

# Interspecific Killing of an Arctic Fox by a Red Fox at Prudhoe Bay, Alaska

NATHAN J. PAMPERIN,<sup>1</sup> ERICH H. FOLLMANN<sup>2</sup> and BILL PETERSEN<sup>3</sup>

(Received 21 February 2006; accepted in revised form 24 May 2006)

**ABSTRACT.** We report on the interspecific killing of an arctic fox (*Alopex lagopus*) by a red fox (*Vulpes vulpes*) in the Prudhoe Bay Oilfield, Alaska, an event that was captured on video in November 2004. Both the video and evidence from observation indicate that this may be a case of intraguild predation. The interaction represents an extreme example of competitive behavior and suggests that increased contact between these two sympatric canids in northern Alaska could be detrimental to arctic foxes.

**Key words:** *Alopex lagopus*, arctic fox, *Vulpes vulpes*, red fox, competition, interspecific killing, intraguild predation, Prudhoe Bay, Alaska

**RÉSUMÉ.** Dans un champ pétrolier de la baie Prudhoe, en Alaska, un renard roux (*Vulpes vulpes*) a tué un renard arctique (*Alopex lagopus*). Il s'agit là d'une attaque interspécifique qui a été captée sur vidéo en novembre 2004. La vidéo et les indices prélevés au moment de l'observation laissent croire qu'il pourrait s'agir d'une prédation intraguild. Cette interaction représente un exemple extrême de comportement compétitif et laisse supposer que le contact accru entre ces deux canidés sympatriques du nord de l'Alaska pourrait nuire aux renards arctiques.

**Mots clés :** renard arctique, *Alopex lagopus*, renard roux, *Vulpes vulpes*, compétition, attaque interspécifique, prédation intraguild, baie Prudhoe, Alaska

Traduit pour la revue *Arctic* par Nicole Giguère.

## INTRODUCTION

It has been suggested that the southern range limit of the arctic fox (*Alopex lagopus*) is determined, through competition, by the northern range limit of the red fox (*Vulpes vulpes*) (Hersteinsson and Macdonald, 1992). A commonly held belief is that over parts of the Arctic, red foxes underwent a range expansion into higher latitudes during the 20th century (Macpherson, 1964; Chirkova, 1968). While there is anecdotal evidence for a similar range extension of red foxes in Alaska, supporting data are absent from the literature.

The Prudhoe Bay Oilfield is home to sympatric populations of red and arctic foxes. Both species are known to occur year-round and to breed successfully within the oilfield, but studies to date have concentrated mainly on the arctic fox and its relationship to petroleum development activities (e.g., Eberhardt, 1977; Fine, 1980; Garrott, 1980; Eberhardt et al., 1982, 1983). Competition and interactions between these two species remain poorly understood in northern Alaska.

Previous studies have reported on the interactions of red foxes and arctic foxes under experimental conditions (Rudzinski et al., 1982; Bailey, 1992; Korhonen et al., 1997) as well as in the wild (Schamel and Tracy, 1986; Frafjord et al., 1989; Tannerfeldt et al., 2002). An experiment on penned animals that were caught in the wild

(Rudzinski et al., 1982) showed red foxes to be dominant over arctic foxes, but never documented killing or fighting between the two. Observations of encounters between red and arctic foxes in the wild are rare, but published accounts show that red foxes dominate the smaller arctic foxes or that arctic foxes avoid confrontation altogether (Schamel and Tracy, 1986; Frafjord et al., 1989). Frafjord et al. (1989) and Tannerfeldt et al. (2002) reported that red foxes killed arctic foxes, but these reports do not include evidence that the arctic foxes were consumed after being killed.

## STUDY AREA AND METHODS

The Prudhoe Bay Oilfield (70°15' N, 148°22' W), situated on the central Beaufort Sea coast in northern Alaska, consists of a network of roads, gravel pads, and pipelines. The area is characterized by wet tundra composed of grasses, sedges, and mosses and includes many small ponds, lakes, and streams. Topography is mainly flat except for pingos and elevated banks of creeks and rivers. The area is described in detail by Murray (1978).

As part of oilfield operations, security officers conduct regular patrols of facilities in the field, traveling the road network by vehicle. While their intent is to maintain security, these patrols also provide excellent opportunities

<sup>1</sup> Department of Biology and Wildlife, University of Alaska Fairbanks, Fairbanks, Alaska 99775-6100, U.S.A.; ftnjp@uaf.edu

<sup>2</sup> Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, Alaska 99775-7000, U.S.A.

<sup>3</sup> Purcell Security, Pouch 340123, Prudhoe Bay, Alaska 99734, U.S.A.



FIG. 1. Red and arctic fox fighting, with red fox maintaining a superior position, Prudhoe Bay oilfield, Alaska, November 2004.

to observe wildlife species that inhabit the oilfield. A digital video recording of an encounter between a red fox and an arctic fox was made on one of these patrols. It was later transferred to a computer and examined at half the normal playback speed.

## RESULTS

In November 2004, a red fox was observed chasing an arctic fox under parked trucks and a nearby building constructed on stilts. As the chase proceeded, the red fox continued to gain on the arctic fox until contact was made, at which point video shots were taken to document the encounter. Six video clips totaling 2 minutes 36 seconds were taken of the interaction.

The first video clip shows the two animals fighting. The red fox was maintaining a superior position with respect to the arctic fox, while trying to roll the arctic fox over in repeated attempts to bite its neck. The arctic fox, struggling underneath the red fox, was kicking and biting at it (Fig. 1). At the 10-second mark of the video, the red fox succeeded in biting the neck of the arctic fox and then shook its head quickly from side to side, instantly killing or paralyzing the arctic fox. The red fox proceeded to carry the limp carcass across a parking lot and onto an adjacent patch of undisturbed snow (Fig. 2). The last three video clips show the red fox biting at the back of the arctic fox just behind the shoulders, in what seemed to be attempts to break open the skin (Fig. 3). Patches of bloody fur around the neck of the arctic fox are noticeable in the last two video clips. The following night, a red fox with the leg of an arctic fox in its mouth was observed walking in the vicinity of the kill, providing further indication that the arctic fox was at least partially consumed by the red fox after the kill. We were not able to follow the red fox for the rest of the night, so it is not known how long it fed on the arctic fox, or whether it might have left the carcass and



FIG. 2. The red fox carrying the carcass of the arctic fox away from the kill site.

come back to it between the time when the video was taken and the time when a red fox was seen with the leg of the arctic fox the following night.

## DISCUSSION

We have had many conversations with oilfield personnel during which they reported on similar encounters between red and arctic foxes. Most encounters reported involve red foxes chasing arctic foxes, but some report arctic foxes being killed and consumed. Longtime oilfield personnel generally agree that the number of red foxes is increasing within the field and this evidence, while anecdotal, may explain the increasing number of reports on aggressive and sometimes fatal encounters between red and arctic foxes in the oilfield.

Competitive behavior and even interspecific killing have previously been documented between red and arctic foxes in the wild (Schamel and Tracy, 1986; Frafjord et al., 1989; Hersteinsson and Macdonald, 1992; Tannerfeldt et al., 2002). Interspecific killing is also thought to be common among mammalian carnivores in general (Palomares and Caro, 1999), with the frequency of occurrence increasing when participants' body-size differences are intermediate (41.4–88.3% body size difference, Donadio and Buskirk, 2006). Differences in body size between red and arctic foxes in northern Alaska fall within this intermediate range (N.J. Pamperin and E.H. Follmann, unpubl. data), suggesting that interspecific killing between the two species could be common. To our knowledge, however, there is no documented case of intraguild predation involving red and arctic foxes in any part of their range where they are sympatric. Such an occurrence where the two species occur and breed is therefore noteworthy, especially in the context of a possible ongoing range expansion of the red fox.

Intraguild predation as described by Polis et al. (1989:297) involves "the killing and eating of species that



FIG. 3. The red fox biting and chewing at the back of the arctic fox, just posterior to the shoulders, after carrying the carcass off from the kill site.

use similar, often limiting, resources and are thus potential competitors” and it “is distinguished from traditional concepts of competition by the immediate energetic gains for one participant (the predator).” It is unknown how common intraguild predation or interspecific killing may be between red and arctic foxes in northern Alaska, but competition for the same resources occurs where these two species overlap (Elmhagen et al., 2002; Tannerfeldt et al., 2002), and except for moving onto the sea ice during winter months, the two species are essentially at their maximum extent because of the coastline.

Summer diets of arctic and red foxes have been found to be similar in northern Alaska (Eberhardt, 1977) and the Yukon Territory (Smits et al., 1989). Tannerfeldt et al. (2002) and Elmhagen et al. (2002) also reported on similarities in diet of sympatric arctic and red fox populations in Fennoscandia, but found that the foxes exhibited a spatial segregation during the breeding season that was explained by competition and expressed over an altitudinal gradient, with the arctic foxes taking refuge at higher elevations and denning in areas away from breeding red foxes.

Frafjord (2003) found a similar spatial segregation through elevation among dens of red and arctic foxes in Norway. Both Elmhagen et al. (2002) and Frafjord (2003) identified red foxes as a threat (through competition) to an already endangered arctic fox population in Fennoscandia. While the arctic fox population is not presently threatened in Alaska, the terrain on the coastal plain does not offer the altitudinal refugia found in the alpine regions of Sweden and Norway, to which arctic foxes are now restricted as a result of competition with red foxes (Elmhagen et al., 2002; Frafjord, 2003). Thus, if competition with red foxes becomes widespread in northern Alaska, it is unclear how arctic foxes might separate spatially from red foxes given the available habitat on the coastal plain.

In northern Alaska, prey for both fox species is more limited in winter than in summer since birds and their eggs are lacking (except those in caches). This scarcity could increase competition between the species during winter, especially in years of low microtine abundance. A complicating factor, however, is the year-round availability of food sources (such as garbage and handouts) that are a byproduct of human activities in the oilfield and nearby service areas. Direct observations indicate that arctic foxes seem to take advantage of anthropogenic foods more often than do red foxes (N.J. Pamperin and E.H. Follmann, unpubl. data). Despite management methods intended to prevent wildlife from feeding on garbage, sightings of arctic foxes feeding at dumpsters are commonplace within the oilfield, especially during winter. It is plausible that competition for food between red and arctic foxes is more intense outside the oilfield, where anthropogenic food sources are not present.

Similar food habits and overlapping ranges of red and arctic foxes in northern Alaska produce conditions that likely lead to competition between these two species (see Hersteinsson and MacDonald, 1992). The account we report here represents a possible case of intraguild predation, a severe example of a type of competitive encounter not previously reported for these two species. The evidence of predation has implications for both species. As the red fox is the larger, superior competitor, increases in its abundance may have negative implications for the arctic fox population if encounters between the two species also increase. Predation by red foxes could represent a significant source of mortality for arctic foxes in areas where the two species are sympatric if encounters such as the one reported here occur frequently. Physical contact between the two species through fighting or predation also increases the chances of rabies transmission, as the arctic fox is a known host of rabies in northern Alaska and periodically suffers from epizootics (Ritter, 1981).

Clearly more information is needed to better understand the competitive interactions between red and arctic foxes in northern Alaska and their implications for both species. Specifically, studies on winter diet (e.g., stable isotopes) and on the spatial use patterns of both red and arctic foxes in areas such as Prudhoe Bay are needed to assess how these species are interacting and the scale at which competition is occurring.

#### ACKNOWLEDGEMENTS

We thank Dr. Bill Streever and the environmental staff at BP Exploration Alaska Inc., for logistical support in getting N. Pamperin and E. Follmann to and from the oilfield, and the North Slope Borough Department of Wildlife Management, who provided support for our winter movement study of arctic foxes. We also thank Eva Fuglei and two anonymous reviewers whose comments helped to improve the earlier manuscript.

## REFERENCES

- BAILEY, E.P. 1992. Red foxes, *Vulpes vulpes*, as biological control agents for introduced arctic foxes, *Alopex lagopus*, on Alaskan islands. *Canadian Field-Naturalist* 106(2):200–205.
- CHIRKOVA, A.F. 1968. The relationship between arctic fox and red fox in the far North. *Problems of the North* 11:129–131.
- DONADIO, E., and BUSKIRK, S.W. 2006. Diet, morphology, and interspecific killing in carnivora. *American Naturalist* 167: 524–536.
- EBERHARDT, L.E., HANSON, W.C., BENGSTON, J.L., GARROTT, R.A., and HANSON, E.E. 1982. Arctic fox home range characteristics in an oil development area. *Journal of Wildlife Management* 46(1):183–190.
- EBERHARDT, L.E., GARROTT, R.A., and HANSON, W.C. 1983. Winter movements of arctic foxes, *Alopex lagopus*, in a petroleum development area. *Canadian Field-Naturalist* 97(1): 66–70.
- EBERHARDT, W.L. 1977. The biology of arctic and red foxes on the North Slope. M.S. thesis, University of Alaska Fairbanks, Fairbanks. 125 p.
- ELMHAGEN, B., TANNERFELDT, M., and ANGERBJÖRN, A. 2002. Food-niche overlap between arctic and red foxes. *Canadian Journal of Zoology* 80:1274–1285.
- FINE, H. 1980. Ecology of arctic foxes at Prudhoe Bay, Alaska. M.S. thesis, University of Alaska Fairbanks, Fairbanks. 77 p.
- FRAFJORD, K. 2003. Ecology and use of arctic fox *Alopex lagopus* dens in Norway: Tradition overtaken by interspecific competition? *Biological Conservation* 111:445–453.
- FRAFJORD, K., BECKER, D., and ANGERBJÖRN, A. 1989. Interactions between arctic and red foxes in Scandinavia — predation and aggression. *Arctic* 42(4):354–356.
- GARROTT, R.A. 1980. Den characteristics, productivity, food habits, and behavior of arctic foxes in northern Alaska. M.S. thesis, Pennsylvania State University, University Park. 95 p.
- HERSTEINSSON, P., and MACDONALD, D.W. 1992. Interspecific competition and the geographical distribution of red and arctic foxes *Vulpes vulpes* and *Alopex lagopus*. *Oikos* 64: 505–515.
- KORHONEN, H., ALASUUTARI, S., MAKINEN, A., and NIEMELA, P. 1997. Inter- and intraspecific competition between the fox species *Alopex lagopus* and *Vulpes vulpes*: An evaluation trial under penned conditions. *Polar Biology* 17:330–336.
- MACPHERSON, A.H. 1964. A northward range extension of the red fox in the eastern Canadian Arctic. *Journal of Mammalogy* 45(1):138–140.
- MURRAY, D.F. 1978. Vegetation, floristics, and phytogeography of northern Alaska. In: Tieszen, L.L., ed. *Vegetation and production ecology of an Alaskan Arctic tundra*. New York: Springer-Verlag. 19–36.
- PALOMARES, E., and CARO, T.M. 1999. Interspecific killing in mammalian carnivores. *American Naturalist* 153:492–508.
- POLIS, G.A., MYERS, C.A., and HOLT, R.D. 1989. The ecology and evolution of intraguild predation: Potential competitors that eat each other. *Annual Review of Ecology and Systematics* 20:297–330.
- RITTER, D.G. 1981. Rabies. In: Dieterich, R.A., ed. *Alaskan wildlife diseases*. Fairbanks: University of Alaska Fairbanks. 6–12.
- RUDZINSKI, D.R., GRAVES, H.B., SARGEANT, A.B., and STORM, G.L. 1982. Behavioral interactions of penned red and arctic foxes. *Journal of Wildlife Management* 46(4):877–884.
- SCHAMEL, D., and TRACY, D.M. 1986. Encounters between arctic foxes, *Alopex lagopus*, and red foxes, *Vulpes vulpes*. *Canadian Field-Naturalist* 100(4):562–563.
- SMITS, C.M.M., SLOUGH, B.G., and YASUI, C.A. 1989. Summer food habits of sympatric arctic foxes, *Alopex lagopus*, and red foxes, *Vulpes vulpes*, in the northern Yukon Territory. *Canadian Field-Naturalist* 103(3):363–367.
- TANNERFELDT, M., ELMHAGEN, B., and ANGERBJÖRN, A. 2002. Exclusion by interference competition? The relationship between red and arctic foxes. *Oecologia* 132:213–220.