



Effects of helping behaviors on coyote packs in Yellowstone National Park, Wyoming  
by Kezha Guittard Hatier

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in  
Biological Sciences

Montana State University

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Abstract:

Helping behaviors, during the denning season, were studied for twelve coyote packs (*Canis latrans*) in Yellowstone National Park, Wyoming. Of 14 helpers 12 (86%) were known to be related to one or both of the alpha pair they helped. Observations were made from the end of April until the end of July during the summers of 1992 and 1993. The den site was the area of focus, and only one coyote was observed at a time. Summers were divided into three biologically defined periods; the beginning and end of each period was determined by the temporally changing needs of the pups. Objectives were to compare the differences in helping behaviors between the adults in a pack, to determine if there was a difference in behaviors among adults from period to period, to determine if the age of the beta helpers and the size of the litter influenced the amount of time they spent helping, to determine if the alpha pair benefited from the presence of the beta helpers, and to determine if the pups benefited from the presence of the betas. All alpha females were alone more than all alpha males during period one, and they played more with the pups during period three. Alpha females with betas socialized with the young more during periods two and three, and regurgitated more with the young during period three than did alpha females without betas. Alpha males without betas howled more during period two than did alpha males without betas. Alpha females with betas were present at the den, and alone at the den more than alpha males with betas during the first period. Beta females were present at the den more than were beta males during period one, and alone at the den more than were beta males during period three. Beta males were alert at the den more than were beta females during period three. There was no difference in the amount of time all alpha females and all alpha males were present from period to period. Beta females spent more time present during period one, less time present during period two, and the least time present during period three. The beta males were present at the den less during period one than during period two, and the least during period three. Alpha and beta females were alone the most during period one, the least during period two, and less than period one during period two. Beta males were alone the den the most during period two, less during period one, and the least during period three. The amount of time betas spent helping was not influenced by their age or the number of young in the litter. However only one beta was older than two years. There was a positive correlation between the size of the pack and the initial litter size, and between the number of provisionings and the litter size. There was also a positive correlation between the number of feedings to the pups from the alpha female and the size of the litter. There was no correlation between the number of betas in a pack and the amount of time the alpha pair spent resting. Pups in larger packs were left alone less, and fed more than pups in smaller packs. There was a negative correlation between the size of the pack and the survival of the pups until August. However, the pups were hit heavily with Parvo virus one year, and this undoubtedly skewed the results.

**EFFECTS OF HELPING BEHAVIORS ON COYOTE PACKS**

**IN**

**YELLOWSTONE NATIONAL PARK, WYOMING**

**by**

**Kezha Guittard Hatier**

**A thesis submitted in partial fulfillment  
of the requirements for the degree**

**of**

**Master of Science**

**in**

**Biological Sciences**

**MONTANA STATE UNIVERSITY  
Bozeman, Montana**

**May 1995**

N378  
H2862

ii

APPROVAL

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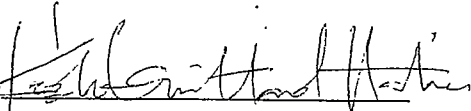
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## ACKNOWLEDGMENTS

This study was supported by the U.S. Park Service, and cooperative research agreement # 12-34-74-0226(CA) between U.S.D.A. Denver Wildlife Research and Montana State University. The National Geographic Society, the U.S. Department of the Interior Fish and Wildlife Service, and the Hornocker Wildlife Research Institute also provided funding. I thank Dr. R. Crabtree who gave help in criticizing the drafts of the thesis, and in sparking ideas about coyote behaviors. I thank also Dr. R. Moore who helped me out of many financially and intellectually tight corners, and Dr M. Jaeger who helped in reviewing drafts of the study plan and the thesis. Dr. K. O'Neill went far beyond the call of duty in correcting the various drafts of the thesis, and was a key figure in opening my eyes to the excitement and possibilities in the field of animal behavior.

Dr. J. Robison-Cox gave advice about statistics, and Dr. W. Thompson spent hours helping with statistical tests. M. Connor, B. Fuhman, J. Grahe, J. Weinberg, Valerie Slade, Timm Stotts, and Dr. J. Williams spent hours in the field helping to collect data, and L. Yengoyan helped with the beginning.

E. Gese and S. Grothe gave advice and encouragement when it was needed. I would like to thank J.T. Stangl for help in the hurttles of the master's program, and P. Riess for putting up with such grumpiness. Finally I would like to thank my parents whose patience seemed endless.

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## ABSTRACT

Helping behaviors, during the denning season, were studied for twelve coyote packs (*Canis latrans*) in Yellowstone National Park, Wyoming. Of 14 helpers 12 (86%) were known to be related to one or both of the alpha pair they helped. Observations were made from the end of April until the end of July during the summers of 1992 and 1993. The den site was the area of focus, and only one coyote was observed at a time. Summers were divided into three biologically defined periods; the beginning and end of each period was determined by the temporally changing needs of the pups. Objectives were to compare the differences in helping behaviors between the adults in a pack, to determine if there was a difference in behaviors among adults from period to period, to determine if the age of the beta helpers and the size of the litter influenced the amount of time they spent helping, to determine if the alpha pair benefited from the presence of the beta helpers, and to determine if the pups benefited from the presence of the betas. All alpha females were alone more than all alpha males during period one, and they played more with the pups during period three. Alpha females with betas socialized with the young more during periods two and three, and regurgitated more with the young during period three than did alpha females without betas. Alpha males without betas howled more during period two than did alpha males without betas. Alpha females with betas were present at the den, and alone at the den more than alpha males with betas during the first period. Beta females were present at the den more than were beta males during period one, and alone at the den more than were beta males during period three. Beta males were alert at the den more than were beta females during period three. There was no difference in the amount of time all alpha females and all alpha males were present from period to period. Beta females spent more time present during period one, less time present during period two, and the least time present during period three. The beta males were present at the den less during period one than during period two, and the least during period three. Alpha and beta females were alone the most during period one, the least during period two, and less than period one during period two. Beta males were alone the den the most during period two, less during period one, and the least during period three. The amount of time betas spent helping was not influenced by their age or the number of young in the litter. However only one beta was older than two years. There was a positive correlation between the size of the pack and the initial litter size, and between the number of provisionings and the litter size. There was also a positive correlation between the number of feedings to the pups from the alpha female and the size of the litter. There was no correlation between the number of betas in a pack and the amount of time the alpha pair spent resting. Pups in larger packs were left alone less, and fed more than pups in smaller packs. There was a negative correlation between the size of the pack and the survival of the pups until August. However, the pups were hit heavily with Parvo virus one year, and this undoubtedly skewed the results.

## INTRODUCTION

Among the major factors influencing the social organization of a population are its mating systems, its spacing patterns, and its feeding ecology (Moehlman 1983). Monogamy is a mating system rare in mammals (Moehlman 1983). It has been documented in many canids, but not felids. Canid males feed the young with regurgitated food (Wittenberger and Tilson 1980) and help to rear and to protect their young, whereas felid males do not. Two ways monogamous mammals may care for their young are biparentally, and communally. Biparental care is defined as the establishment of monogamy between a male and a female, and parental duties are divided among each (Gittleman 1985). In some families of mammals, communal care includes both biparental care and alloparental helpers to share with the duties of rearing the young. These helpers, of either sex, serve to guard, and to feed the current offspring (Gittleman 1985). Alloparental helpers do not mate, but expend time and energy to rear young that are not their own (Malcolm and Marten 1981). The degree of relatedness between such helpers and breeders, (consequently, between helpers and young) is one of the primary factors influencing non-parental aid or "helping behavior" (Owens and Owens 1984). Thus, helping may have evolved via kin selection, the process by which a trait is favored because of its beneficial effects on relatives, such as siblings or cousins (Maynard Smith 1964).

Spacing patterns also can affect the social organization of a population. If individuals are territorial, and unoccupied territories are rare, the young may have to travel great distances before they can settle. If the young remain on their parents territory, they may increase their rate of survival which also would benefit the parents (Selander 1964). However, with each member added to a family group, there must be a high enough food base to support all. Von Schantz (1984) hypothesized that the evolution of kinship groups can be induced by a temporary resource surplus within the territories. Helping can be either direct or indirect. Direct helping occurs only in response to the presence of the young, and includes such activities as feeding, carrying, grooming, playing with, and protecting the young (Gittleman 1985). Indirect helping might include defense of a territory or feeding a breeding female while she is pregnant. There are many benefits and some costs that have been attributed to communal breeding and to different forms of helping. The pack benefits from greater coordination of group movements, and by sharing of information. The breeders may benefit from the non-breeders' help in the care and rearing of their current offspring (Emlen 1978). The acceptance of genetically related helpers may ensure that the young reared in the territory after the breeders' death are related to them (Brown 1974, Woolfenden and Fitzpatrick 1978). Furthermore, a larger pack helps to divide the labor of caring for offspring. With a shortage of available territories helpers benefit by staying on their natal territory; they gain more easily food, a relatively safe environment, and experience. The breeders allow them to remain because of a surplus of resources,

and because of the benefits to the breeders from helping. Finally, current offspring can receive a higher rate of food intake, and more protection from predators.

In order to maintain helping behaviors in a population, the benefits to breeders and to helpers should exceed costs when one or more helpers remain on the territory, and whatever costs might be experienced by the helper in not breeding (Kinnaird and Grant 1982). Among the costs to all members of a pack, attributed to the presence of helpers, are increased competition, increased transmission of disease or ectoparasites, increased conspicuousness to predators, and increased aggression (Gittleman 1985). Helpers alone withstand the cost of delaying reproduction.

Among species that engage in a variety of group-level activities, decisions about grouping patterns are likely to be highly complex (Packer 1990). Bertram (1978) found that the presence of subordinate non-breeding adults (betas) within groups of genetically related individuals appears to be widespread in carnivores. In addition, species that have communal care tend to live in small (3-10 individuals), relatively stable groups in well-defended territories.

In Yellowstone National Park coyote (*Canis latrans*) packs in the northern range are made up of either the dominant and breeding alpha pair and of the subordinate nonbreeding betas, or of the alpha pair only. Only a structured pack, never a lone coyote or unstructured group, was observed, during this study, to hold a territory. Most of the packs studied had beta helpers. Coyote pups are born at the end of April, or the beginning of May (Bekoff and Wells 1981). Their first two weeks are spent entirely in the den. They are helpless, toothless, hairless and blind (Gier 1975)

for about the first ten days, during which they depend completely on the mother for their nourishment and for their protection, and on their newborn siblings and their mother for heat. They cannot use their teeth until about six weeks of age (Gier 1975), so milk continues to be their staple diet until their teeth can be used to tear meat apart. The pups begin to eat regurgitated food about the beginning of June and hard food at the end of June. They are not very mobile for the first few weeks, and usually can run quickly by the middle or end of June. By the end of July, they rarely use the den, but they do have rendezvous sites near the most recent den, and often travel with the adults. If the young disperse from their natal territories, they do so from September through January.

In winter, coyotes may hunt alone, or in packs when they try to kill large prey. In which case, the alpha male usually takes down the prey before the other pack members help with the final kill (Gese and Grothe 1995). In the summer, however, when the pups are growing, Yellowstone coyotes seem to hunt alone. In this case the prey they take is fairly small and can be handled by one adult. For example, during the denning season the coyotes have an ample supply of Uinta ground squirrels (*Spermophilus armatus*), elk calves (*Cervus elaphus*), voles (*Microtus* spp.), pronghorn fawns (*Antilocapra americana*), and pocket gophers (*Thomomys talpoides*).

Winter pack size decreased slightly in Yellowstone Park during the denning season, and the boundaries of the territories were enforced more during the mating and early denning season than during the beginning of winter (Crabtree 1989). There was an even sex ratio of beta helpers. Most of the betas of a known age

were one to two years old, and were the offspring of the alpha pair they helped.

The northern range has much open habitat which makes observing the coyote behavior from a distance accurate. Coyotes in Yellowstone Park are, for the most part, monogamous. Because of high population density, and because territories are fixed at about 3-4 square miles, there is little room for territorial change. Consequently, the chance of a dispersing coyote finding unoccupied territory is slim. Yellowstone Park offers the advantage of studying coyotes in an area where they are relatively undisturbed. To my knowledge, no study has focused on the contributions of coyote helpers to the pack. Because coyotes are wary, it is difficult to observe coyotes in the wild. This study provided a chance to examine the behavior of coyotes during their denning season in natural surroundings. Furthermore, cohesive family groups are found most often in remote areas or locations where coyotes are relatively unpersecuted (McMahan 1975).

My objectives and hypotheses were as follows:

1. Objective: To determine the relationship in social position between adults (one or more years old) in the pack, and their roles in rearing the pups.

Hypothesis: There will be differences in behaviors among the different levels of social class and/or the different sexes.

Null: There will be no difference in behaviors among different levels of social class and/or the different sexes.

2. Objective: To examine the phenology of denning behavior of twelve coyote packs in Blacktail Plateau and Lamar Valley.

Hypothesis: The proportion of time the alphas and the betas are present at the den, and guarding the pups will change as the pups grow.

Null: The proportion of time the alphas and betas are present at the den, and guarding the pups will not change as the pups grow.



3. Objective: To determine whether the amount of time spent by betas on helping to rear pups is influenced by the age of the betas and/or by the number of pups in a litter.

Hypothesis: The age of the betas and the size of the litter will affect the amount of time the betas spend with the pups.

Null: The age of the betas and the size of the litter will not affect the amount of time the betas spend with the pups.

4. Objective: To determine whether the alpha pair benefit directly from the helping behaviors of betas.

Hypothesis: The alpha pair will benefit from the presence of betas.

Null: The alpha pair will not benefit from the presence of betas.

5. Objective: To determine whether the presence of betas influences the survival of the pups.

Hypothesis: The presence of betas will benefit the current pups, by an increase in their rate of survival, their rate of food intake, and a decrease in the amount of time they are left alone.

Null: The presence of betas will not benefit the current pups.

## STUDY AREA

The two areas of study were in the northern range of Yellowstone National Park in northwest Wyoming (Figure 1 and Figure 2). The first was on the Blacktail Plateau, 16 kilometers east of Mammoth, Wyoming. The second was in Lamar Valley, 40 kilometers east of Mammoth.

Blacktail Plateau is at an elevation of 1920 meters. The average annual temperature ranges from a high of 18 degrees C, to a low of -6 degrees C. The average annual precipitation is 28 centimeters, with an average annual snowfall of 278 centimeters (Dirks 1982). Each territory, of the four packs studied (Deer Creek, Oxbow, Blacktail, and Lava Creek), included rolling grassland hills covered with big sagebrush (*Artemisia tridentata*), Idaho fescue (*Festuca idahoensis*), quaking aspen (*Populus tremuloides*), Douglas fir (*Pseudotsuga menziesii*), and lodgepole pine (*Pinus contorta*) (Despain 1990). There are either small creeks or ponds in each territory and the Park's Northeast Entrance Road runs across this plateau.

Lamar Valley is at an elevation of 1988 meters. The average annual temperature is a high of 16 degrees C, with an average low of -12 degrees C. The average annual precipitation is 28 centimeters, with 278 centimeters of snowfall annually (Dirks, 1982). The Lamar River flows through the valley and defines a border for three of the four packs' territories (Norris, Druid, and Bison packs); the fourth packs' territory (Soda Butte) is bisected by Soda Butte Creek. The upland slopes of each territory overlook the valley and the flat open grassland of the valley floodplain. The slopes are grown with aspen, lodgepole pine, and Douglas fir, the valley with

lodgepole pine, Douglas fir, Engelmann spruce (*Picea engelmannii*), big sagebrush, and Idaho fescue (Despain 1990). Each territory includes 2-4 km<sup>2</sup> of mesic floodplain dominated by sedges and an occasional shrub. The Northeast Entrance Road runs across three of the four packs' territories.

The primary mammal fauna on each study site are coyote, grizzly bear (*Ursus arctos*), black bear (*Ursus americanus*), mountain lion (*Felis concolor*), badger (*Taxidea taxus*), red fox (*Vulpes vulpes*), weasel (*Mustela frenata*, *M. erminea*), river otter (*Lutra canadensis*), vole (*Microtus* spp.), Uinta ground squirrel (*Spermophilus armatus*), pocket gopher (*Thomomys talpoides*), deer mice (*Peromyscus maniculatus*), muskrat (*Ondatra zibethicus*), bighorn sheep (*Ovis canadensis*), moose (*Alces alces*), elk (*Cervus elaphus*), mule deer (*Odocoileus virginianus*), buffalo (*Bison bison*), and antelope (*Antilocapra americana*).

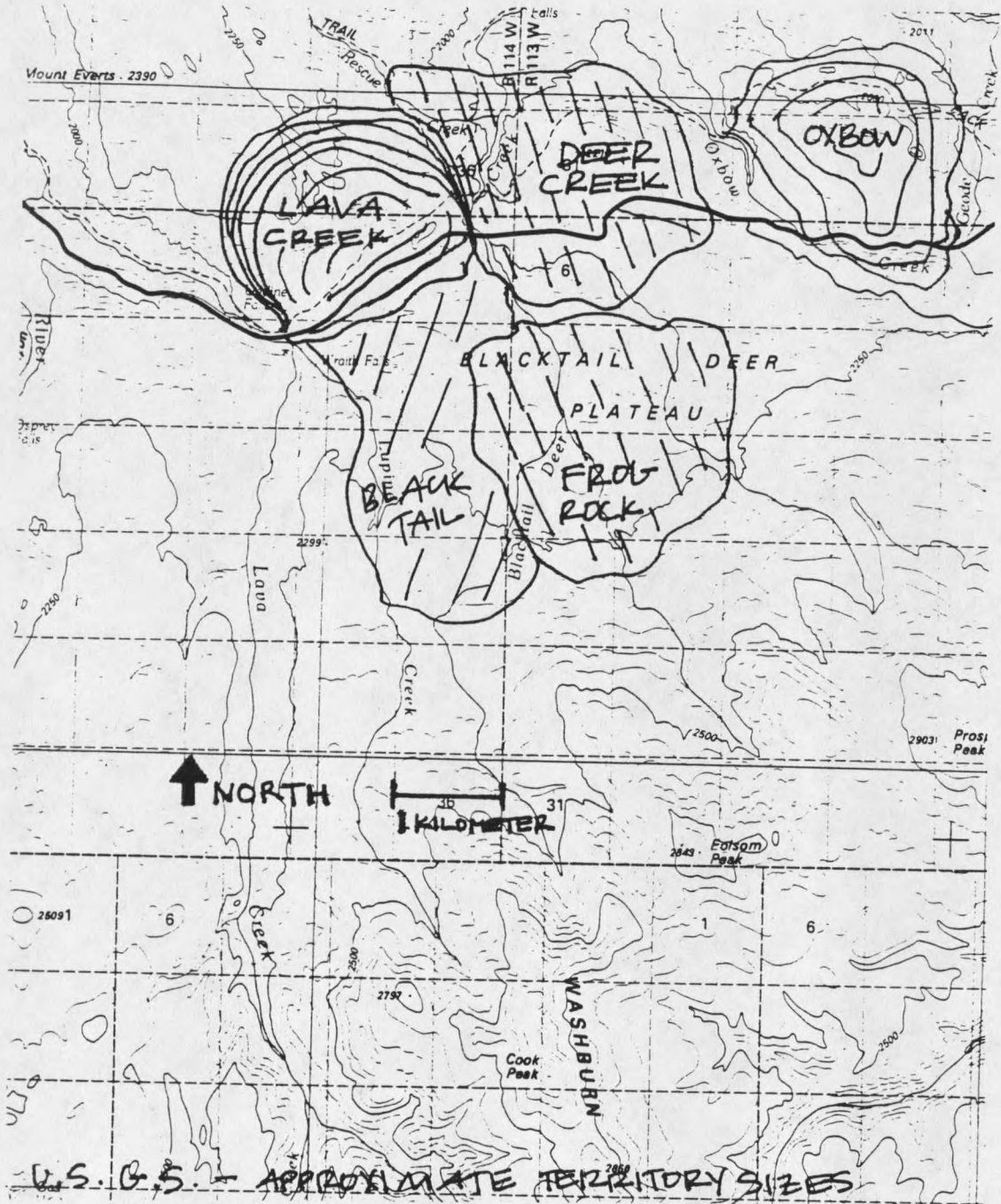


Figure 1. Study area 1 on Blacktail Plateau. Including the territories of the Lava Creek, the Deer Creek, the Blacktail, and the Oxbow coyote packs.





























































































































































