

## DESCRIPTION AND POSSIBLE REASONS FOR AN ABNORMALLY LARGE GROUP SIZE OF ADULT EASTERN COYOTES OBSERVED DURING SUMMER

JONATHAN G. WAY<sup>1</sup>

**ABSTRACT** - During summer 2001 I consistently observed a group of 6 adult coyotes (the breeding female was radiocollared) raising 1 pup in a suburban area on Cape Cod, Massachusetts. In this note I describe the activities of this group and possible reasons for the large pack size.

### INTRODUCTION

Sociality has been reported to be variable in coyotes, *Canis latrans*, ranging from coyotes living in packs of 5-10 adults to the mated pair (Bekoff and Wells 1980, Gese et al. 1996, Harrison 1992a, Kamler and Gipson 2000, Patterson and Messier 2001). Little is known of the sociality of coyotes in suburban and urban areas (Quinn 1995), especially in northeastern North America (Gompper 2002, Way 2000). Previous studies in the northeast (Harrison, 1992a,b; Messier and Barrette 1982; Patterson and Messier 2001) were unable to quantify group stability in summer because of difficulties observing coyotes in predominately wooded habitats; rather researchers relied on dirt/sand tracking to determine group size (Messier and Barrette 1982, Patterson and Messier 2001). For instance, Brundige (1993) quantified summer group sizes of eastern coyotes using track counts on raked gravel roads, but the literature indicates that coyotes typically travel alone during the summer (Gese et al. 1996, Messier and Barrette 1982). Thus, track counts would likely underestimate territorial group sizes of resident coyote packs.

As Messier and Barrette (1982:1748) noted, it is likely that the size of foraging groups decreases in the summer (also see Mech et al. 1998:105 for wolves [*Canis lupus*]), but that does not necessarily imply a change in the size of the social groups per se. It is important to report extremes of group sizes in various environments for canids, especially during the summer when sightings of coyotes are infrequent. This is because, coupled with territory size determination, estimation of group sizes affects population density extrapolations (Fuller and Snow 1988). Way (2000) reported that in an average territory size of 30 km<sup>2</sup> on Cape Cod, 3-4 adult coyotes live together. In general,

however, knowledge of coyote group sizes and densities in areas of high human densities are not known. Additional knowledge is needed in order to more accurately understand coyote ecology in urbanized areas. Accordingly, I document the observations of a family group of eastern coyotes at a rendezvous site, as defined by Harrison and Gilbert (1985) and Mech (1970), during summer 2001 in the Town of Barnstable (specifically, Marstons Mills) on Cape Cod (Fig. 1), Massachusetts, where average human density on the study site was 290 people/km<sup>2</sup> and road density, defined as centerline km of roadway per km<sup>2</sup>, was 4.66 (Cape Cod Commission, 1996, Barnstable, MA; U.S. Census Bureau, 1998 estimates).

### METHODS

Initial contact with this group was established on 8 June 2001 when a 9-12 year old (based on tooth wear; Bowen 1982, Landon et al. 1998), 17.7 kg, lactating female coyote (ID# 0110) was captured in a baited

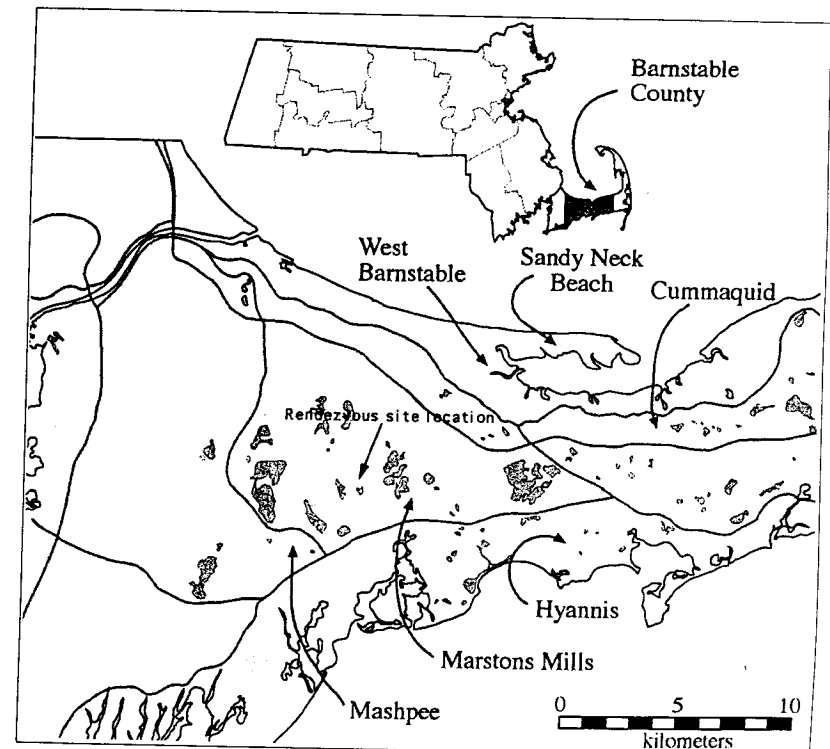


Figure 1. Map of Massachusetts with delineated county lines. The inset map depicts the study site showing principle locations (including the rendezvous site mentioned in the text) and main roads within Barnstable County, Cape Cod, Massachusetts.

<sup>1</sup>Lynch School of Education and Environmental Studies Program, Biology Department, Boston College, Higgins Hall, Chestnut Hill, MA 02467; wayjo@bc.edu.

(using meat scraps and road-kills) box trap (model 610B, 152.4 cm x 50.8 cm x 66.0 cm, Tomahawk Live Trap Co., Tomahawk, WI), radiocollared, and released. Portable receivers (Custom Electronics, Urbana, IL) and hand-held 3-element Yagi antennas were used to radiotrack the coyote when it was away from the rendezvous site. I used binoculars, 15–45X spotting scopes, and video-cameras when observing coyotes at the rendezvous site.

The single rendezvous site where all observations were made for the following account consisted of two 2 ha cultivated cranberry bogs, an open 75 x 75 m sand hill that bordered both of the bogs (the south end of the north bog and the west edge of the southeast bog), and a 1 ha patch of woods immediate south of the sandhill consisting mostly of scrub oak (*Quercus ilicifolia*) and greenbriars (*Smilax* sp.). A small ca. 5 ha pond bordered the wooded patch at the south end of the site. There was a narrow strip of woods (ca. 100 m in width and the length of the site) that bordered the west edges of both the sandhill and northern bog—this area was dense enough for coyotes to bed down in during the day. Surrounding this rendezvous site were residential neighborhoods and a main road to the west and north, a main road immediately east of the southeast bog and the small pond, then a neighborhood to the south. Therefore, when adult coyotes left the rendezvous site they had to pass through neighborhoods and cross a paved road. Despite human presence around this rendezvous site it was typical in description (Joslin 1967, Mech 1970) because there was food (rodents in the bogs to hunt), cover, water, and open space where the pups and adults could hunt and see for a long distance (> 400 m) in an otherwise forested or residential environment.

## RESULTS AND DISCUSSION

I could not determine 0110's group size from 8 June–15 July because they were located at another rendezvous site and were difficult to reliably observe. Then on 15 July 0110's group moved ca. 4 km to the previously described cranberry bog location where they focused their activities until 4 August. Six adult coyotes and 1 pup were visually identified by pelage coloration, pelage pattern, and physical characteristics (e.g., body size) at this rendezvous site. During this time (15 July–4 August), 18 separate visual observations were made of these coyotes during dawn ( $n = 8$ ) or dusk ( $n = 10$ ) periods. Observation bouts (i.e., a dawn or dusk session) varied between 5 minutes and 2 hours, and averaged 39 min. Long observations ( $n = 5$ ; > 1.5 hours) took place when coyotes slept in the open, usually at the top of the sandhill or at the west edge of the west bog at the edge of the 50–75 m

strip of woods bordering suburbia. Four of 6 adults were smaller and actively submitted (by food begging/licking the adults' mouth and wagging their tails low to the ground) to the breeding female (0110) (Andelt 1985, Patterson and Messier 2001) and to another coyote, which was assumed to be the breeding male based on size and behavior (Mech 1970).

During dominance displays the breeding pair stood in a posture with body, head, and tail held up. The pair was never observed to be aggressive to submissive coyotes and, in fact, readily played with these coyotes. The 4 smaller coyotes were believed to be resident associate, "helper" coyotes and may have been offspring (probably yearling) of the mated pair, based on smaller size and behavior around adults (Andelt 1985, Patterson and Messier 2001). All observations at the rendezvous site involved  $\geq 1$  of these associate coyotes, which provided care (based on direct observations) to the only documented pup. However, the associate coyotes did leave the rendezvous site and were often seen returning (i.e., crossing roads and traveling through neighborhoods) to the area, usually at dawn.

The pup commonly solicited play with the resident associates and occasionally the two adults ( $n = 4$  times) and I observed all 7 coyotes chasing each other back and forth in the cranberry bogs (2–7 coyotes), especially at dusk when the coyotes were waking up (Bekoff 1974, J. Way unpublished data). Four different coyotes (excluding 0110) were observed bringing and/or regurgitating food to the pup.

Although all 7 (2 adults, 4 associates, and 1 pup) coyotes were observed together at the rendezvous site on 6 occasions, they usually did not travel together when leaving the site, which is similar to observations by Mech et al. (1998) for wolves in Denali National Park and by Crabtree and Sheldon (1999:136) for coyotes during summer. In addition, eight direct observations from 0.9–5.2 km (straight distance) away from the rendezvous site were made of 0110 during this sampling block; 6 times she was seen alone and twice with a second coyote. All observations were made at night (via headlights), thus the possibility exists that there were other group members nearby, just not in view during the sighting (Crabtree and Sheldon 1999:136).

This note documents the largest recorded group of coyotes on Cape Cod (Way 2000) and the northeast United States during summertime, and next to studies in Yellowstone (Crabtree and Sheldon 1999, Gese et al. 1996), it is believed to be one of the largest documented groups reported for coyotes during summer. Coyote 0110's territory size was close to 30 km<sup>2</sup>, which is very similar to the average territory size for 3–4 coyotes on Cape Cod (Way 2000). Possible reasons, not necessarily mutually exclusive, for this large group size are: 1) habitat saturation

and delayed dispersal of surviving offspring (Andelt 1985, Way 2000); 2) defense of territorial and hunting grounds, i.e., cranberry bogs for rodents (Bekoff and Wells 1980); and 3) potential inheritance of the natal territory because of the very old breeding female (Patterson and Messier 2001).

Given the flat and coastal nature of Cape Cod (i.e., suitable coyote habitat), there is the possibility that delayed dispersal due to habitat saturation (i.e., no vacant territories) could play a role in associate coyotes remaining within their natal territory rather than dispersing. Coyotes colonized Cape Cod in the late 1970s/early 1980s (J. Cardoza, MassWildlife, pers. comm.) and are currently known to exist in every town on Cape Cod. Way (2000) and Way (unpublished data) indicated that, on his 200 km<sup>2</sup> study area, coyote territories averaged 30 km<sup>2</sup> and closely adjoined but did not overlap within this study area. Harrison (1992a) documented higher coyote survival for resident versus dispersing coyotes. Therefore, a coyote may be able to increase its fitness by remaining within its natal range rather than dispersing to new, unfamiliar areas. Also, coyotes were often observed hunting rodents in the cranberry bogs at the rendezvous site. Thus, the potential also exists that the coyote pack was defending hunting grounds. Additionally, because the genetic relatedness amongst group members was not known, there is a possibility that non-breeding animals stayed within the pack in hopes of inheriting 0110's position, especially if they were unrelated to 0110 or to the breeding male. In summary, a possibility exists that a combination of these not mutually exclusive factors could work together whereby habitat saturation, protection of hunting grounds, and the potential inheritance of a natal territory could all be responsible for this large coyote group.

Hunting large prey does not seem to be a plausible explanation (Brundige 1993) for the large group size because of the paucity of white-tailed deer, *Odocoileus virginianus*, observed (via tracks, scats and sightings) in 0110's home range (J. Way, unpublished data). Also, access to the opposite sex (Gittleman 1989, Patterson and Messier 2001) does not seem to be an advantage to group formation in this situation because the pack that I monitored was most likely related (Andelt 1985, Gese et al. 1996, Patterson and Messier 2001). Research shows that canids typically avoid inbreeding (Meier et al. 1995), therefore, the territorial inheritance hypothesis (listed as hypothesis #3 above) would mean that a coyote would inherit the territory of its parents and would find an unrelated mate once breeding status was attained. This would be especially true if the breeding male was also very old. However, because the relationship of the helpers to the breeding male was not positively

determined, they possibly could have mated with him if he was unrelated to them (i.e., if it was his first breeding season with 0110) and the associates were females.

Future monitoring of large groups of coyotes should be long-term and should attempt to capture as many coyotes as possible in a social group, in order to reveal genetic patterns of family groups and to study radiocollared coyote interactions in the summer and subsequently during fall and winter when adults and pups become less visible, because they are mostly nocturnal (Way 2000), and are not regularly returning to a predictable area of use (i.e., a rendezvous site). Two additional activities that might gain insights into coyote sociality could involve: 1) saturating a coyote group(s) with bait in order to see if large group sizes consistently form during an unusual abundance of food; and 2) collecting hair and/or scat from den and rendezvous sites to determine the number and familial relationships among different individuals using the site. However, I suspect that the present observation resulted from the old age of the breeding female causing an unusual number of coyotes to inhabit this territory (i.e., the territorial inheritance hypothesis); no doubt other factors (listed above) also played a role.

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#### LITERATURE CITED

- Andelt, W.F. 1985. Behavioral ecology of coyotes in south Texas. *Wildlife Monographs* 49:1-45.
- Bekoff, M. 1974. Social play and play-soliciting by infant canids. *American Zoologist* 14:323-340.
- Bekoff, M., and M.C. Wells. 1980. The social ecology of coyotes. *Scientific American* 242:130-148.
- Bowen, W.D. 1982. Determining age of coyotes, *Canis latrans*, by tooth sections and tooth-wear patterns. *Canadian Field-Naturalist* 96:339-341.

- Brundige, G.C. 1993. Predation ecology of the eastern coyote (*Canis latrans*) in the Adirondacks, New York. Ph.D. Dissertation, State University of New York, College of Environmental Science and Forestry, Syracuse, NY.
- Crabtree, R.L., and J.W. Sheldon. 1999. Coyotes and canid coexistence in Yellowstone. Pp. 127–163, *In* T. W. Clark, A.P. Curlee, S.C. Minta, and P.M. Kareiva (Eds.). *Carnivores in ecosystems: the Yellowstone experience*. Yale University Press, New Haven, CT. 429 pp.
- Fuller, T.K., and W.J. Snow. 1988. Estimating winter wolf densities using radiotelemetry data. *Wildlife Society Bulletin* 16:367–370.
- Gese, E.M., R.L. Ruff and R.L. Crabtree. 1996. Social and nutritional factors influencing the dispersal of resident coyotes. *Animal Behavior* 52:1025–1043.
- Gittleman, J.L. 1989. Carnivore group living. Pp. 183–207, *In* J.L. Gittleman (Ed.). *Carnivore Behavior, Ecology, and Evolution*. Cornell University Press, Ithaca, NY. 620 pp.
- Gompper, M.E. 2002. Top carnivores in the suburbs? Ecological and conservation issues raised by colonization of northeastern North America by coyotes. *Bioscience* 52:185–190.
- Harrison, D.J., and J.R. Gilbert. 1985. Denning ecology and movements of coyotes in Maine during pup rearing. *Journal of Mammalogy* 66:712–719.
- Harrison, D.J. 1992a. Dispersal characteristics of juvenile coyotes in Maine. *Journal of Wildlife Management* 56:128–138.
- Harrison, D.J. 1992b. Social ecology of coyotes in northeastern North America: Relationships to dispersal, food resources, and human exploitation. Pp. 53–72, *In* A.H. Boer (Ed.). *Ecology and management of the Eastern Coyote*. Wildlife Research Unit, University of New Brunswick, Fredericton, NB. 194 pp.
- Joslin, P.W.B. 1967. Movements and homesites of timber wolves in Algonquin Park. *American Zoologist* 7:279–288.
- Kamler, J.F., and P.S. Gipson. 2000. Space and habitat use by resident and transient coyotes. *Canadian Journal of Zoology* 78:2106–2111.
- Landon, D.B., C.A. Waite, R.O. Peterson and L.D. Mech. 1998. Evaluation of age determination techniques for gray wolves. *Journal of Wildlife Management* 62:674–682.
- Mech, L.D. 1970. *The Wolf: The Ecology and Behavior of an Endangered Species*. 1995, Reprint, University of Minnesota Press, Minneapolis, MN. 384 pp.
- Mech, L.D., L.G. Adams, T.J. Meier, J.W. Burch, and B.W. Dale. 1998. *The Wolves of Denali*. University of Minnesota Press, Minneapolis, MN. 227 pp.
- Meier, T.J., J.W. Burch, L.D. Mech, and L.G. Adams. 1995. Pack structure and genetic relatedness among wolf packs in a naturally regulated population. Pp. 335–340, *In* L.N. Carbyn, S.H. Fritts and D.R. Seip (Eds.). *Ecology and conservation of wolves in a changing world*. Occasional Publication No. 35. Canadian Circumpolar Institute, University of Alberta, Edmonton, AB. 642 pp.

- Messier, F., and C. Barrette. 1982. The social system of the coyote (*Canis latrans*) in a forested habitat. *Canadian Journal of Zoology* 60:1743–1753.
- Patterson, B.R., and F. Messier. 2001. Social organization and space use of coyotes in eastern Canada relative to prey distribution and abundance. *Journal of Mammalogy* 82:463–477.
- Quinn, T. 1995. Using public sighting information to investigate coyote use of urban habitat. *Journal of Wildlife Management* 59:238–245.
- Way, J.G. 2000. Ecology of Cape Cod coyotes. M.S. Thesis, University of Connecticut, Storrs, CT. 107 pp.