Wolves in Yellowstone: Records Since 1967

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Abstract

Central to wolf (*Canis lupus*) reintroduction in the Yellowstone Ecosystem is the question: Were wolves present either occasionally or in some continuous fashion prior to reintroduction? Since the extermination of wolves in the Yellowstone area in the 1930s, there have been continued reports of visual observations of large canids identified as wolves. However, such visual sightings are difficult to verify. Seven reports since 1967 deserve detailed analysis because the presence of physical evidence goes beyond the capabilities and credibility of individual observers. Photographs, movie film, track casts, or carcass material show that both male and female wolves have been present in the Yellowstone area. The potential presence of both male and female wolves in Yellowstone suggests at least the possibility of residency and breeding.

Introduction

Central to the issue of wolf (*Canis lupus*) reintroduction into the Yellowstone Ecosystem is the question of the presence of wolves before the reintroduction (Fish and Wildlife Service 1994a, 1994b).The presence of wolves would have direct bearing on reintroduction under the portions of the Endangered Species Act dealing with breeding populations and geographic separations between populations. Since the extermination of wolves in the Yellowstone area in the 1930s, there have been continued reports of visual observations of large canids identified as wolves (C. and J. Urbigkit, pers. commun.; see also Urbigkit and Urbigkit *this volume*). However, visual sightings are difficult to verify. Seven reports since 1967 (and prior to wolf reintroduction in 1995) are of special note because they include physical evidence in the form of carcasses, photographs, or track casts. These reports deserve detailed analysis because the presence of physical evidence goes beyond the capabilities and credibility of individual observers.

Methods

Reports of wolf occurrences in the Yellowstone area were solicited from state and federal agencies and private individuals. To be included in this analysis, physical supporting evidence had to have been examined or had to be available for examination. Physical evidence was considered to be photographs, movie film, video tape, track casts, or carcass material. When possible, those originating the reports were interviewed. Only 7 reports were available that met these criteria.

I compared unknown samples of track photographs and casts to my database of wolf and dog tracks using comparative morphologic techniques and discriminant analysis. My database includes tracks from about 200 known dogs and 150 known wolves. Known wolf track samples were collected from 15 locations in North America and China. Information on gender, age, and weight were available for many animals. Dog track samples were obtained by visiting dog shows to make plaster casts of dogs of known breed, age, gender, and weight. To assure consistent measurements, minimum out-

line methods were used (Fjelline and Mansfield 1989, Halfpenny 1995, Halfpenny et al. 1995). Discriminant analysis was based on my databases and those of Harris and Ream (1983).

For the purposes of this paper, 3 reliability categories were assigned to reports: positive, probable, and possible. Positive reports are those reports supported by irrefutable evidence of a carcass that was examined through DNA or morphological testing. Probable reports are those that include quality supporting evidence (film or track casts) and achieve the agreement of at least 2 wolf experts. Possible reports are those that include physical evidence (film or track casts), but are less clear as to the species of origin.

The strength of the methods used is in differentiating between tracks of dogs and wolves. While less rigorous, anecdotal and observational information was used to infer whether evidence suggested a wild or captive wolf, since track analysis cannot distinguish between the 2. Determination of wolves versus wolf-dog hybrids from tracks, like physical, behavioral, and other evidence, can only suggest not prove the likelihood of one or the other.

Results

Seven reports of potential wolves in the Yellowstone Area were accepted for analysis (Table 1). Two were classified as positive, 4 as probable, and 1 as possible. The approximate locations of the reports are shown in Figure 1. These reports span the period from 1967 to 1993. Of the 7 reports, 4 had been previously examined and classified as wolves based on carcasses (Kysar, Newman) or film and photographs (Gates, Paunovich). Further examination was not attempted on these animals, although I do report lesser known or not readily available details. Three sets of previously unidentified tracks were located and analyzed.

Footprints reported in this paper were judged to have originated from wolves, not from dogs or wolf-dog hybrids. Discriminant analysis scores were beyond the range of known dogs and wolf-dog hybrids. For the carcasses, gender was based on necropsy results. Gender was not assigned to the animal that was only represented by a photograph, but the animal represented by film was believed to be a male based on size and behavior. Two sets of tracks were judged to have been made by females based on size and, for one animal, supplemental evidence of visual reports of accompanying tracks made by pups. One set of tracks was judged to have been made by a male based on size.

Table 1. Reports of wolves located in the Yellowstone area since 1967. The type of supporting evidence and suggested sex of each animal is listed.

#	Date	Location	Source	Evidence	Sex
1	1967	Hayden Valley	Marshal Gates	8 mm film	?
2	Oct. 25, 1968	Slough Creek	L. Hendrickson	Cast	F?
3	May 21, 1988	Chico	Jeff Newman	Carcass	M
4	Aug. 7, 1992	Hayden Valley	Ray Paunovich, Kevin Sanders	16 mm film 35 mm slides	M?
5	Aug. 19, 1992	Woodard Creek	Ralph Hudelson, Ron Kent, Steve Yekel, Steve Pudroski	35 mm print	F
6	Sep. 30, 1992	Fox Park	Jerry Kysar	Carcass	M
7	May 23, 1993	Otter Creek	Jim Halfpenny, Dixie Finley, Larry & Melinda Jones	Casts	M

Jeff Newman's Report

On May 21, 1988, Jeff Newman (Perkins 1988) struck and killed an adult male wolf on the East River road near Chico, Montana (about 30 miles north of Yellowstone National Park). The wolf weighed 65 lbs. There were no ear tags, tattoos, or other identifying marks. Dr. R. Nowak (1988) determined the skull was from a gray wolf and estimated the age was 3 years. He also reported the skull was "notably smaller than those of other male wolves taken in the northwestern conterminous U.S."

With regard to the wolf's origin, Dr. Nowak stated, "your specimen looks more like a member of this original U.S. population." The original U.S. population referred to by Nowak was that thought to be exterminated in Yellowstone. He also noted that the specimen "was in good condition, with none of the deterioration or mal-

it was a male. I accepted this as a positive wolf report.

Marshal Gates' Report

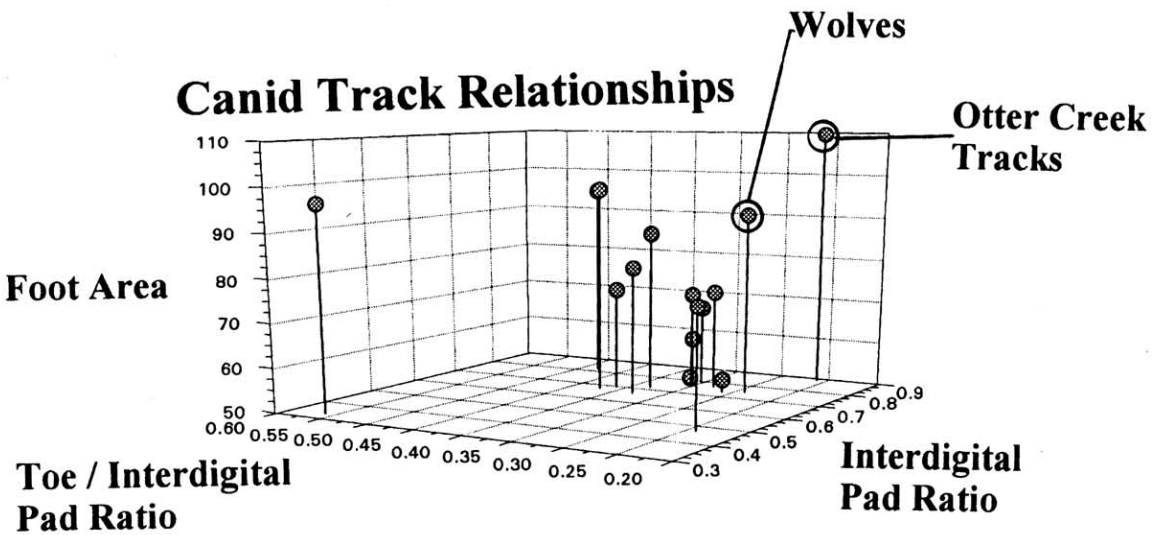
Two films have been made of canids believed to be wolves. The first, an 8 mm film, was made by Marshal Gates, a seasonal summer employee in Yellowstone. Gates filmed a large canid during his ski trip into Hayden Valley during the winter of 1967. I have been unable to locate either copies or the original film, and I have been unable to interview Marshal Gates. However, in 1971, I made copies of prints made from his film (Figure 3). At that time, research biologists from the Park told me that they believed the animal was a wolf. This identification is open to debate, especially based on the existing evidence. For this study, I am accepting the animal as a possible wolf. I could not ascertain any information as to gender or age from the photographs.

Figure 3. Suspected canid from Marshal Gate's (1967) film. In 1971, picture frames were printed from the original 8mm, and transferred to 35 mm slide film. In 1994, computer processing was used to produce this print.

Ray Paunovich and Kevin Sanders' Reports

The second film, 16 mm, was made by Ray Paunovich in Hayden Valley on August 7 and 8, 1992. Kevin Sanders took 35 mm photographs concurrently. These materials are available in the Yellowstone Park archives. Experts have not been able to agree on species in the films, but there is enough agreement to merit its consideration as a probable wolf. After viewing his film and studying the animal's behavior, I suggest that it may have been a male.

Figure 4: Canine track relationships. Relationships are depicted among several dog breeds, the average for wolves, and the suspected tracks found at Otter Creek. The 3 measures used to indicate front foot shape are the area (cm^2) of the entire foot, the ratio between toe and interdigital pad length, and the ratio of the length to the width of the interdigital pad.



Reports by Hendrickson, Hudelson et al., and Halfpenny et al.

In addition to the above carcass and photographic evidence, 3 sets of tracks were identified and included as wolf tracks. Measurements from tracks are presented in Table 2. All 3 sets of tracks had high discriminant analysis scores indicative of wolves, and all scores were well above the mean for wolves. All 3 track samples are accepted as probable wolf tracks.

The first set was an imprint preserved in mud and collected in the Slough Creek drainage in December of 1968. The cast bears the name L. Hendrickson and is archived in the Yellowstone Center For Resources. The relatively small size of this print suggests that it may have been made by a female or a juvenile wolf.

The second set of tracks were photographed and reported by Ralph Hudelson and other Wyoming Game and Fish personnel in the Woodard Creek drainage, south of Yellowstone National Park on August 21, 1992. Tracks were first observed on August 19. Their report and photographs are archived with the Yellowstone Center for Resources and copies are in my files.

In his written report, Hudelson said, "all of the observers concurred on the probability these were wolf tracks." One, Steve Pudroski, had worked with wolves in Alaska and "knew it was a wolf." Based on the apparent small size of the prints in the photograph, the animal may have been a female wolf. Additional evidence reported below also suggests a female.

When I questioned Hudelson (1993) about his original report, in which he wrote "there appeared to be at least 1 set of pup tracks with the adult," he indicated that the pup tracks were different from coyote tracks that were on the trail (pers. commun.). The "wolf pup" tracks were "smaller than the tracks photographed but there were no hind feet" (pers. commun.). The "pup tracks" were about the size of an adult coyote but differed from coyote because "this pup walked on heels." The interdigital or heel pads therefore appeared large for a coyote. In the interview, Hudelson also described the "pup" tracks as "more rounded than adult wolf tracks, with outer toe pads especially more rounded and too wide spread [for a coyote]." Measurements were not taken of the "pup" tracks.

The third set of tracks was located by a group I led in the Otter Creek drainage of Yellowstone National Park on May 23, 1993. Over several days, plaster casts were made of 6 different footprints. I have archived 3 casts. Based on the casts, Diane Boyd (pers. commun.) also identified the tracks as made by a wolf.

Discriminant analysis identified the tracks as wolf tracks and the magnitude of their dissimilarity to dog tracks can be seen through morphometric analysis (Figure 4). The tracks of the Otter Creek wolf exceed the mean for all wolves and their great separation from domestic dogs is obvious when using 3 criteria: area of the foot, ratio of the second area to the interdigital pad, and the ratio of the length to the width of the interdigital pad. The relatively large size of the footprints suggests the maker was a male wolf.

Table 2: Selected measurements from wolf prints accepted in this paper. Measurements were defined by Harris and Ream (1983). For sources, refer to Table 1.

Source	Sex	Foot	Total Length	Length Claw	Total Width	Pad Width	Pad Length	Gap Length	Toe Length	Toe Width	Inner Toe Width	Outer Claw Width	Inner Claw Width
Hendrickson	F	F	109	92	100	57	43	16	36	22	57	89	24
Hudelson	F	F	148	108	54	41	67	36	25	25	60	89	34
Kysar	M	F	118	75	50		54	25	21	21	44	62	8
Kysar	M	F	117	73	51		53	23	21	21	43	62	8
Halfpenny	M	F	110	101	105	67	49	25			60	104	41
Halfpenny	M	F	120	104	104	60	54	18	33	24	55	96	37
Halfpenny	M	F	114	104	102	64	50	15	39	21	54	107	42
Hudelson	F	H		79	39	36	60	32	24	24	43		
Kysar	M	H	102	66	37		51	23	18	18	42	51	7
Kysar	M	H	104	67	38		52	23	19	19	42	52	7
Halfpenny	M	H	110	95	108	61	46	22	30	22	58	110	45

F = female, M = M ale, F (under foot column) = front foot, H = hind foot

Discussion

Wolves in Yellowstone

Physical evidence suggests that individual wolves of unknown origin were at least intermittently present in the Yellowstone area prior to reintroduction in 1995. The evidence raises several interesting questions that need to be listed even though we are not able to answer them at the present time. That wolves were present in Yellowstone is not too surprising given that wolves may migrate 886 km from their birth place (Fritts 1983). The Yellowstone area is less than 800 km from potential source populations in Canada. Wolves from Canada have moved south into Montana and have established themselves (Ream et al. 1989). Established populations in Montana are closer to Yellowstone than Canadian ones. The presence of wolves in Yellowstone also raises the question of whether or not the Yellowstone population is completely separate from populations farther to the north.

Analysis suggests that both male and female wolves may have been present in the Yellowstone area. The presence of male wolves fits well with our knowledge of their biology, in that young males often leave the pack and migrate farthest (Carbyn 1987). The wolf Newman killed was of prime age for a migrating male. Traditionally, females were thought to migrate only short distances, in which case the potential existence of female wolves in Yellowstone is less easily explained by immigration. However, new evidence in Montana indicates that females do sometimes move very long distances. If the female wolves reported in this study did not migrate to Yellowstone, their presence raises the possibility that they represent a remnant Yellowstone population. Genetic analysis also does not remove the possibility that the wolf shot by Kysar is a remnant of historic populations.

Temporal Clustering of Evidence

It is interesting to note that most reports presented here clustered at 2 points in time: 1967-68 and 1992-93. The 1967-68 evidence corresponds with several visual sightings of wolves received by the author for that same period of time. In August and September of 1992, Yellowstone National Park staff received 18 additional reports of dark colored canids. Does the temporal clustering of reports lend support to the presence, even temporary, of wolves? Or is it simply coincidence? It is of note that females may have been present during both time periods.

Breeding in Yellowstone

The potential presence of both male and female wolves in Yellowstone suggests wolves may have bred in Yellowstone after the government-sanctioned extermination program earlier in the century and prior to reintroduction in 1995. Additional support for this hypothesis was provided by Hudelson and Wyoming Game and Fish personnel, who found the later-verified wolf tracks and who reported the possible presence of wolf pups.

Also consider the time line of events in 1992-93. On August 21, 1992, an adult, possibly a female wolf, and possibly with pups, was present south of the Park. September 30, 1992, south of the Park and less than 20 miles from the August incident, Jerry Kysar shot a male wolf. Mr. Kysar reported that he shot the most obvious (darker and larger) animal traveling with 4 or 5 other smaller canids. Kysar said "the others could have been pups, but he was not sure what to call [the] others." Is Kysar's report the results of a breeding pack? Subsequent attempts to locate wolves in Fox Park during October 1992 did not yield signs of additional wolves (John Mack, pers. commun.). After being present when a pack member was shot, would the pack have stayed searching for a pack mate or would the pack have left the area? While a pack with 5-month old pups (assuming a birth date of late April) might be restricted in its ability to travel great distances, heavy rain and snow at the time (John Mack, pers. commun.) would have hindered locating tracks. On the other hand, the wolf Kysar shot was a 2-year old male, which is the prime age for dispersal in wild wolves and its age might suggest it was migrating through the area.

Whatever the case, the wolf filmed by Mr. Paunovich in Hayden Valley in August 1992 was definitely a different animal than the 1 killed by Mr. Kysar. Thus, it would appear that at least 3 adult wolves were present during late 1992, and there may have been pups. At least 10 reports of large, dark-colored canids originated from the Hayden Valley area around the time when Paunovich filmed the "wolf." At least 1 animal, probably a male and per-

haps the same animal as was filmed by Mr. Paunovich, was present in May 1993 when I tracked it in the Otter Creek drainage.

The only other wild card explanation for some of the reported wolves is the possible intentional or unintentional release of captive wolves or hybrid wolves. There were strong political reasons for intentional releases early in the 1990s, at the height of the EIS process for reintroduction. Of course, my study can not determine whether reports represent captive releases, but it is not likely that all reports can be explained by such a hypothesis.

Future Research Directions

Evidence suggests the occasional presence of wolves, perhaps even breeding wolves, in the Yellowstone area, although my study did not ascertain length of periods when wolves were present nor their possible areas of origin. While my search was not exhaustive, it is doubtful that many new records with supporting physical evidence will be found. Therefore, the best method for testing questions suggested here will be through genetic analysis of existing and new evidence of suspected wolves in the reintroduction zone. Old specimens (skulls or skins) may be tested with evolving genetic techniques. Many ranchers and outfitters have wolf skins on the walls of their homes. An effort should be made to find these skins and determine their genetic history.

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