

Effects of Hierarchy Rank on Caching Frequency in a Captive Coywolf (Eastern Coyote) *Canis latrans* × *lycaon*, Pack

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Caching is useful because it ensures a consistent supply of food for animals. However, there is a relative paucity of data concerning which members of canid social units make the most caches. We provide data indicating that dominant members of a captive Coywolf “Eastern Coyote”, (*Canis latrans* × *lycaon*) pack did the majority (78%, $n = 46$ of 59) of caching. Caching is a common activity stereotypically performed by canids, and dominant members of a social unit tend to cache more often.

Key Words: Coywolf, *Canis latrans* × *lycaon*, Eastern Coyote, *Canis latrans* var., caching, dominance, food burying, hierarchy, Massachusetts.

Caching is a behavioral adaptation which helps to ensure the availability of food during periods when prey is scarce. It is often performed by animals whose food abundance fluctuates (Sklepkovych and Montevocchi 1996; Mech 1997). Caching is done by a variety of animals, including spiders (Champion de Crespigny et al. 2001), rodents (Abbott and Quink 1970; Gates and Gates 1980; Rice-Oxley 1993; Busher 1996), birds (Dixon and Johnson 1997; Heinrich and Pepper 1998), and mammals (Smith and Reichman 1984), including carnivores (Ewer 1973). Specifically, for canids, caching has been documented in African Wild Dogs (*Lycaon pictus*) (Malcolm 1980); Gray Wolves (*Canis lupus*) (Harrington 1981; Mech et al. 1998; Mech and Adams 1999; Peterson and Ciucci 2003); Red Foxes (*Vulpes vulpes*) (Henry 1993); Arctic Foxes (*Alopex lagopus*) (Sklepkovych and Montevocchi 1996); and Coyotes (*Canis latrans*) (Knowlton et al. 1999).

Knowlton et al. (1999) noted that although caching may be common, it has only recently been described for Coyotes. Yet a review of the literature indicates that it has been reported more than previously recognized (e.g., Young and Jackson 1951: 91; Harrington 1982; Phillips et al. 1991; Windberg et al. 1997; Ellins 2005). There is, however, a relative lack of quantified data about which members of a canid social unit cache most frequently. Phillips et al. (1991: Figure 3) documented the dominant male Coyote in their study pack caching most frequently, while other studies have found that dominant individuals most often scent mark over food in both Wolves (Harrington 1981) and Coyotes (Harrington 1982). The objective of this paper is to provide data on the frequency of caching in a captive pack of “Eastern Coyotes” also called Coywolves, *Canis latrans* × *lycaon*: Way et al. 2010).

Methods

Research was conducted on a litter of five captive “Eastern Coyotes” detailed previously (Way et al. 2006; Way 2007a). The animals were born 18–19 March 2002 in the wild, were taken into captivity at about three and a half weeks of age on 12 April, and were then socialized to JGW as they were raised for a behavioral and educational study. After three months of age, the Coyotes resided in a ~400 m² permanent exhibit at the Stone Zoo in Stoneham, Massachusetts. They were studied until the author was separated (by zoo staff) from the Coyotes in February 2005. Three of the Coyotes (male “Lupe” and females “Cane” and “Caon”) were observed for the entire study period, while the other two (male “Trans” and female “Late”) were observed for a year and a half until they were removed from the pack on 23 October 2003 due to intra-litter aggression (Way 2007a).

Although the Coyotes were hand-raised, JGW made no attempt to interfere with or discipline their activities and therefore gave the Coyotes free access, at all times, to their exhibit/living facilities. The Coyotes were provided with puppy milk (Esbilac, PetAg, Inc., Hampshire, Illinois) via bottle or bowl up until 15 May and were given access to water and dry dog chow (commercially available dog foods until March 2003, then Mazuri exotic canine chow/diet [PMI Nutrition International, LLC., Brentwood, Missouri] thereafter) at all times. They were group fed (i.e., all five at once) 0.75–1.6 kg (varying with their age) of Nebraska Brand chopped frozen canine meat (Central Nebraska Packing Co., North Platte, Nebraska) mixed with dog chow on a daily basis and were given frozen or thawed laboratory rats, guinea pigs, and mice (donated from a rodent breeding facility), and/or bones 2–4 times per week. Within their exhibit, the Coyotes commonly hunted (at least 1 prey item 2 or 3 times daily) and

TABLE 1. Captive Eastern Coyote names, maximum body mass (kg), gender, and pack dominance status from April 2002 to 23 October 2003 before Trans and Late were separated from the pack due to intra-litter aggression.

Name	Gender	Maximum weight (kg)	Intra-sex rank ¹	Overall rank ²		
				20 April 2002 (33 days old)	19 July 2002 (123 days old)	13 to 14 August 2002 (149 days old)
Cane	F	20.5	1	2	2	3
Caon	F	17.3	2	3	4	4
Late	F	14.0	3 ³	5	5	5 ³
Lupe	M	26.0	1	1	1	1
Trans	M	17.7	2	4	3	2

¹Rank for each gender.

²Overall rank within the pack. Pup age in days is denoted in parentheses.

³Late became tied for rank with Caon (4th overall and 2nd among females) from 10 March 2003 (age: 146 days) until 23 October 2003 (permanent separation of pack).

captured (about 1 or 2 prey items per week) Starlings (*Sturnus vulgaris*), House Sparrows (*Passer domesticus*), Eastern Chipmunks (*Tamias striatus*), Brown/Norway Rats (*Rattus norvegicus*), Meadow Voles (*Microtus pennsylvanicus*), and Gray Squirrels (*Sciurus carolinensis*), but did not eat much or any of these prey items.

We created an ethogram of Coyote behavior on standardized observation forms (Way et al. 2006) and also kept daily field notes. Data from this study were obtained by RDC reviewing JGWS notebooks and creating a detailed list of all instances of caching. To assess for dominance, we quantified dyadic interactions. We ranked the Coyotes and called the top-ranking male and female the dominant pack members, with the other three Coyotes referred to as non-dominant (Table 1), even though the second-ranked male was dominant over all three females for most of the study (after three months of age). A chi-square goodness-of-fit test was used to assess for the difference in caches between the two groups and to look at the difference of caching during summer (April–October) and winter (November–March) time periods. Significance was set at $P < 0.05$.

Results and Discussion

We observed 58 bouts of caching, 42 of which (72.4%) occurred during summer and 16 (27.6%) during winter. One caching instance involved a double cache made by Cane, the dominant female of the pack (Table 1). Most caches were made by the two dominant members of the pack (Figure 1 – Lupe and Cane; $n = 46$ of 59; $\chi^2 = 18.5$, $df = 1$, $P < 0.0001$) with more made during both summer ($n = 32$; Cane = 15, Lupe = 17; $\chi^2 = 11.5$, $df = 1$, $P = 0.0007$) and winter time periods (Cane = 8, Lupe = 6; $\chi^2 = 7.1$, $df = 1$, $P = 0.008$).

Caching Coyotes typically took an object to a fairly hidden part of their exhibit, often traveling in zigzag patterns before selecting a caching location. Individuals then created a small hole by digging up substrate (e.g., dirt, snow, leaves, gravel) with backward movements (i.e., toward their body) of their front legs/paws,

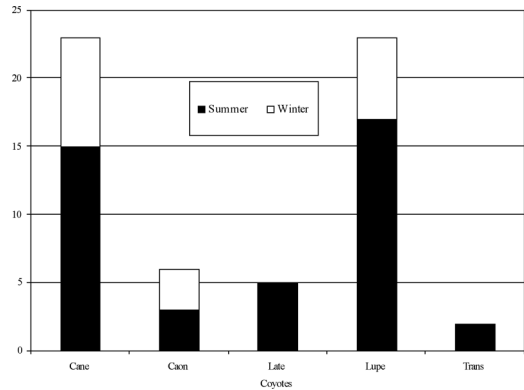


FIGURE 1. Winter (November–March) and summer (April–October) caching events by female (Cane, Caon, Late) and male (Lupe, Trans) Coywolves. Note: Cane and Lupe were dominant members of their sex.

usually with the object to be cached in the mouth (see methods), then deposited the object in the depression that they had dug, using their snout to press the food into the hole (i.e., tamping). They then covered the object with forward motions of their nose (“scooping”—Phillips et al. 1990, 1991) using the substrate that had been dug up (e.g., dirt, sand, or snow).

This observed caching sequence in Eastern Coyotes (Way 2007b; Way et al. 2010) is similar to that described by Phillips et al. (1991) for Coyotes, by Henry (1986: 95, 1993: 76) for Red Foxes, and by Mech (1970: 190, 1997: 121–122), Murie (1944: 60), and Phillips et al. (1990) for Wolves. Caching appeared to be stereotypical and instinctual (as they were raised by JGW and not adult Coyotes) that was perfected with practice (see Henry 1986: 99–101; Phillips et al. 1990, 1991).

Although this study was hampered by a small sample size, common to many captive studies of carnivores, our results suggest that the dominant members of a canid social group make a large proportion of caches.

Dominant Coyotes usually have access to more resources (Gese et al. 1996a, 1996b), and the confined nature of a zoo-like setting likely facilitated competitive interactions (especially between the three females) and subsequent caches when the dominant Coyotes were full. The relatively small size of the exhibit no doubt allowed other Coyotes to locate those caches easily. In the wild, however, Coyotes would likely travel greater distances to hide their food, similar to that described by Mech and Adams (1999) for Wolves. Furthermore, wintertime caching did not appear to differ from non-wintertime caching in form or function, with the exception of snow and ice often being present, and with the overall frequency of caches being less than during summer.

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