Movements of Radio Collared Wolves and Their Significance on Pack Assembly

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Abstract: Little is known about wolf pack assembly throughout the year, such as whether or not pack members do most everything together as a group. This study, however, presents the first quantified evidence of how the movements of individual pack members can indicate the degree of pack assembly over an annual period. The movements of three radio collared wolves (*Canis lupus)* in the Fishtrap pack of northwest Montana, were monitored over a 603-day study period and 532 daily telemetry surveys. Each survey presented a variety of possible pairing results, from finding a single collared wolf to finding all three together at the same location. All possible combinations were observed, and the three collared wolves were found together in only 31.0% of the surveys. For the pack to have been fully assembled, the three collared wolves would have had to be present. Therefore, this pairing combination represented when the pack potentially could have been fully assembled, although no assumption was made that they were. Nevertheless, these preliminary results indicated that pack members were together in 31% or less of the surveys. Although the percentage of surveys did not correlate directly with total time spent together, it did suggest the Fishtrap pack spent the minority of time fully assembled throughout the year. [The Journal of American Science. 2008;4(1):53-58]. (ISSN: 1545-1003).

Introduction

Wolves are known to live in social groups called packs in which interactions among individuals are guided by a hierarchy system (Mech and Boitani, 2003; Packard, 2003). Little is known, however, about the extent of pack assembly throughout the year, and how often all members are actually present at the same time, either at a static location or during movement through their territory. Most studies of wild wolves have focused on the movements of individuals rather than the pack as a whole, although Murie (1944) noted that the wolves he studied usually traveled in packs and occasionally traveled alone or in various combinations.

There seems little doubt wolf packs break into smaller groups for at least the purposes of hunting (Haber, 1977; Mech and Boitani, 2003), and perhaps because of social factors (Haber, 1977) and to find potential mates (Allen, 1979). However, this seems to happen more for some packs than others (Allen, 1979). During the spring and summer, when a pack's focus is on rearing the pups, pack members periodically leave the den and rendezvous sites, and then return to help care for the pups (Murie, 1944; Chapman, 1977; Mech, 1988a). By fall, the pups have matured enough to participate in hunts. The pack then becomes nomadic and moves as a group throughout their territory during the winter (Burkholder, 1959; Mech, 1966b; Peterson, 1977; Jedrzejewski et al, 2001). Some researchers have suggested that a basic wolf pack consists of a breeding pair and its offspring which function as a tight-knit unit year-round (Mech and Boitani, 2003), although it was not specified if tight-knit meant the pack was physically together or not.

Other studies have focused on wolf movements with regard to predation (Mech and Peterson, 2003) or dispersing individuals (Mech and Seal, 1987; Mech, 1987a; Boyd and Pletcher, 1999) rather than on the degree of pack assembly during these times. Radio telemetry studies have tracked individual wolves in which daily movements, territory use, and activity periods were monitored (Jedrzejewski et al, 2001; Theuerkauf et al, 2003), as well as the speed and distance traveled by individual wolves (Musiani et al, 1998; Merrill and Mech, 2000). Again, however, this information was not related to the movements of other pack members, nor was it conducted over several seasons or years. Consequently, to what extent wolf packs are assembled throughout the year has remained unknown. Descriptive phrases such as "moves as a group" or "tight-knit year-round," therefore, have been open to interpretation. A group of wolves could consist of the majority of pack members or all of them. Tight-knit could mean the pack was fully assembled or the wolves acted as a cohesive group even though they spent time apart, like a human family. The definitions of these statements were either nonspecific and unquantified, or just assumed and not defined at all.

Unless all members of a pack were radio-collared, or located by some other method, it would be impossible to know how often they were physically together throughout the year. Instead, this study used the locations found for three radio collared wolves, as they moved through their territory over a two year period, as a general measure of pack assembly throughout the year. Clearly, packs break-up periodically for a variety of reasons, but to what degree was the question posed in this study. The hypothesis, therefore, states that the Fishtrap pack spent the minority of time together as a pack throughout the year. Because one pack was involved in this study rather than several, the results are only a preliminary test of the hypothesis and may not apply to other wolf packs.

Methods

Radio monitoring of the Fishtrap pack began in June 2003, under the guidance of U. S. Fish and Wildlife Service. At that time, an adult male and female wolf had been collared. In January 2004, a female pup from the 2003 litter was also collared. The presence of three collared wolves allowed for the collection of pairing data that could be used to document pack assembly throughout the year. The study period reported here began 8 January 2004 and ended 1 September 2005, and involved radio telemetry surveys conducted mostly on a daily basis. Although the young female was collared two months after the nomadic season began, this season didn't end until 20 April 2004, over three and a half months later. Data from this season was truncated to included all three collared wolves and used in the data analysis. The estimated size of the Fishtrap pack during the study period was determined by telemetry surveys, howling surveys, and snow tracking. In 2004, the pack consisted of at least 12 individuals, and in 2005 there were at least 9 pack members.

Telemetry surveys varied in length from one to five hours, during which I drove through the pack's territory on logging roads. Occasionally, surveys were conducted by walking or on an All Terrain Vehicle. Surveys occurred in both daylight and nighttime hours that varied throughout the seasons, and throughout most of the 24-hour cycle. The exception was between the hours of 0300 and 0800 in which only several surveys were conducted.

I relocated collared wolves by triangulation of radio signals using a handheld yagi-type directional antennae. Triangulations usually involved three azimuths, but occasionally weather conditions and topographical features limited this process to two azimuths. In either case, the bearings were plotted onto 7.5 minute topography maps (scale 1:24,000) in the computer application Topo!. When three azimuths were used, the wolf location was plotted inside of a small triangle, most of which were ≤ 1.3 km^2. GPS locations were obtained by estimating the center of the polygon and using the coordinates generated by Topo!. Using this method, the wolves were found either kilometers apart or within ≤ 0.6 km of one another. This natural break in the data helped determine pairing classifications. In some instances, such as at the den site, individual collared wolves could occasionally be found up to 0.6 km away from the den entrance where other collared wolves were located. The same occurred at rendezvous sites, in which some wolves congregated while others were a short distance away. This information was found using radio telemetry as well as howling surveys. So I kept the distance of ≤ 0.6 km to define when collared wolves were paired to accommodate the movement of the wolves during telemetry surveys, such as walking around the immediate area. Therefore, pairing did not necessarily mean the collared wolves were standing next to each other, but rather they were in the same immediate vicinity. This was analogous to human family members at home, but in their rooms, or visiting together in the living room, etc. The same logic applied to when the wolves were traveling. If they were less than ≤ 0.6 km apart and moving in the same direction, they were considered paired. Pairing combinations were documented throughout all seasons of the year and defined as adult female-adult male (AF-AM), adult female-young female (AF-YF), adult male-young female (AM-YF), and all three collared wolves found together at the same location (AM-AF-YF).

For data analysis, an annual cycle was divided into three "wolf seasons" in which the collared wolves' movements were based on several contexts: denning, rendezvous sites, and nomadic (when the wolves roamed their territory throughout the winter with that year's litter). During the study period, each of these seasons was documented twice and defined as Den 04 and Den 05 (denning), Ren 04 and Ren 05 (rendezvous sites), Nom 04 and Nom 05 (nomadic). Because the surveys were conducted on almost a daily basis, the data showed a distinctively different pattern of wolf locations within a day or two after the end of one season and the beginning of another, therefore, seasons were easily distinguishable. Because the collared wolves monitored in this study were all from the same pack, they did not represent a sample of the greater wolf population in northwest Montana. Consequently, data analysis was limited to mostly descriptive statistics, along with a non-parametric chi square test.

Results and Discussion

Over the 603-day study period, 532 telemetry surveys were conducted throughout the Fishtrap pack's known territory. One or more collared wolves were found in 437 (82%) of these surveys, which were used in the analysis. Significant differences in pairing occurred throughout the seasons (χ^2=79.95, *df*=30, $P \leq 0.001$), and when viewed as a percent of observed pairings (Figure 1), the most common occurrence was when all collared wolves were found together (AM-AF-YF). Overall, this category averaged 31.0% of possible pairings throughout the study period (Figure 2). The other pairing categories were missing at least one collared wolf, which raised the possibility that perhaps the missing wolves were actually present and the radio telemetry equipment did not pick up their signals because of local topography, the wolves were behind a knoll, or other environmental factors. Although this scenario was possible, it seemed unlikely. At least five to six telemetry stations were conducted in the immediate area where collared wolves was found, and spaced over two to three miles. This would have eliminated most topographical features that would have blocked a collared wolf's signals. In addition, if I continued to search for the other collared wolves, I found them at other locations 40% of the time. If I didn't find them, they were either in areas I didn't search, or the telemetry equipment missed their signals. In the AM-AF-YF category, all three collared wolves were accounted for and found together in the same vicinity, so there was no problem with the telemetry equipment potentially missing their signals, unless all three collared wolves were missed at the same time. Again, this seemed unlikely given the previous explanation.

At the beginning of the study period, I assessed the accuracy of the telemetry azimuths to determine if they could be used reliably to classify the collared wolves as paired. I did this by comparing them to azimuths obtained from howling surveys which were known to be accurate. For example, in June 2003, I found the Fishtrap pack's den site by using howling surveys. I accrued numerous triangulations of the wolves' responses, including those of the pups. When the wolves vacated the den area to begin their rendezvous site season, I used the handheld GPS unit at the den site to determine the den's precise location. The majority of howling survey azimuths were within the uncertainty range provided by the GPS unit, which was ±7.6 to 45.7 m. Therefore, I considered the azimuths from howling surveys to be accurate. I then compared the azimuths obtained from telemetry surveys at the den area with those from the howling surveys. The majority of telemetry azimuths were within ±1 to 2 degrees of the howling azimuths, with occasional extremes of ±3 to 4 degrees, or an exact match. Both the telemetry and howling surveys were conducted at a distance of 0.5 to 0.8 km from the den site, and the uncertainty of the telemetry azimuths fit well within the definition of when the collared wolves were considered paired. So the telemetry azimuths were found to be accurate enough to at least determine pairing.

Of all the possible pairing combinations, the AM-AF-YF pairing was the most significant, because it was the category on which the study's hypothesis was based. It was the only category in which all collared wolves were found together. Had the pack been fully assembled at that time - and no assumption was made that they were - then a fully assembled pack could have only occurred in 31% of the surveys or less, on average (Figure 2). Although the percent of surveys did not necessarily equate to the exact amount of time the collared wolves spent together, it did sample the degree in which the entire pack was potentially assembled at particular moments in time, and over almost a 2-yr period. This result suggests the pack spent the minority of time together throughout the year, although the exact amount of time remains unknown.

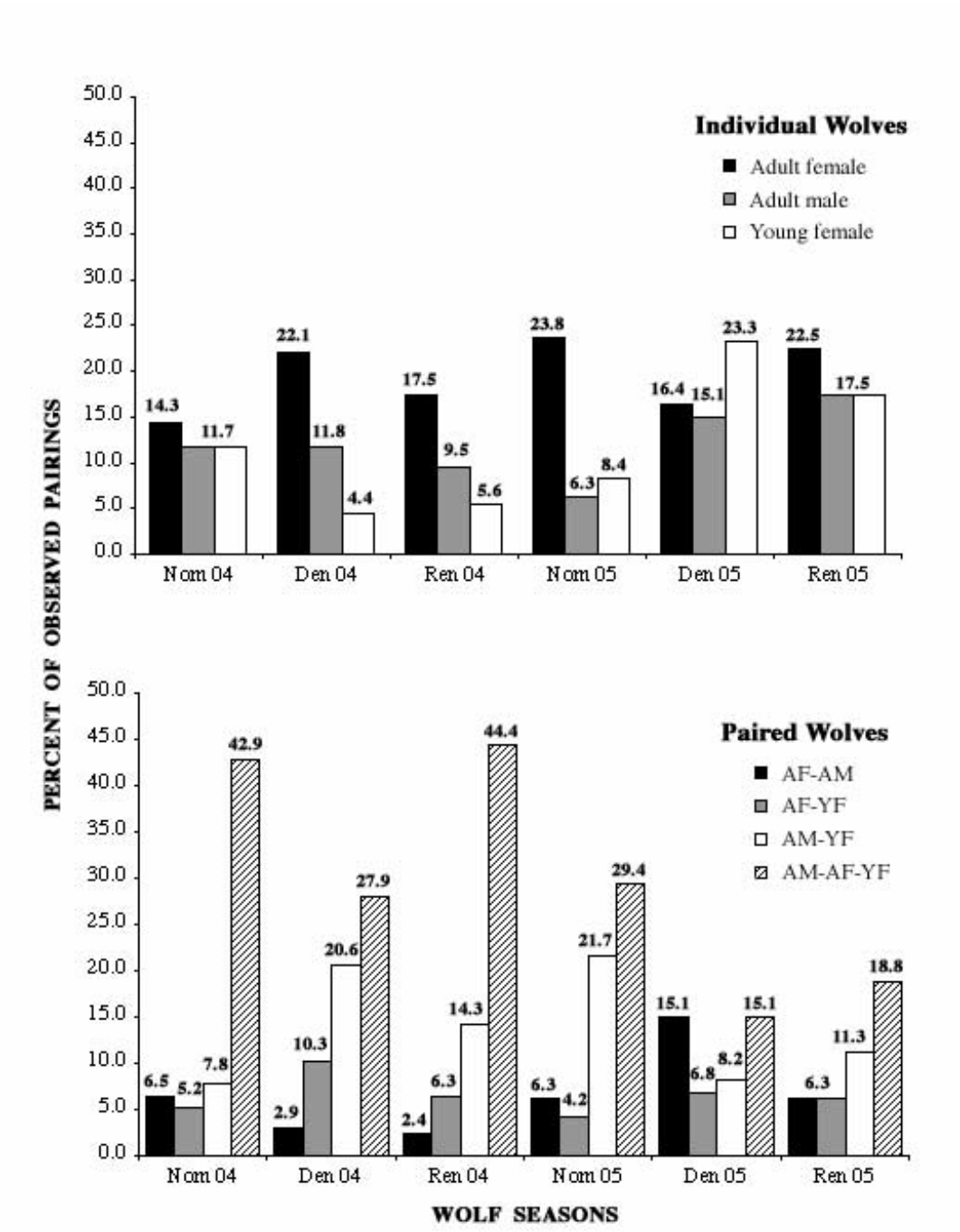

Figure 1. Percentage of observed pairings found over wolf seasons. The number above each column is the percentage for that pairing. From the 357 surveys represented in the graph, there were 567 pairings, ranging from individual collared wolves found in separate locations to all possible pairing combinations: adult female-adult male (AF-AM), adult female-young female (AF-YF), adult male-young female (AM-YF), and all three collared wolves found together at the same location (AM-AF-YF).

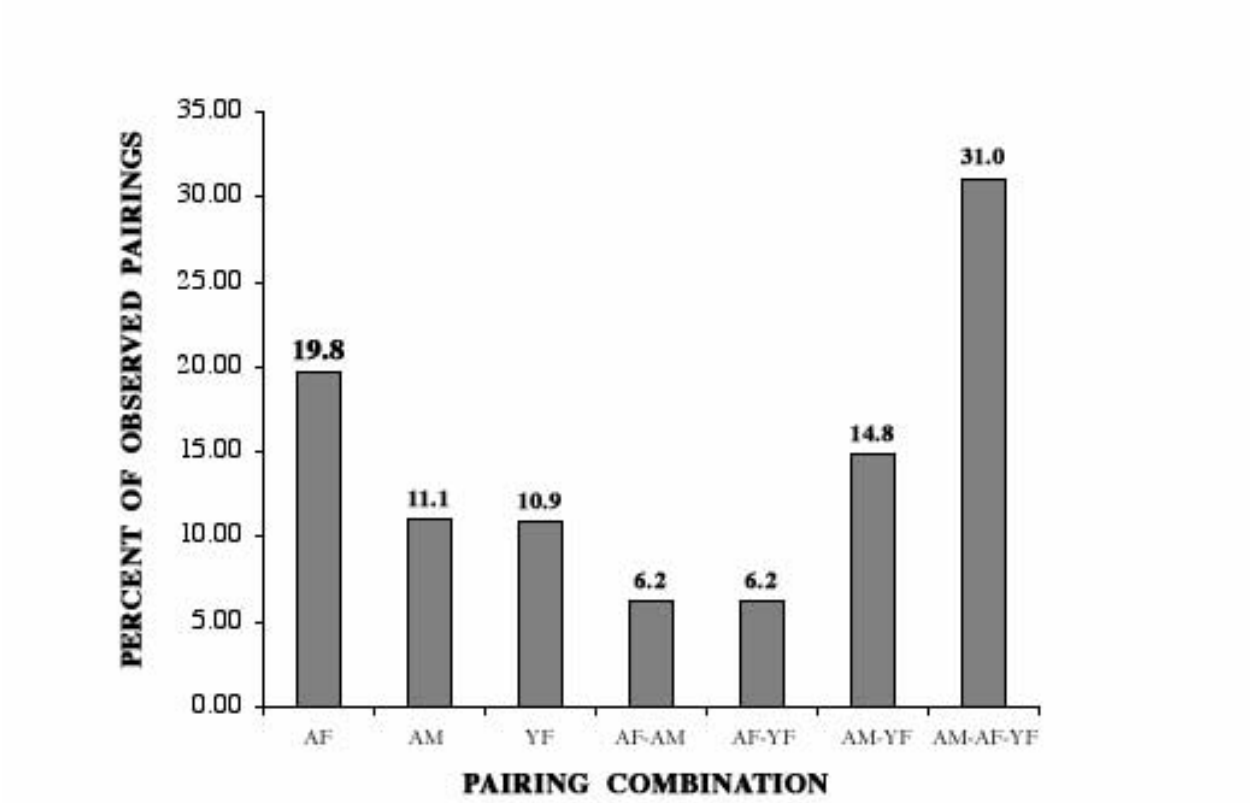

Figure 2. Average percentage of observed pairings found throughout all seasons of the study period.

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