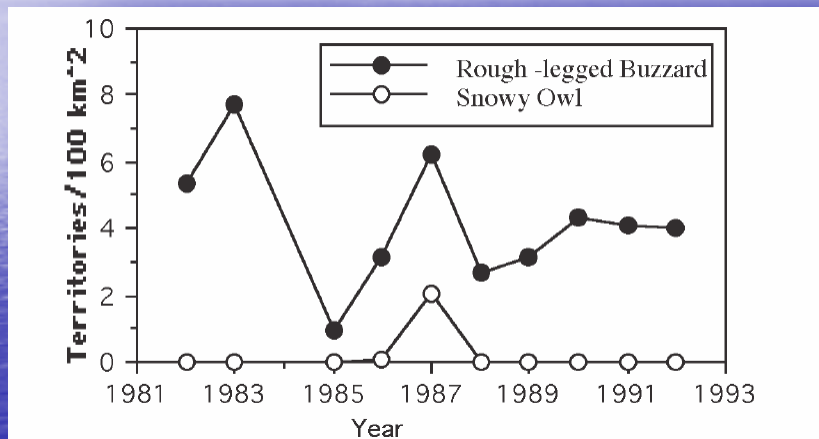


## Body weight during a season

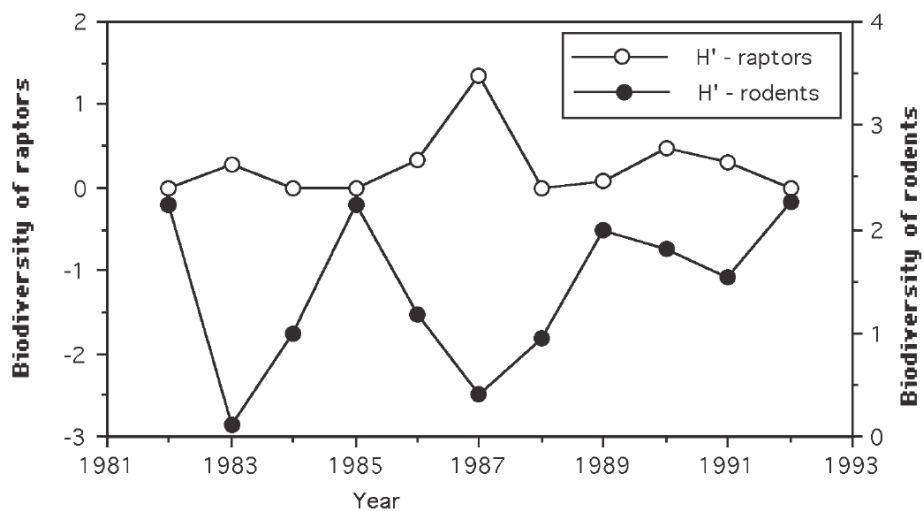
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Successful pairs ????? ? ? ? ? ? ? ?

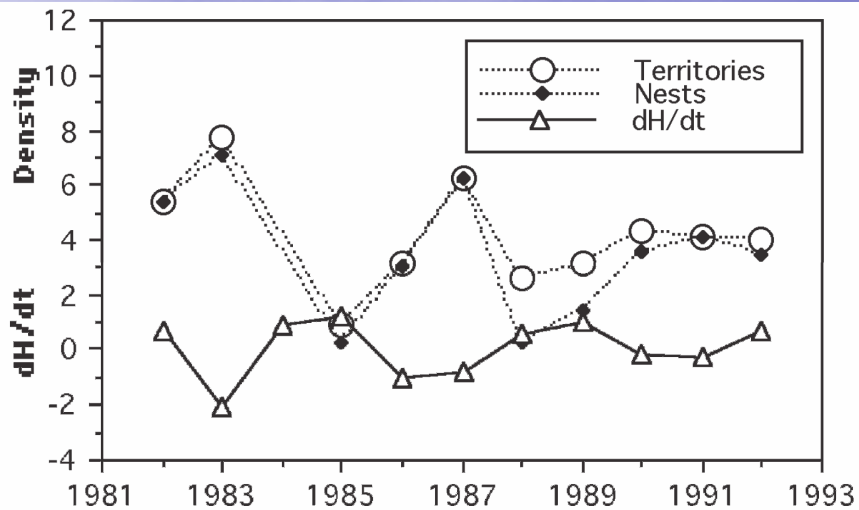


Diversity of small mammals and avian predators  
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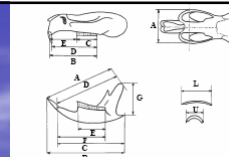
## All raptorial bird's territories

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## Who eats what?

??? ??? ???? ?

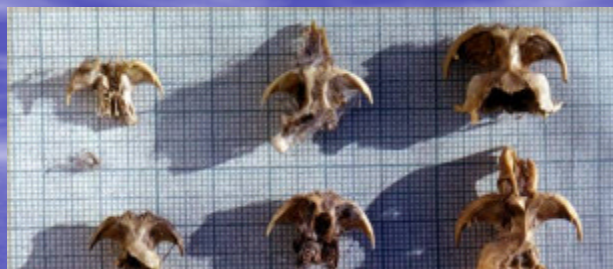
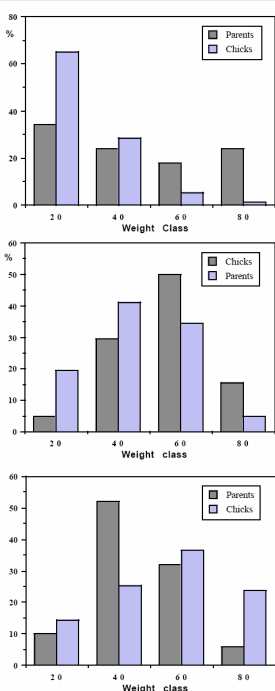
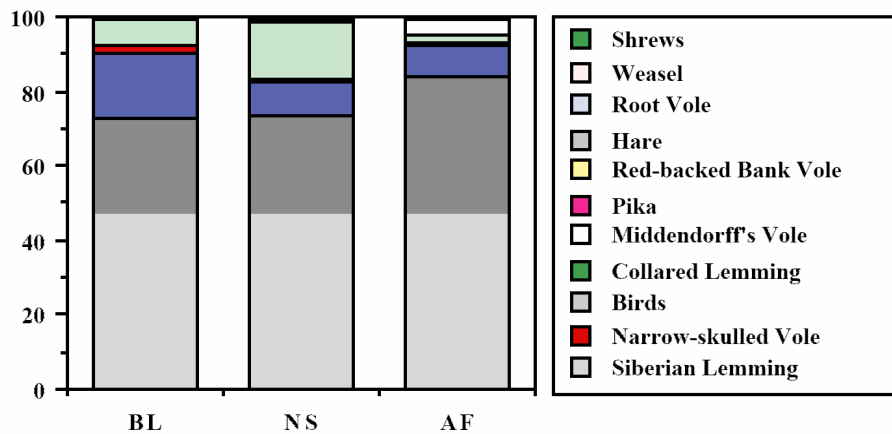


Species	Lower jaw						
Parameter	A	B	C	D	E	F	G
Siberian Lemming <i>Lemmus sibiricus</i>	$Wb = 10^{0.0005+0.04}$ , $R=0.94$ , $N=94$	$lgWb = 3.85^*lgL - 3.55$ , $R=0.97$ , $N=67$	$lgWb = 3.48^*lgL - 2.78$ , $R=0.93$ , $N=24$	$Wb = 10^{0.0005+0.04}$ , $R=0.996$ , $N=18$	$lgWb = 4.78^*lgL - 2.61$ , $R=0.90$ , $N=17$	$lgWb = 3.90^*lgL - 2.67$ , $R=0.93$ , $N=20$	$Wb = 26.50^*L - 120.97$ , $R=0.94$ , $N=23$
Narrow-skulled Vole, <i>Microtus gregalis</i>	$lgWb = 5.47^*lgL - 5.297$ , $R=0.95$ , $N=29$	$lgWb = 5.55^*lgL - 5.557$ , $R=0.95$ , $N=29$	$Wb = 10^{0.0005+0.04}$ , $R=0.93$ , $N=28$	$Wb = 10^{0.0005+0.04}$ , $R=0.96$ , $N=28$	$Wb = 10^{0.0005+0.04}$ , $R=0.93$ , $N=19$	$Wb = 100.278^*L - 1.212$ , $R=0.96$ , $N=24$	$Wb = 24.13^*L - 103.78$ , $R=0.90$ , $N=24$
Middendorff's Vole, <i>Microtus middendorffii</i>	$Wb = 10^{0.0005+0.04}$ , $R=0.89$ , $N=18$	$Wb = 10^{0.0005+0.04}$ , $R=0.92$ , $N=14$	$lgWb = 5.82^*lgL - 5.46$ , $R=0.94$ , $N=14$	$lgWb = 5.26^*lgL - 4.79$ , $R=0.88$ , $N=17$	$Wb = 46^*L - 2343.6$ , $R=0.82$ , $N=19$	Non significant	$Wb = 10^{0.0005+0.04}$ , $R=0.87$ , $N=13$
Collared Lemming, <i>Dicrostonyx torquatus</i>	$Wb = 10^{0.0005+0.04}$ , $R=0.98$ , $N=41$	$lgWb = 4.65^*lgL - 4.52$ , $R=0.96$ , $N=21$	$lgWb = 5.01^*lgL - 4.75$ , $R=0.97$ , $N=20$	$lgWb = 6.74^*lgL - 7.06$ , $R=0.93$ , $N=21$	$lgWb = 6.02^*lgL - 3.39$ , $R=0.93$ , $N=20$	$Wb = 100.318^*L - 2.34$ , $R=0.90$ , $N=19$	$lgWb = 3.20^*lgL - 0.788$ , $R=0.89$ , $N=22$
Root Vole, <i>Microtus oeconomus</i>	$lgWb = 5.39^*lgL - 5.389$ , $R=0.87$ , $N=107$	$Wb = 11.54^*L - 195.58$ , $R=0.92$ , $N=18$	$Wb = 478.53^*L - 548.63$ , $R=0.92$ , $N=18$	$lgWb = 4.62^*lgL - 4.10$ , $R=0.91$ , $N=20$	$lgWb = 3.86^*lgL - 1.527$ , $R=0.82$ , $N=20$	$Wb = 21.15^*L - 188.45$ , $R=0.91$ , $N=22$	$lgWb = 2.63^*lgL - 0.458$ , $R=0.88$ , $N=18$
Upper jaw and molars							
Parameter	A	B	C	D	E	F	G
Siberian Lemming <i>Lemmus sibiricus</i>	$Wb = 10^{0.0005+0.04}$ , $R=0.93$ , $N=23$	$lgWb = 3.98^*lgL - 3.73$ , $R=0.98$ , $N=54$	$lgWb = 3.72^*lgL - 1.65$ , $R=0.92$ , $N=24$	$lgWb = 3.52^*lgL - 2.73$ , $R=0.97$ , $N=24$	$lgWb = 3.16^*lgL - 1.48$ , $R=0.96$ , $N=22$		
Narrow-skulled Vole, <i>Microtus gregalis</i>	$lgWb = 3.07^*lgL - 1.82$ , $R=0.96$ , $N=21$	$Wb = 12.22^*L - 137.91$ , $R=0.95$ , $N=27$	$lgWb = 4.97^*lgL - 2.36$ , $R=0.94$ , $N=28$	$Wb = 10.73^*L - 123.81$ , $R=0.93$ , $N=34$	$lgWb = 3.38^*lgL - 1.70$ , $R=0.96$ , $N=21$		
Middendorff's Vole, <i>Microtus middendorffii</i>	$lgWb = 5.55^*lgL - 3.69$ , $R=0.93$ , $N=18$	$Wb = 100.164^*L - 0.892$ , $R=0.87$ , $N=19$	$Wb = 52.22^*L - 274.2$ , $R=0.81$ , $N=19$	$Wb = 100.166^*L - 0.982$ , $R=0.93$ , $N=19$	$Wb = 100.198^*L - 0.753$ , $R=0.86$ , $N=19$		
Collared Lemming, <i>Dicrostonyx torquatus</i>	$lgWb = 4.30^*lgL - 3.63$ , $R=0.97$ , $N=19$	$lgWb = 4.41^*lgL - 3.75$ , $R=0.91$ , $N=20$	$lgWb = 5.47^*lgL - 2.96$ , $R=0.94$ , $N=22$	$lgWb = 4.88^*lgL - 4.29$ , $R=0.95$ , $N=20$	$lgWb = 3.93^*lgL - 2.20$ , $R=0.88$ , $N=20$		
Root Vole, <i>Microtus oeconomus</i>	$lgWb = 3.61^*lgL - 2.56$ , $R=0.98$ , $N=20$	$Wb = 100.125^*L - 0.345$ , $R=0.86$ , $N=21$	$Wb = 100.125^*L - 0.345$ , $R=0.86$ , $N=21$	$lgWb = 5.365^*lgL - 4.789$ , $R=0.93$ , $N=21$	$lgWb = 5.141^*lgL - 3.306$ , $R=0.93$ , $N=21$		
Bone							
Parameter	Scapula	Ulna	Radius	Femur	Fibula	Upper incisors (U in Figure 3.1)	Lower incisors (L in Figure 3.1)
Equation	$Wb = 10^{0.0005+0.04}$ , $R=0.98$ , $N=36$	$Wb = 8.23^*L - 89.04$ , $R=0.93$ , $N=41$	$Wb = 0.64^*L - 87.59$ , $R=0.94$ , $N=43$	$Wb = 10^{0.0005+0.04}$ , $R=0.97$ , $N=41$	$Wb = 6.86^*L - 93.22$ , $R=0.97$ , $N=35$	$Wb = 13.95^*L - 82.58$ , $R=0.95$ , $N=30$	$Wb = 10^{0.0005+0.04}$ , $R=0.89$ , $N=27$



# Diets of the avian predators

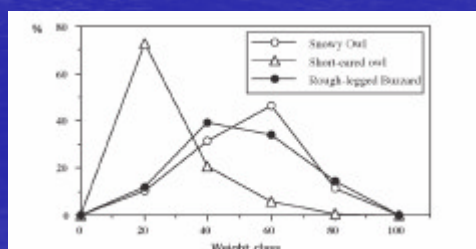
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Short-eared Owl  
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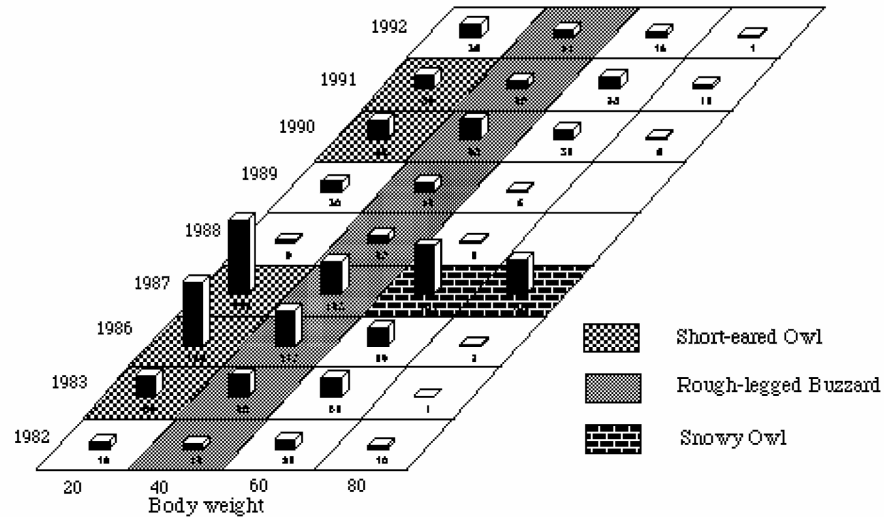
Rough-legged  
buzzard  
??????

Snowy Owl  
???? ???? ?

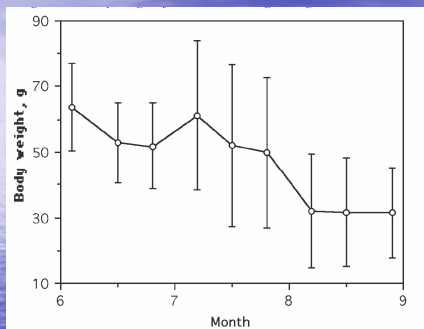


Distribution of weight of small mammals in various years. Patterned cells show breeding of Short-eared Owl, Snowy Owl and Rough-legged Buzzard.

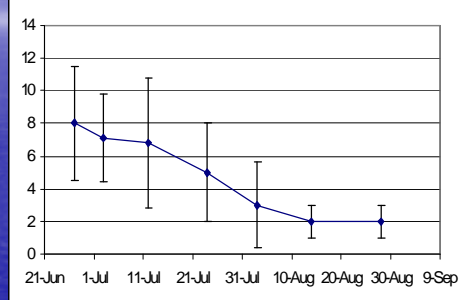
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Costs ???? ?



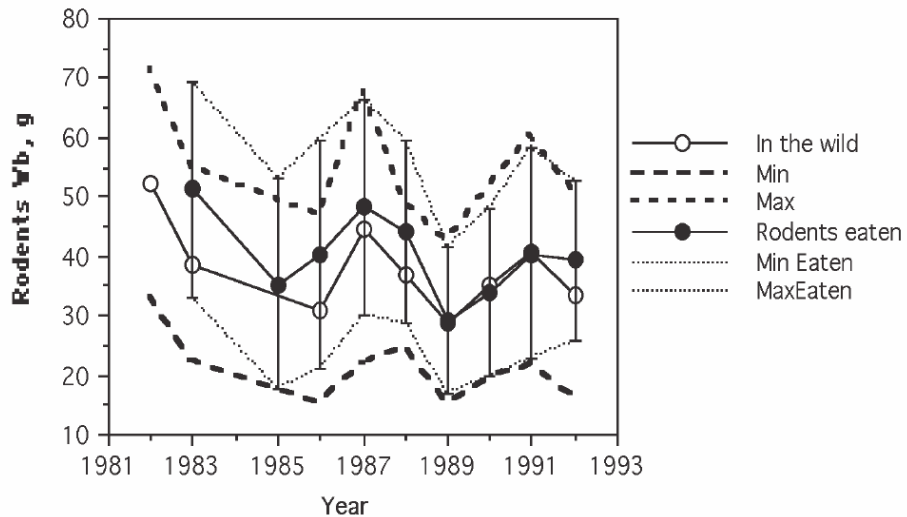
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Weight of rodents



Brood size reduction  
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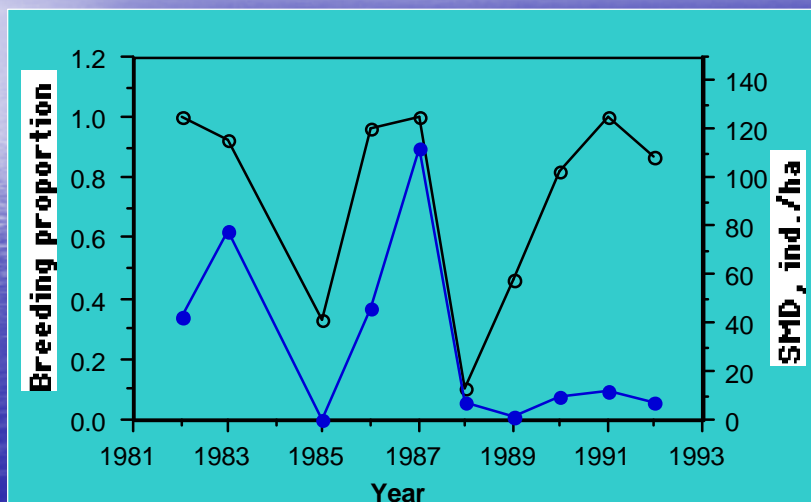
# Weight of small mammals in the diet of the RLB

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# Rough-legged buzzard. Percent of breeding pairs.

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- The total number of breeding pairs of rodent-eating birds correlates with rodent abundance.
- Maximum diversity of rodent-eating birds was observed in the years with the minimum diversity of small mammals.
- In such years Snowy Owl takes best places and dominates RLB and SEO.
- During lemming peaks Siberian Lemming becomes available in a number of different sizes. This allows three species of rodent-eating birds to coexist and to share one prey species, as each takes animals of different size. This significantly reduces the amount of competition for food even if the Siberian Lemming dominate in the diet of all species.
- Weight reduction of small mammals is a critical factor in the breeding of Snowy Owl