Northwest Science Notes

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Wolverine Makes Extensive Movements in the Greater Yellowstone Ecosystem

Introduction

Wolverines (*Gulo gulo*) are believed to be have been extirpated, or nearly so, from the northern Rocky Mountains of the contiguous United States by around 1920 (Skinner 1927, Davis 1939, Newby and Wright 1955). Recovery has occurred to some degree (Newby and Wright 1955, Newby and McDougal 1964, Edelmann and Copeland 1999, Cegelski et al. 2003); however, wolverines are classified as a sensitive species by the USDA Forest Service, a species of special concern in Idaho and Wyoming, and a furbearer of restricted harvest in Montana. The United States Fish and Wildlife Service has been petitioned to list wolverines as a Threatened or Endangered species in the contiguous United States (60 Fed. Reg. At 19567). Wolverines have not been listed, based in part on insufficient data to determine population status and the effects of human activities on wolverines (FR Doc. 03-26453). The difficulties associated with studying a species that exists at low densities and resides in rugged, inaccessible areas have resulted in extremely limited documentation of wolverine population status and ecology. Only two ecological studies, one in northwestern Montana (Hornocker and Hash 1981) and another in central Idaho (Copeland 1996), have been completed in the contiguous United States. The Greater Yellowstone Area (GYA) is thought to be the southern periphery of current wolverine distribution, and population levels, demographics, and factors influencing demographic rates remain undocumented there. Wolverine habitats in the GYA exist in distinct mountain ranges that are often separated by arid valleys and increasing levels of human activity. Understanding both wolverine movement and dispersal within the GYA is important for assessing long-term viability of wolverines in the region and the potential for continued expansion southward into historically occupied range.

Methods

As part of an ongoing study of wolverine ecology in the GYA (Inman et al. 2003), we captured

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wolverines in log box traps (Copeland et al. 1995) and surgically implanted them with VHF intraperitoneal transmitters. We attempted to relocate wolverines via telemetry flights every 7-10 days. We also fit select individuals with store-on-board global positioning system (GPS) units that were programmed to collect locations every 2 hr. Results presented here recount one individual wolverine, M304, who made exceptional movements worth documenting.

During captures, we collected small tissue samples (earplugs or at surgical site) for genetic analyses. To estimate lineage we extracted DNA using standard protocols and used the following 17 microsatellite markers: *Mvis072*, *Mvis075*, *Mvis87*, *Mvis020* (Fleming et al. 1999), *Gg3*, *Gg4*, *Gg7*, *Ma2*, *Ma8*, *Ma9*, *Tt1*, *Tt4* (Davis and Strobeck 1998), *Ggu234*, *Ggu101*, *Ggu216*, *Ggu238* (Duffy et al. 1998), and *Lut604* (Dallas and Piertney 1998). Using these microsatellite data we compared hypotheses regarding the paternity of M304 with program CERVUS (Marshall et al. 1998, Slate et al. 2000). We used default simulation conditions except we set the simulation parameters to the following: a) error rates (due to gel scoring, allelic dropout, or computer data entry): 1%, b) Proportion of loci typed : 100%, c) Proportion of adults sampled: 50%, d) Number of candidate parents: 10, and e) number of cycles to determine delta significance: 10,000. Varying these simulation parameters did not significantly alter our results.

Results

We captured a young male wolverine (M304) in the Teton Range of Wyoming on 23 January 2001. His testes were undescended and we estimated his age at 11 mo. Paternity analysis from the genetic data suggest with >80% confidence that M304 was the offspring of F401 (LOD = 3.47; Delta = 1.88), a resident adult female of the Teton Range (Inman et al. 2003). We collected 10 VHF aerial locations on M304 in the Teton Range between 26 January and 23 April 2001 after which he disappeared from radio-contact for 11 mo. On 23 March 2002 this wolverine was re-captured in the Teton Range. His testes were descended and he was bearing a functioning VHF implant, indicating an extended absence from the Teton Range. We equipped him with a new VHF implant and a GPS collar. The wolverine, now estimated to be 25 mo old, retained the GPS unit for 42 days, and we obtained 209 GPS locations (Figure 1). During that same 42-day period we were able to collect only 4 aerial locations from the VHF implant.

GPS data revealed two large movements that were not documented with our VHF telemetry flights. Between 26 March and 13 April 2002, the wolverine moved south from Grand Teton National Park, Wyoming to the Portneuf Range east of Pocatello, Idaho, and subsequently returned to the Teton Range, covering a minimum distance of 412 km in 19 days. Soon afterward, 18 – 24 April, this wolverine moved north to Mount Washburn in the northern portion of Yellowstone National Park and back to the Teton Range, traveling a minimum distance of 226 km over 7 days. The detachment mechanism of the GPS collar fired prematurely and the collar dropped off of the wolverine on 4 May 2002. In total, this wolverine traveled a minimum of 874 km during a 42-day period (23 March – 4 May 2002). Rate of travel for the 99 GPS locations made at 2 hr intervals ranged from 0.0 – 6.9 km/hr (average 1.36 ± 0.14 km/hr); the largest distance moved during a 2 hr period was 13.8 km. GPS data provided 26 independent (separate and exclusive) 24 hr sampling intervals, and this wolverine moved a mean of 14.3 km (range 0.7 – 33.1 km) during those intervals. The wolverine moved >20 km during 38% of 24 hr sampling intervals.

After dropping the GPS collar this wolverine was located on 29 occasions via the VHF implant transmitter over the next 19 mo. These 29 locations were made in several distant areas including the Gros Ventre, Wind River, and Salt River Ranges of Wyoming and the Centennial Range along the Idaho – Montana border, further extending the known range of this wolverine.

M304 was legally harvested by a trapper in the Montana portion of the Centennial Range on 11 Jan 2004 at 47 mo of age. Greatest straight-line movement distance between two locations of this individual was 266 km (Mount Washburn and Portneuf Range). Bearings and straight-line distances at which M304 has been relocated from his capture site in the Tetons include 155 km southwest, 137 km north, 101 km southeast, 124 km south, and 135 km northwest; he returned to the Tetons in-between at least 2 of these relocations. All 252 of M304's locations produced a home

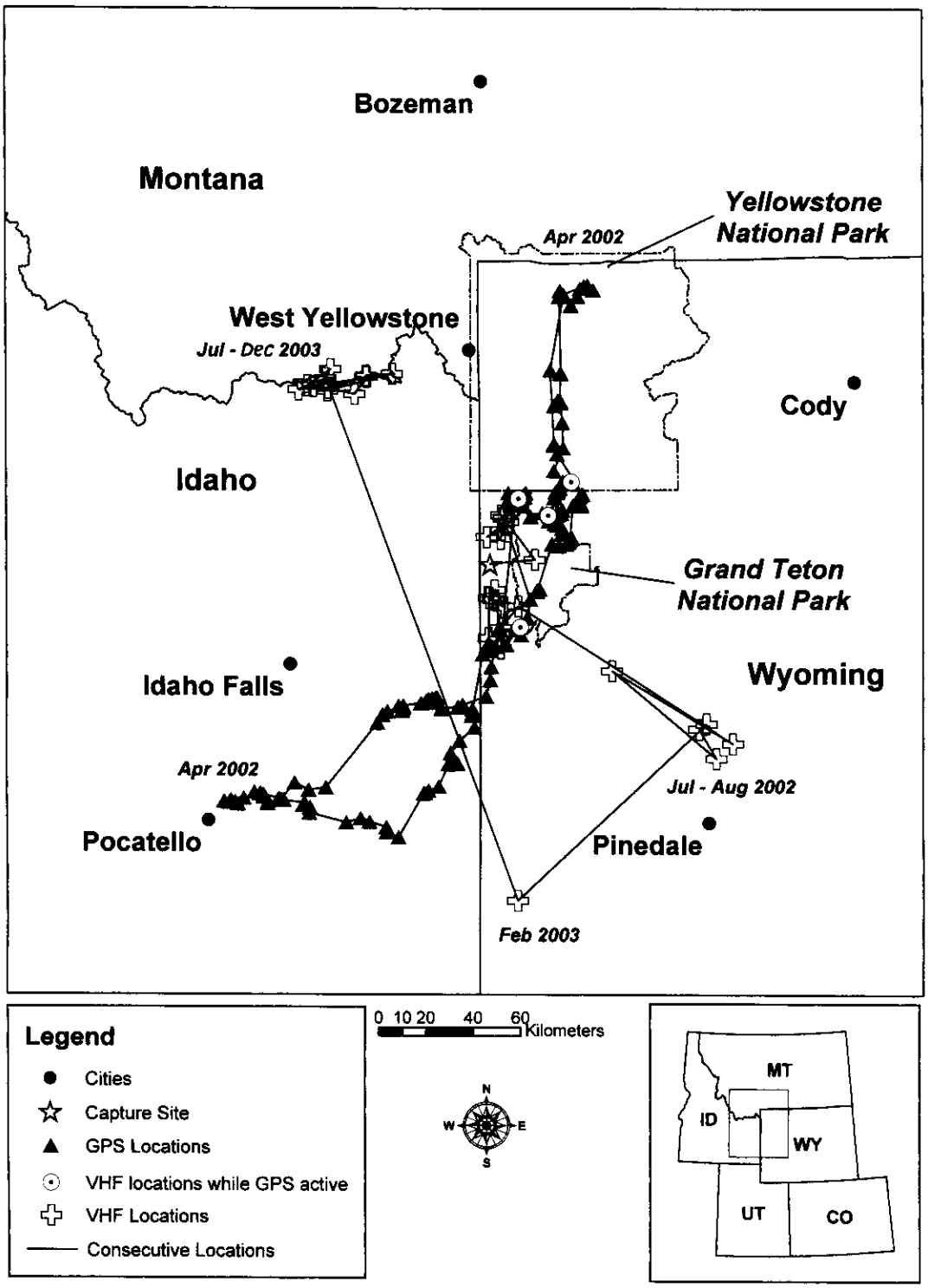

Figure 1. Locations of a male wolverine, M304, captured in the Teton Range of western Wyoming and made over a 34 mo period while the wolverine was 11–46 mo of age, 23 February 2001–19 December 2003.

range estimate of 37,637 km^2 using the 100% minimum convex polygon (MCP) method (Hayne 1949). Locations made >24 hr apart (n = 77) resulted in home range estimates of 36,906 km^2 using 100% MCP, and 26,312 km^2 using the 95% fixed kernel method (Worton 1989, Seaman et al. 1998).

Discussion

M304 was born in the Teton Range, initiated exploratory movements (Vangen et al. 2001) at a maximum of 15 mo of age, and continued to do so through at least 36 mo of age, a period of almost 2 yr. Exploratory movements to areas >100 km away occurred in as few as seven days or took place over several months. This wolverine moved into at least eight distinct mountain ranges including the Snake River, Caribou, Portneuf, Mt. Washburn, Gros Ventre, Wind River, Salt River, and Centennial Ranges. During these movements the wolverine was located within the jurisdictions of 3 states, 2 national parks, 9 districts of 3 national forests, the Bureau of Land Management, the Bureau of Indian Affairs, the Idaho Department of Lands, the U.S. Sheep Experiment Station, and private parcels.

Greatest reported movement distances of wolverines in North America include a 2-yr-old male wolverine in Alaska that was trapped 378 km from his research capture location (Gardner et al. 1986) and an unknown age female that moved 300 km (Magoun 1985). Idaho wolverines have been documented traveling >200 km at 2-3 yr of age (Copeland 1996). Greatest straight-line distance between two of M304's locations was 266 km, which is within the observed range for the species. However, M304 moved large distances in several different directions from the Teton Range, often in separate excursions. Hornocker and Hash (1981) reported an average annual home range of 422 km^2 for male wolverines in northwest Montana using the minimum polygon method. Copeland (1996) reported total home ranges of 1,313 – 2,059 km^2 for 3 adult male wolverines and 776 – 3,692 km^2 for 3 subadult male wolverines in central Idaho using 24 hr independent locations and the 95% MCP method. Male wolverines become sexually mature at 14–27 mo (Rausch and Pearson 1972, Banci and Harestad 1988), and dispersal occurs at 13 mo of age on average (range 7-18 mo) in Scandinavia (Vangen et al. 2001). The large home range estimate for M304 likely represents that of a male during the period of exploratory movement and dispersal and thus may not be directly comparable to typical adult home range size. Few wolverines in the contiguous U.S. have been monitored during the age-period that we were able to monitor M304 and none before with GPS technology. M304 appears to have started the dispersal process, but had not established a resident area similar in size to other adult male home ranges by as late as 36 mo of age.

Collecting VHF radio-telemetry data on wolverines is difficult because the physical characteristics of the species limit the size and signal range of transmitters, they often use rugged terrain that can further limit signal reception, and they have large home ranges. Our data indicate that aerial locations scheduled to occur >7 days apart or single instances of non-locations during weekly flights may miss important movements. Underestimation of home range size and population connectivity may occur in the absence of extraordinary flight coverage or use of developing technologies.

Low densities (Banci 1994), low reproductive rates (Persson 2003), large home range sizes (Inman et al. 2003), and the scale of movement documented with M304 suggest that wolverine populations may function over an extremely large geographic area in the GYA. Regional planning that occurs collaboratively across multiple jurisdictions may be important for maintaining viable populations and allowing continued expansion into historically occupied areas. Austin (1998) suggested that roads with rights-of-way >100 meters serve as a deterrent to wolverine movements and Cegelski et al. (2003) suggested that major roads (e.g., Interstate Highways 15 and 90), cities, and agricultural areas in lowland valleys structure wolverine populations. While these features may limit movement, major rivers and some roads do not appear to be impermeable barriers to our male wolverine, and genetic interchange among distinct mountain ranges in the GYA is currently possible. However, human densities and associated developments are increasing rapidly in the region (Johnson 2001), and timely management actions designed to maintain linkage zones between ranges of the GYA are warranted for wolverines.

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