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PROGRAM & ABSTRACTS

Linking red fox use of Arctic fox dens to reindeer herding practices in Fennoscandia

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The tundra of Fennoscandia is a fragmented landscape that stretches over 1,500 km along the Scandinavian Mountains from southern Norway into the low Arctic. Arctic foxes here form a meta-population that has been endangered for more than a century. Among the challenges facing arctic foxes are intensified interspecific competition and predation by red foxes, which have increased in abundance and expanded into the tundra. Red foxes, being opportunistic generalists, benefit from environmental changes and human activities that alleviate food-scarcity. The Fennoscandian tundra is also inhabited by both semi-domestic and wild reindeer, managed in various ways. Winter mortality of reindeer can provide important food subsidies to red foxes that scavenge on carcasses. While some reindeer herds migrate to the forest in winter, others remain on the tundra where mortality can be high. Indeed, previous research has linked red fox expansion to reindeer herding and mortality. However, no large-scale analyses have been carried out and little is known about the importance of reindeer herding practices relative to other environmental drivers of red fox expansion. Furthermore, occurrence of red foxes within the tundra does not necessarily imply establishment in dens. We present data about red fox activity and reproduction in more than 400 arctic fox dens that have been monitored throughout the Fennoscandian tundra over the last 20 years under the National monitoring programs for arctic foxes and analyze them in relation to the spatial distribution of reindeer winter-pastures and other environmental covariates.

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Arctic fox litter size and diel activity at dens with different proximity to human infrastructure: Insights from Yamal, Russia

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The Arctic fox (*Vulpes lagopus*) is the most common mammalian predator in the Arctic. Across its circumpolar range it exhibits wide variability in litter size and behavior in response to fluctuations in prey abundance, predator pressure, human presence and some other factors. We analyzed data from 16 arctic fox dens with confirmed breeding during June-July in 2014-2018 on the north-eastern Yamal peninsula, Russia (71.2° N, 71.5° E). Dens were equipped with automatic cameras using motion sensor to monitor 24-hours activity of juvenile and adult Arctic foxes. We divided all the dens into two groups: (1) human-proximate dens (n=9), located within 2 km of human activity (roads, cabins, gas industry objects, etc.); and (2) human-distant dens (n=7), situated further than 2 km from mentioned human activity. In total, we analyzed 1 831 camera-hours, yielding 3 491 triggered detections (10 images per trigger). To quantify activity differences within the 24-h period, we distinguished diurnal (6:00-21:00) and crepuscular (21:00-6:00) periods. The average number of juveniles per litter was higher at human-distant dens (7,14 young) than at human-proximate dens (5,1 young), though difference was statistically insignificant (p=0,92). Juveniles showed similar activity patterns at both groups of dens: peak activity occurred at twilight onset. Interestingly, juveniles at human-proximate dens showed an additional activity peak just before twilight transitioned to daylight. As expected, adults appeared on images less frequently than juveniles. Adults at both groups of dens exhibited cathemeral activity. While we are not hypothesizing the observed differences, we believe that studies of Arctic fox breeding ecology should continue due to anticipated increases in human presence in the Arctic.

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Arctic foxes at their southern breeding edge on the Yamal Peninsula, Russia

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We have conducted extensive Arctic fox monitoring at our long-term international field station, Erkuta, since 2007. The study area lies near the middle of the shrubby-tundra zone (bio-climatic subzone E), covering approximately 220 km^2. Annually, we survey 50–75 dens, each has from 1 to over 30 entrances. Breeding litters were confirmed at 35 of these. Annual breeding den occupancy ranges from 0% (observed once, in 2008) to 47%, with an average litter size of 5.6 (range: 1–9). In late winter (late February to mid-April), we monitor Arctic foxes and other scavengers using 10 baited timelapse camera traps along a 50-km transect extending inland from Yamal's west coast. Camera data suggest a decline in Arctic fox abundance in recent years, while red fox detections show an increasing trend; wolverines remain stable at low numbers. Over 25 years of small rodent monitoring at Erkuta, we documented declining lemming occurrence—particularly the Siberian lemming (*Lemmus sibiricus*), last detected in 2011. Collared lemmings (*Dicrostonyx torquatus*) exhibit stable, low-amplitude annual dynamics. Voles (*Microtus* spp.) have remained relatively stable, though high-amplitude peaks have been absent in recent years. New species have emerged: the water vole (*Arvicola amphibius*) appeared in 2020 and is now detected annually at relatively high densities. As a low-Arctic site, Erkuta provides abundant alternate prey. Willow ptarmigans and snowshoe hares have increased since 2007 without steep declines or cyclic patterns. Together with diverse waterfowl (waders and ducks) and growing domestic reindeer herds—now experiencing frequent mass mortality events due to rain-on-snow—they form a rich food subsidy for foxes and other scavengers. These conditions likely facilitated red fox regular detections and breeding events since 2014. We aim that future research at Erkuta experiencing fauna borealization and growing human presence (both reindeer herders and hydrocarbon exploration) will quantify drivers of change affecting the local Arctic fox population. While Erkuta has site-specific peculiarities as with any field site, we believe that its location at the tundra ecotone and uninterrupted long-term dataset provide critical insights for researchers studying other Arctic fox populations across its southern breeding range, the first encountering borealization.

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