Wolf, *Canis lupus*, Pup Mortality: Interspecific Predation or Non-Parental Infanticide?

A. DAVID M. LATHAM[1, 2] and STAN BOUTIN

Department of Biological Sciences, CW405, Biological Sciences Building, University of Alberta, Edmonton, Alberta T6G 2E9, Canada

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[1]Present address: Landcare Research, Gerald Street, P.O. Box 40, Lincoln 7640, Canterbury, New Zealand
[2]Corresponding author: email: ADM.Latham@yahoo.co.nz

A breeding male Gray Wolf, *Canis lupus*, equipped with a GPS collar was documented going to the den site of another Gray Wolf pack. This trip was coincident with an attack on the den of the other pack and the occurrence of a dead and partially consumed Gray Wolf pup at the same location. We present two possible explanations—interspecific predation and non-parental infanticide—to account for this observation. Because the Gray Wolf with the GPS collar and his mate were first-time breeders and were attempting to establish a territory space of their own, we speculate that, based on the available evidence, this observation most likely represents a case of non-parental infanticide that fits the predictions of the resource competition hypothesis.

Key Words: Gray Wolf, *Canis lupus*, interspecific predation, non-parental infanticide, resource competition hypothesis, Alberta.

Intraguild predation and competition can result in the killing of individuals from species within the same guild, whereas intraspecific competition can result in the killing of individuals within the same species. The large carnivore guild in northeastern Alberta consists of Gray Wolves (*Canis lupus*), Coyotes (*C. latrans*), and American Black Bears (*Ursus americanus*). Although Gray Wolves have been shown to be competitively dominant over Coyotes and American Black Bears, there have been a few reports of interactions in which American Black Bears have chased or killed Gray Wolves (Ballard et al. 2003). Intraspecific competition or intraspecific strife can be an important source of mortality within a population, and for Gray Wolves it has been shown to be one of the commonest sources of mortality outside of human exploited Gray Wolf populations (Mech and Boitani 2003). Although many deaths occur as a result of disputes between packs at territorial boundaries, disputes can also occur within a pack's territory (Mech and Boitani 2003).

The aim of this note was to document a trip by a breeding male Gray Wolf to the den site of another Gray Wolf pack and the occurrence of a dead and partially consumed Gray Wolf pup at the same location. We present two possible explanations—interspecific predation and non-parental infanticide—to account for the pup's mortality.

Study Area and Methods

Between January 2006 and January 2008, we conducted a radio-tracking study on a Gray Wolf population near the town of Wabasca-Desmarais (55°57'N, 113°49'W) in northeastern Alberta. During this period, we deployed 20 very high frequency (VHF) radio-collars and 12 remote downloadable global positioning system (GPS) collars (Lotek Wireless, Aurora, Ontario, Canada) on Gray Wolves from 11 packs. GPS collars were programmed to provide a location every 2 hours, whereas telemetry flights were flown 3 or 4 times per month (Latham 2009). We subsequently investigated the clusters of locations (i.e., locations in close temporal and spatial proximity; Anderson and Lindzey 2003) retrieved from the GPS collars to investigate kill sites and to collect Gray Wolf scats (i.e., to assess food habits).

Results

The Calling Lake pack consisted of a first-time breeding pair (Wolves 8 and 31) and their litter of six pups (Latham 2009). On 22 June 2007, we investigated a GPS cluster generated by the breeding male from the Calling Lake pack (Wolf 31). Wolf 31 generated this cluster just outside the northwestern boundary of his territory on 25 and 26 May 2007 and he subsequently returned to his den site. The approximate round-trip distance from Wolf 31's den to the cluster and back to his den was 70 km. Wolf 31 did not go to this location at any other time during our study. To our knowledge, his mate (Wolf 8), who was equipped with a VHF radio-collar, did not accompany Wolf 31 to this location, because data from telemetry flights placed her at (or near) her den throughout the month of May.

Examination of the site associated with the GPS cluster revealed a recently used Gray Wolf den belonging to a pack unknown to us. The den was approximately 22 km in a direct line from the den site of the Calling Lake pack. The southeast-facing entrance of the den had been dug under the roots of a White Spruce (*Picea glauca*) stump situated beside a stream. Closer examination of the site revealed extensive digging on the western side of the den that appeared to be an attempt to gain access to the denning chamber. Claw

marks on the tree roots where the digging occurred were more recent than those at the den's entrance, and they appeared to be those of a large mammalian carnivore. Based on the size of the claw marks on the tree roots, they were most likely Gray Wolf or possibly American Black Bear.

Further investigation of the site revealed the partially consumed carcass of a Gray Wolf pup estimated to be 4 to 5 weeks old on the grass outside the den. The carcass consisted of the upper and lower jaw bones (including the nose), the lower portion of the legs (including the feet), and the hide. The leg bones and skull had been completely sheared by a predator's teeth. The carcass was filled with maggots and had begun to decay. In addition to the Gray Wolf pup carcass, the skulls and fur of two Beavers (*Castor canadensis*) were found at the site.

The area surrounding the den site was further examined for evidence of potential predators/scavengers, particularly American Black Bear, Coyote, Red Fox (*Vulpes vulpes*), and Common Raven (*Corvus corax*); however, the only sign (tracks, scat, and hair) of predators that was evident in the area was that of Gray Wolf.

Interspecific predation?

We suggest two explanations to account for the destroyed and vacated den and the dead and partially consumed Gray Wolf pup at this site. First, a sympatric predator such as an American Black Bear, a Coyote, or a Red Fox could have found the den site, destroyed it as it attempted to gain access to one or more pups that were hiding, and killed and eaten the pup that we found (i.e., interspecific predation). However, while there have been a few accounts of mature American Black Bears chasing off (or in one instance killing) lone wolves (Joslin 1966; Rogers and Mech 1981; Fremmerlid and Latham 2009), we are unaware of any instances where these species have attacked a Gray Wolf den or killed Gray Wolf pups. Furthermore, although these opportunistic predators may be capable of attacking and killing Gray Wolf pups, they have been shown to be the loser in competitive interactions with Gray Wolves, particularly in a pack (e.g., Carbyn 1982; Peterson 1995; Ballard et al. 2003). We therefore argue that Gray Wolf dens are dangerous places for these species to forage and that these predators should be expected to avoid the dens of Gray Wolves. In addition, we found no evidence of tracks, hair, or scat belonging to any of these species in the vicinity of the den site. Consequently, while interspecific predation remains a possible explanation for our observation, we believe that evidence for this explanation is lacking. Similarly, we observed no evidence of Common Ravens scavenging at the site, and Common Ravens are unlikely to shear through leg bones. Thus, scavenging by Common Ravens did not influence our conclusions.

It is also possible that the pup died of unknown causes and was scavenged by its parents, by its litter mates, by Wolf 31, or by an alternative predator species. The primary piece of evidence that suggests that this is not the case is the apparent digging to gain access to the den. Within the denning chamber, there were numerous small spaces associated with the tangle of tree roots where a pup could hide from predators. It appears likely that the comparatively recent digging that exposed the denning chamber was an attempt by a predator to gain access to one or more hiding pups, not a dead pup. Furthermore, if the pup was scavenged rather than killed, it appears illogical that the parents would destroy their own den to gain access to the dead pup. Finally, we argue that it was unlikely that the pup was scavenged by its litter mates because this would not account for the destruction of the den, nor do we believe it possible that litter mates 4 to 5 weeks old would be capable of shearing through the femur and skull of a dead sibling (Packard 2003).

Non-parental infanticide?

GPS data and subsequent field investigations have been used to help infer all manner of results from predator-prey research in recent years (e.g., Anderson and Lindzey 2003; Demma et al. 2007; Webb et al. 2008), and we believe a more parsimonious explanation for our observation is that the trip by Wolf 31 to the unknown pack's den site resulted in the den being attacked and (at least) one pup being killed (i.e., non-parental infanticide) (Hrdy 1979; Ebensperger 1998). The most important evidence to support this claim is the fact that GPS data placed Wolf 31 at the den site for two days (non-maternal wolves frequently leave their den for two or more days at this time of year) where the pup was killed at approximately the same time as the pup died. In addition, the estimated age of the pup supports Wolf 31 being responsible for its death. Assuming an average birth date of mid- to late April for Gray Wolves in Alberta (Latham 2009; Webb 2009), the estimated age of the pup at the time of death (4 to 5 weeks) matches the dates when Wolf 31 was documented at the den (25 and 26 May).

Discussion

Non-parental infanticide has been reported from a wide variety of animal taxa (Ebensperger 1998), including the family Canidae. For example, it has been documented from captive populations of Dingoes (*Canis lupus dingo*) (Corbett 1988), Indian Wolves (*C. lupus pallipes*) (McLeod 1990), and Wolves (*C. lupus* ssp., Altmann 1974 *in* Packard 2003; Altmann 1987 *in* Packard 2003). In all cases, females were responsible. Furthermore, non-parental infanticide has been reported in wild Coyotes (Camenzind 1978), African Wild Dogs (*Lycaon pictus*) (van Lawick 1973), and Red Foxes (Vergara 2001). Females are believed to have been responsible in the two former cases, whilst

the sex in the latter was unknown. Non-parental infanticide has not previously been documented in wild Gray Wolves; consequently, our observation represents the first possible account of non-parental infanticide by a wild male Gray Wolf.

Most explanations of non-parental infanticide suggest some adaptive benefit to the perpetrator (Hrdy 1979; Pierotti 1991). In our opinion, the resource competition hypothesis, which suggests that infanticide may eliminate competition for the animal responsible, or its offspring, to limited physical resources such as food, nesting sites, or space (Rudran 1973; Hrdy 1979), provides the most plausible explanation for the current possible case of non-parental infanticide.

This hypothesis makes two predictions: infanticide is expected to be more prevalent (1) under conditions when resources are more limited and (2) when population densities are high (Butynski 1982). Gray Wolf densities in this region of northeastern Alberta have increased substantially over the last 15 years; however, there has also been a substantial increase in the availability of prey (Latham et al. 2011). Despite the apparent contradiction, it should be emphasized that Wolf 31 and his mate, Wolf 8, were young wolves attempting to carve out a territory of their own in a space that had become available after the demise of the pack that formerly occupied that space (Latham 2009). There were likely other Gray Wolves (floaters or neighbouring packs) also attempting to claim this available space (Mech and Boitani 2003). Consequently, Wolf 31's behaviour may have been an attempt to eliminate current or future competition for limited physical resources (prey and territory space) within an area that he and his mate were trying to establish as their own.

Given our knowledge of territoriality in Gray Wolves (see Mech and Boitani 2003), it is not surprising that non-parental infanticide is not a commonly observed phenomenon in wild Gray Wolf populations. Gray Wolves put considerable effort into territory defence, particularly during the breeding season (Peters and Mech 1975). Consequently, instances of a Gray Wolf going to a neighbouring pack's den site are probably rare. However, where space for a territory has become available (such as in the current example), non-parental infanticide may be less of a rarity as competing Gray Wolf packs or floaters vie to establish an exclusive territory. Because Gray Wolf pups are easier to kill than adults, one would expect that, during such boundary disputes, a Gray Wolf from a competing pack would target pups rather than adults in an attempt to reduce future competition.

Although the current example of non-parental infanticide has been inferred from GPS data and subsequent field investigation, we believe that available evidence from the site and the predictions associated with the resource competition hypothesis support a non-parental infanticide scenario. Current technology, such as GPS collars with downloadable data, in combination with timely field investigations, may help to clarify the importance and role of non-parental infanticide in territorial animals (such as Gray Wolves) where little information currently exists.

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