Greater Yellowstone Wolverine Study

Wildlife Conservation Society - North America Program
CUMULATIVE PROGRESS REPORT
DECEMBER 2003

F105 in log-box trap prior to release, January 2003.

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This is an abbreviated version of the 2003 Cumulative Progress Report submitted to project partners.
The following analyses are preliminary, most with very small sample sizes. We will continue to supplement analyses with additional data. Our intent is to summarize what has been learned to this point and provide insight into the direction and potential of the research project.

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Requests for copies of the manuscript published in Northwest Science “Wolverine Makes Extensive Movements in the Greater Yellowstone Area” can be made at binman@wcs.org.

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Abstract

The status of wolverine populations in the lower 48 remains uncertain and the ecological requirements of the species are not well described. Federal and state resource managers need information in order to make well-informed policy decisions that affect land-use practices and populations of wolverines. This project is designed to provide baseline ecological data and answer specific questions relevant to wolverine management and related land-use policies (i.e., does winter recreation impact wolverine reproduction, where are critical habitat and travel corridors, and are fur trapping practices sustainable). Two areas, the Madison Focal Area of southwestern Montana and eastern Idaho (MFA) and the Teton Focal Area of northwestern Wyoming and eastern Idaho (TFA), have been selected for intensive study. These areas are representative of the land management jurisdictions and human-use impacts common to the Greater Yellowstone Area (GYA).

To date we have constructed 53 log box-traps in Montana, Idaho, and Wyoming. Eighteen different wolverines (9 female, 9 male) have been captured and 10 (6 female, 4 male) are currently radio-instrumented. Seven wolverines were fit with store-on-board GPS collars, and one was fit with a satellite collar. Success and failure of collars is discussed below. We have obtained 921 VHF and GPS locations of wolverines.

We have documented four causes of wolverine mortality: avalanche, trapper-harvest, inter-specific competition (black bear), and vehicle collision. Three adult males have died from non-human-related mortality sources, and a subadult female, an adult female, and an adult male from legal harvest. Data suggest that four females have given birth, between Feb.14-24. One natal den was located at approximately 2,200 m elevation (7,200 ft) in an area of mixed conifer stands, the second was at 2,750-3,000 m elevation (9,000-10,000 ft) on a north facing slope.

More specific habitat information will be available at a later date. We have not yet documented the presence of kits with 100% certainty. Doing so, along with documentation of reproductive den habitat, is of highest priority this spring. Although sample sizes for all reproductive analyses are extremely small at this point, pregnancy rates of females more than 2 years old averaged 67% (n=6) and has varied by year (50-100%). We estimated age at first reproduction to begin at 3 years of age; 0% of one-year olds (n=6), 0% of two-year olds (n=3), 50% of three-year olds (n=2), and 100% of 4+ year olds (n=7) showed evidence of reproduction. Percentages of females more than 2 years old giving birth averaged 40% and has varied by year (0-100%, n=5).

Adult female 100% MCP (Minimum Convex Polygon) home range size averaged 754 km² (3 wolverines, 202 locations) while sub-adult females averaged 429 km² (5 wolverines, 213 locations). Adult male home ranges averaged 910 km² (5 wolverines, 231 locations) and a single sub-adult male had a home range of 629 km² (1 wolverine, 24 locations). M304's movements and home range appear to be that of a dispersing male and 251 locations yield a 100% MCP home range estimate of 37,638 km². Fixed Kernel (95%) estimates are also provided for animals with more than 30 locations. Two sub-adults (1 female, 1 male) appear to have shifted home ranges in response to the death of a same-sex adult. Although statistical tests have not yet been performed, it appears that wolverines use higher elevations (greater than 6,890 ft), steep slopes (greater than 16°), NW and N aspects, evergreen forest, bare rock, and perennial ice and snow disproportionately to their availability.

Pilot season data on winter recreation indicated that peak hours of snowmobile and ski activity occurred between 11:00-15:00, and that mean amount of use differed between weekdays and weekends ($P \leq 0.005$). After analysis of parking area data from the pilot season, we classified mean levels of use as low impact (≤ 15 trailer spaces), moderate impact (16-40), and high impact (41-80). A recreational flight survey technique was developed and tested on the MFA and then used on the TFA. We conducted one survey of 2,523 km² for distribution of snowmobile and ski use on the MFA and one survey of 3,059 km² for snowmobile and ski use on the TFA during Feb 2003. On the MFA, 18% of the area was impacted by snowmobile use (11% highly impacted), and 4% was impacted by ski use (2% highly impacted). On the TFA, 36% of the area was impacted by snowmobile use (1% highly impacted), and 9% was impacted by ski use (1% highly impacted).

Introduction

The wolverine (*Gulo gulo*) is a medium-sized carnivore that inhabits remote areas of the Northern Hemisphere and is one of the least understood carnivores in North America. Wolverines may be more vulnerable to local extinction and population decline than most species because of their low population densities and reproductive rates (Banci 1994). They are believed to have been extirpated, or nearly so, from the northern Rocky Mountains of the contiguous United States by 1920 (Skinner 1927, Newby and Wright 1955). Recovery has occurred to some degree (Newby and Wright 1955, Newby and McDougal 1964, Cegelski 2002). However, recovery from historic threats (i.e. unregulated trapping and predator control efforts) may have occurred during a window of opportunity in the recent past, and current influences on the landscape are more likely to have some bearing on future persistence of wolverines in the contiguous U.S. These new influences are primarily associated with human population growth and technological advancements that have allowed greater access to the backcountry during winter. In the contiguous U.S., the difficulties associated with studying such an inaccessible and uncommon creature have resulted in little documentation of wolverine status and ecology; only two ecological studies have been completed (Hornocker and Hash 1981, Copeland 1996), and wolverines have never been studied in the Greater Yellowstone Area (GYA).

The scarcity of information on wolverine ecology is hindering managers who face a number of difficult and important decisions. State and Federal agencies are currently wrestling with issues such as population numbers, threatened or endangered status, methodology for assessing population trends, habitat requirements, genetic exchange capabilities, sustainable trapping quotas, and the potential impacts of winter recreation on wolverines. The wolverine was recently reviewed as a candidate species for listing as a threatened or endangered species. The United States Fish and Wildlife Service is awaiting more information regarding basic ecological and demographic information, what the potential threats are to wolverines, and the distribution and abundance of wolverine populations before making a decision on listing. This study is designed to advance conservation of this species by addressing multiple information gaps on wolverine life history and population dynamics in a manner that will facilitate defensible management decisions from a strong information base.

While this study is designed to address multiple needs, we are placing particular emphasis on determining whether backcountry winter recreation does or does not impact wolverine populations and their potential for long-term persistence. Human population density is increasing rapidly in the GYA. Outdoor recreation-related tourism is becoming an important sector of the area's economy, and many new residents are drawn to the area because of the great diversity of outdoor opportunities. In addition to increasing numbers of backcountry users, recent developments in snowmobile technology and use of helicopters to access extreme ski terrain have allowed recreationists to access areas that have historically been inaccessible winter refugia for wolverines. Winter recreation occurs during an energetically challenging period for wolverines when thermoregulatory demands are high, females are developing, birthing, and nursing kits, and food resources may be limited. Wolverines, having recovered from near extinction levels, have existed in remote areas of the GYA that have been largely inaccessible to humans during winter until recently. It is likely that these reclusive creatures are now encountering and possibly avoiding humans with greater frequency. Energy spent avoiding human encounters is energy that will not be available for reproduction. Given increasing numbers of recreationists and the overlap in time and now space between winter recreationists and the reproductive segment of wolverine populations, there is reason for concern that disturbance from recreation could negatively impact wolverine reproductive success and population viability. For these reasons, we are attempting to quantify levels of recreational use and document wolverine characteristics in a way that will provide insight into whether wolverine populations are impacted, where impacts may occur, and how land managers may provide for the needs of wolverine populations within the multiple-use context.

Land management plans for the GYA will benefit from knowledge of the relationship that wolverines have with other carnivore populations, prey species, and ecosystem dynamics. The wolverine, because of its wide-ranging use of remote habitats, potential susceptibility to disturbance, and relatively vulnerable population demographics, may serve as an umbrella species in the GYA; healthy wolverine populations may indicate overall system integrity to a greater degree than most species. Thus, management for wolverine persistence is a logical component of a large scale, multi-species conservation effort.

Objectives

1. Document wolverine demographic parameters (reproductive rates, reproductive denning habitat, home range size, dispersal, survival rates, causes of mortality, habitat use, movement patterns, and genetic relatedness)
2. Determine if and how wolverine populations may be affected by human recreational activities (snowmobiling, skiing, fur-trapping, heli-skiing, ski resorts and associated housing development)
3. Identify wolverine dispersal corridors and/or linkage areas between mountain ranges in the GYACollaboratively design and implement management strategies and actions aimed towards the long-term persistence of wolverines in the GYA
4. Collaboratively design and implement management strategies and actions aimed towards the long-term persistence of wolverines in the GYA

Study Area

Two areas, the Madison Focal Area (MFA) of southwestern Montana and eastern Idaho and the Teton Focal Area (TFA) of northwestern Wyoming, have been selected for intensive study. These areas were chosen because they are representative of the land management jurisdictions and human-use impacts that are common to the GYA. Variation in jurisdiction, management policies, and human-use impacts between these two study areas will facilitate our ability to compare and contrast influences on wolverine population dynamics.

Methods

Capture. Wolverines were captured from December – March in log box traps (Copeland et al. 1995). Live capture efforts are restricted to the winter when grizzly bears are denning and the risk of attracting bears to our traps is reduced. A large portion of our study site is in wilderness areas where traveling to traps is challenged by the difficulty of accessing the remote and high elevations areas where traps are placed. Once wolverines were live captured they were immobilized and surgically implanted with either a Telonics 400L or Advanced Telemetry Systems M1250 VHF internal radio-transmitter. A subset were fit with global positioning system (GPS) or satellite radio-collars. Blood, hair, and tissue samples were taken for genetic analysis and physiological evaluation.

Technology Development. We evaluated the performance of Televilt POSREC 300 store-on-board GPS collars and SirTrack KiwiSat 101 ARGOS satellite collars on wolverines. GPS collars store location data within the collar and must be retrieved from the field to acquire data. Location data from satellite collars can be remotely downloaded. GPS collars are accurate to ±10 meters, but satellite collars are rarely accurate to less than 500 meter radius. Considering the inherent accuracy and data acquisition techniques of the two types of collars, we targeted adult females for our store-on-board GPS units and young wolverines of dispersal age for our satellite collars (Inman et al. submitted). Due to the huge distances wolverines can disperse we sacrificed the accuracy of locations from GPS collars for the ability to remotely download data and keep up with the large dispersal movements.

Re-locations. We attempted to locate all radio-implanted wolverines from fixed-wing aircraft every 7-10 days; we made more frequent locations during the reproductive denning season.

Locations were used to estimate survival rates, home range size, habitat use, social interactions, and to assist in finding natal dens and document reproduction.

Causes of Mortality. All radio-transmitters were equipped with a motion sensitive mortality signal. We made an immediate visit to mortality signals to determine cause of mortality. At the mortality site all evidence regarding cause of death was recorded. Wolverine carcasses are necropsied at Montana Fish, Wildlife, and Parks, Region 3 Headquarters in Bozeman, Montana or Driggs Veterinary Clinic in Driggs, Idaho to determine cause of death.

Reproduction. Pregnancy status was evaluated with blood samples taken during winter captures and tested for serum progesterone levels (Mead et al. 1993). When possible we also used a portable ultrasound device or palpated the uterus to check for presence of fetuses during the radio-implant surgical procedure. When there were indications at capture that a female may have been pregnant, we increased our aerial telemetry flight schedule in an attempt to find clusters of female locations or other indications of active den sites.

Home Range. We used the animal movements extension of ArcGIS 8.3 (ESRI, Redlands, CA) to calculate total home range size using 100% Minimum Convex Polygon (MCP) and 95% Fixed Kernel methods (Silverman 1986, Worton 1987, Harris et al. 1990). We used all aerial VHF and GPS collar locations of wolverines.

Movements. We calculated movement distances and rates from 1 wolverine that was fitted with a GPS collar using the spatial analyst extension of Arcview 3.2.

Habitat Use. We made a preliminary estimation of wolverine habitat selection (use vs. availability) utilizing ArcGIS 8.3. Habitat availability was determined by sampling both study sites in their entirety using available GIS layers describing elevation, slope, and aspect. Wolverine use was described with 862 VHF and GPS locations from both study sites that were categorized by elevation, slope, aspect, and season.

Winter Recreation Surveys. We conducted a preliminary season of winter recreation surveys during the winter of 2002-2003 to test survey methods, perform preliminary analyses, and adapt survey protocols. To estimate levels of use, we surveyed 11 access points with parking area counts. We sampled each access point for snowmobile use (trailer-spaces) and ski use (vehicle counts) to test for differences in use levels among days of the week and access points. We also sampled 11 access points on the MFA with trail counters, 4 of these simultaneous with parking area counts. Trail counter accuracy was validated with direct counts during multiple 2-hour survey periods at each access point. Analysis of trail counter data is currently underway. We developed a survey methodology to estimate spatial distribution of winter recreational use. We flew the Madison and Teton Ranges after a weekend and prior to the next significant snowfall to record distribution of snowmobile and ski tracks.

Preliminary Results And Discussion

The following analyses are preliminary, most with very small sample sizes. We will continue to supplement analyses with additional data. Our intent is to summarize what has been learned to this point and provide insight into the direction and potential of the research project.

Capture. We constructed 18 additional log box traps (13 MFA, 5 TFA) prior to the 2002-2003 winter capture season, bringing the total to 37 (21 MFA, 16 TFA). On the MFA we achieved 925 trap nights from 20 different traps between 6 Dec 2002 and 31 Mar 2003. Eight unmarked wolverines were captured 15 times, providing a capture rate of 1.6 wolverines/100 trap nights or 62 trap nights/wolverine capture. On the TFA we achieved 425 trap nights from 12 traps between 2 Jan and 31 Mar 2003. One unmarked and four marked wolverines were captured nine times, providing a capture rate of 2.12 wolverines/100 trap nights or 47 trap nights/one wolverine capture. We fit two adult female (F107, F404) and one adult male (M206) with store-on-board GPS collars. We also fit one young adult male (M301) with an ARGOS satellite collar. During the summer and fall of 2003, we constructed 16 new traps (10 MFA, 6 TFA), bringing the total to 53 (31 MFA, 22 TFA) available for use in the upcoming winter capture season.

GPS Collar Performance. To date we have deployed 6 Televilt POSREC 300 store-on-board GPS collars and 1 Lotek store-on-board GPS collars on wolverines; results have been mixed. Two collars are still on animals and one collar was recently recovered; results on these three collars are still pending analysis. The first collar deployed was retrieved after M304 retained it for 42 days prior to a failure by the drop mechanism. This collar obtained locations on 42% of attempts. We obtained 209 locations accurate to ±10 meters and documented two exploratory movements by M304 (Inman et al. submitted). A second collar was retrieved after M206 was killed by a black bear 27 days after capture. This collar obtained locations on only 9% of attempts. We were not able to retrieve any data from either of the GPS collars that were placed on adult females (F107, F404) because we lost contact with the VHF signal from the collars. Both females were recaptured and were not wearing the GPS collar. It appears that the VHF component of these two collars may have failed or the collars were dropped in terrain that blocks the VHF signal, making retrieval of these collars impossible. Overall, reliability has been questionable, but the data we have acquired have proven valuable. It should be noted that Televilt has been helpful in addressing our problems and has replaced the two collars for which the VHF portion may have failed. The quality of GPS fixes (number satellites making fix) was high.

GPS collar technology is relatively new and will continue to be an exploratory aspect of our research. In the future we expect that technological advancements will produce a GPS collar from which the data can be downloaded remotely through a satellite uplink. This feature is currently available in collars designed for larger animals. We will continue the process of development of GPS technology by reporting successes and shortcomings of products we use. As technology develops we will begin shifting towards use of GPS collar technology on all of our study animals. The GPS collar that was used on a young male wolverine in the Tetons (M304) demonstrates the importance and relevance of this technology and that GPS locations can be collected from wolverines even in remote and rugged terrain.

Home Range Estimates.
We have obtained 504 VHF and 209 GPS locations of wolverines on the TFA, dating 1 Jan, 2001 - 29 Oct 2003, and 186 VHF and 22 GPS locations of wolverines on the MFA, dating 1 Jan, 2003 - 29 Oct 2003. Minimum Convex Polygon (MCP) home ranges were calculated for all wolverines (Table 1), and fixed kernel home ranges were calculated for wolverines with greater than 30 locations (Seaman et al. 1999). Average adult home range estimates for this study are larger than those reported in previous studies. Annual home range estimates for adult female wolverines have ranged between 87 and 388 km² (avg. 274 km²) and for adult males between 238 and 1417 km² (avg. 647 km² ; Hornocker and Hash 1981, Gardner 1985, Magoun 1985, Whitman et al. 1986, Banci 1987, Copeland 1996, Krebs and Lewis 1999, Landa et al. 1998).

After the death of adults M561 and F401, we observed home range shifts of same-sex younger wolverines into the area previously occupied by adults (Figures 1 & 2).

Table 1. Minimum Convex Polygon (MCP) and Fixed Kernel total home range estimates of all captured wolverines, Madison and Teton Focal Areas, 1 Jan 2001 - 29 Oct 2003.

			100%				95% Fixed
Age-class & Sex	**n[1]**	**n[2]**	**MCP (km^2)**		**n[1]**	**n[2]**	**Kernel (km^2)**
Average Sub-adult Female	5	213	429		1	114	1,008
Average Adult Female	3	202	754		2	181	673
Average Sub-adult Male	1	24	629		-	-	-
Average Adult Male[3,4]	5	231	910		3	182	1,294
M304 Dispersing Male[3]	1	251	37,683		1	75	26,058[5]

[1]Number of different wolverines.
[2]Number of telemetry locations.
[3]Homerange calculation includes VHF and GPS collar locations.
[4]Average adult male home range does not include M304 as he may be a dispersing animal.
[5]Using 24 hour independent GPS and VHF locations only.

Figure 1. Sub-adult F402 (Yellow) 100% MCP Home range before adult F401 (Purple) death.

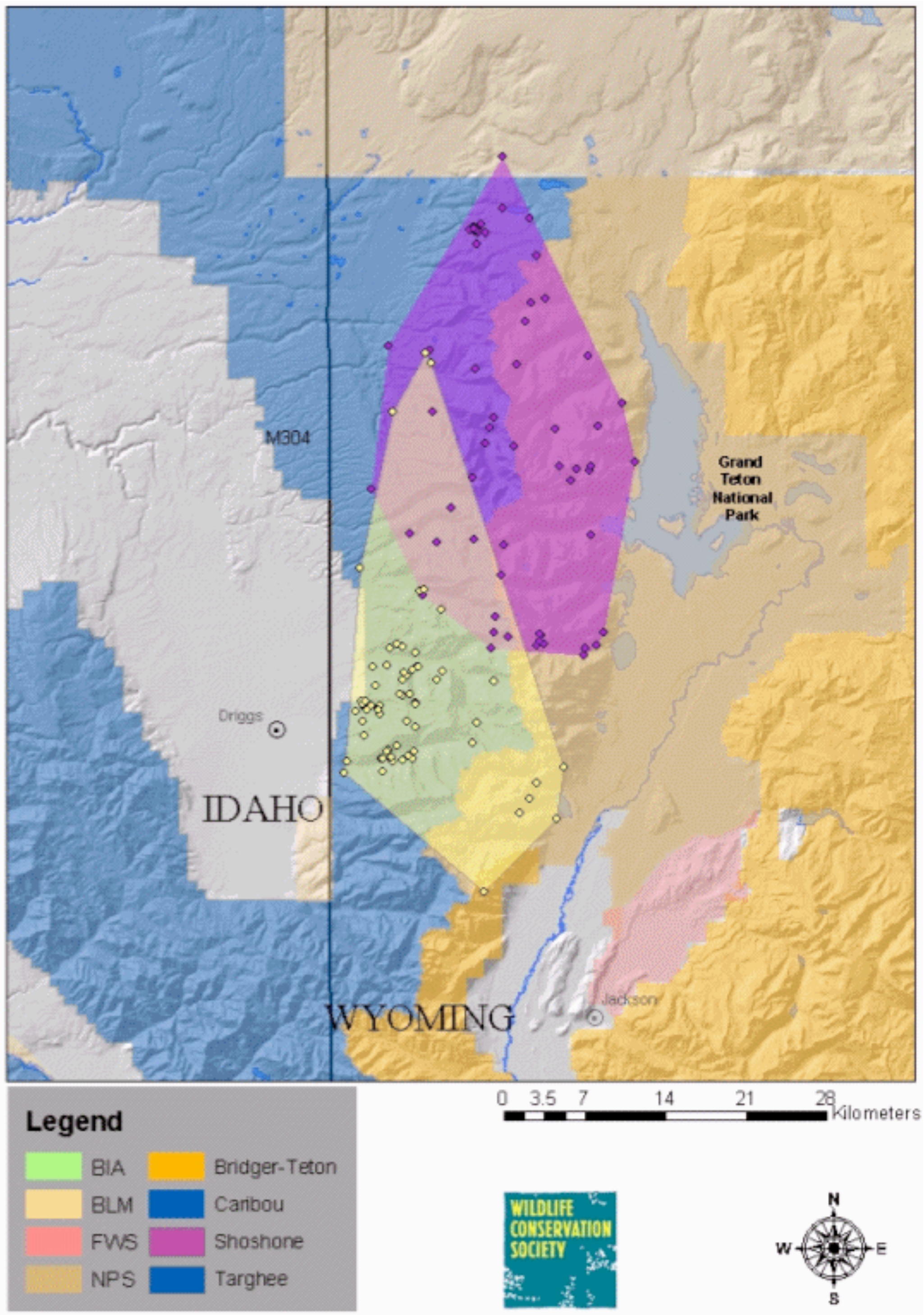
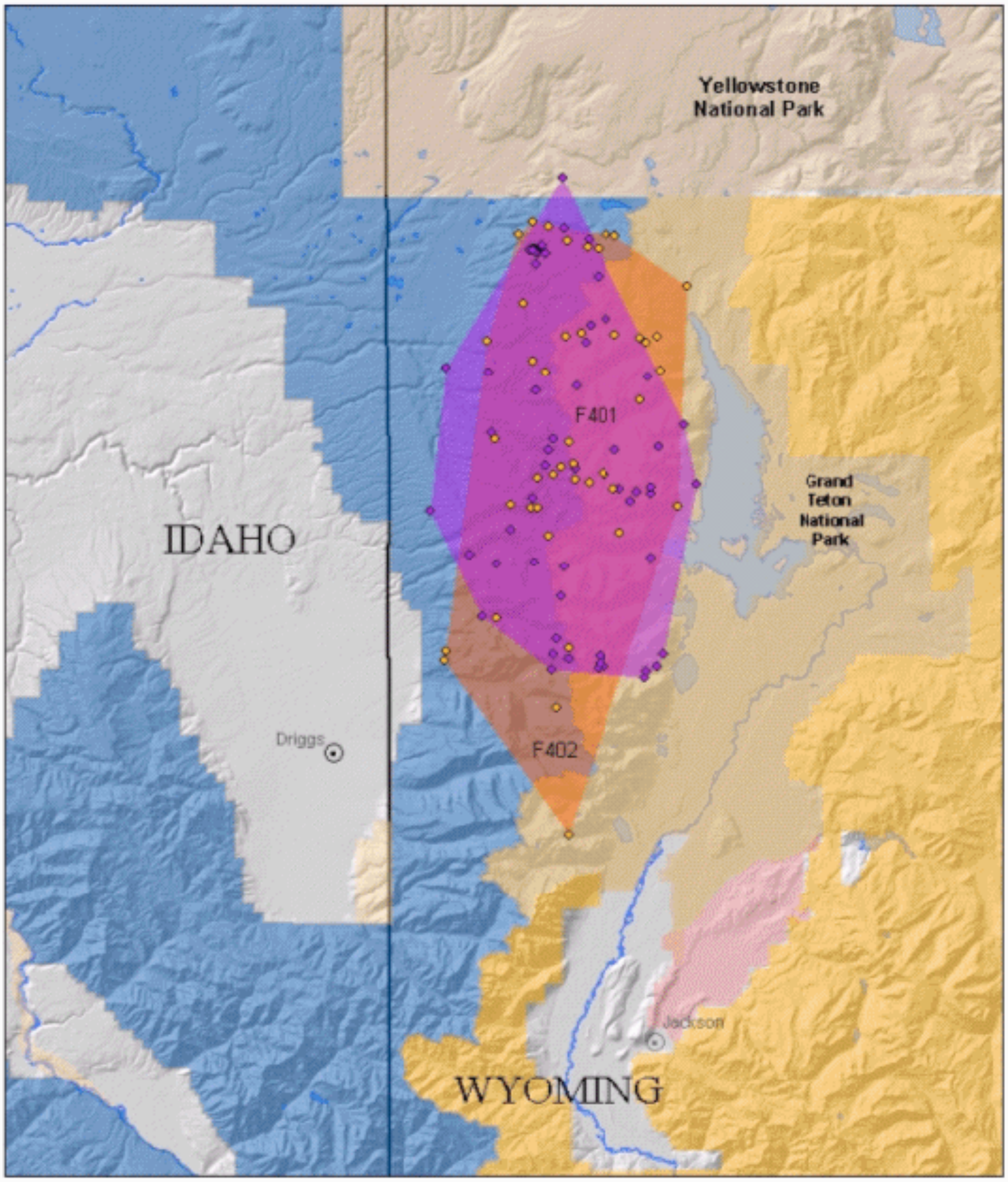


Figure 2. Sub-adult F402 (Orange) 100% MCP Home range after adult F401 (Purple) death.



Cartography by J. Rieck and K. Inman
Sources: ESRI, Montana State Library (NRIS), United States Forest Service, National Park Service, State of Idaho, Montana, and Wyoming.

Movements. In 2002, a sub-adult male wolverine (M304) captured in the Teton Range made impressive and extensive movements to southeastern Idaho and northern Yellowstone National Park (Inman et al. 2004). These movements were documented from the first GPS collar ever to be fitted on a wolverine in North America. Between 26 March and 13 April 2002, the wolverine covered a minimum distance of 412 km in 19 days. Soon afterward, this wolverine traveled a minimum distance of 226 km over seven days. In total, this wolverine traveled a minimum of 874 km during a 42-day period (23 March – 4 May 2002). Rate of travel for 99 GPS locations made 2 hours apart ranged from 0.0 – 6.9 km/hour (mean = 1.36 km/hour, SE = 0.14); the largest distance moved during a 2 hour period was 13.8 km. GPS data provided 26 independent 24-hour sampling intervals, and this wolverine moved an average of 14.3 km (range 0.7 – 33.1 km) during those intervals. The wolverine moved more than 20 km during 38% of 24 hour sampling intervals. M304, likely a dispersing male (Inman et al. submitted), has been located in nine distinct mountain ranges. During these movements he has been located in three states, two national parks, three national forests, one Bureau of Land Management (BLM) unit, and on Bureau of Indian Affairs (BIA) lands. Without GPS collar technology we would have been unable to document these movement distances and would not know how this wolverine traveled through distinct and island-like mountain ranges.

Social Interactions. We saw or located four wolverines captured at the same trap in close proximity to each other on several occasions (Table 4). We located at least two individuals together during 80% of search flights between 7 Jan - 10 Apr, and during 12% of flights between 22 Apr - 15 Oct, 2003. Males and females were seen at distances less than 50 m apart four times (F103/M204, F103/M205, 105/M205), and at less than 500 m on three additional occasions. The least distance between the two males was less than 50 m, and they were located at less than 500 m on two additional occasions. The least distance between the two females was 655 m, and they were located at less than 1,050 m on two more occasions. We suspect these individuals are related. Our age estimates indicate that F105 and M205 were born in the same year, and that F103 and M204 could have been born during the same year, two years after F105 and M205. It is possible that these wolverines represent two sets of siblings. We are in the process of having genetic samples analyzed.

Causes of Mortality. We have documented three types of wolverine mortality (Table 2) occurring within two sex-age-classes (Table 3).

Table 2. Causes of wolverine mortality in the Greater Yellowstone Area, 2001-2003.

Cause of Mortality	Observations	Percent
Avalanche	1	33.3
Inter-specific Competition (black bear)	1	33.3
Trapper-Harvest	1	33.3
Total	3	100.0

Table 3. Distribution of mortalities among wolverine sex-ageclasses in the Greater Yellowstone Area, 2001-2003

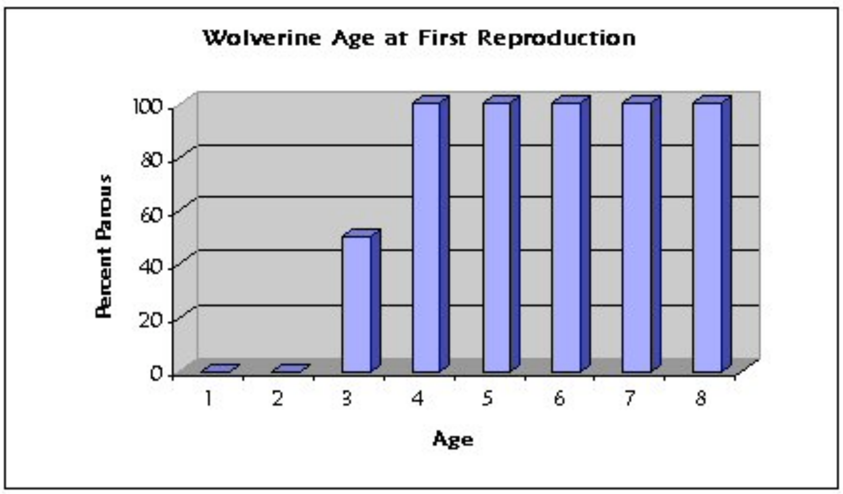
Sex & Ageclass	Mortality Observations	Percent
Sub-Adult Male	0	0.0
Sub-Adult Female	1	33.3
Adult Male	2	66.7
Adult Female	0	0.0
Total	3	100.0

Reproduction. During the previous two winters, we have been extremely cautious about visiting den sites because of the perception that den and/or kit abandonment was highly probable. We have sought out more information about the potential for disturbance and have discovered that with proper timing of visits, impact to wolverines should be negligible (see methods section above). Documentation of litters along with specific reproductive den habitat, is our highest priority during the upcoming year. Even so, we have documented two natal den sites using telemetry data. A summary of specific habitat information will be available at a later date.

Parturition Date: Based on reproductive condition at capture, telemetry locations during the denning period, and field observations, our data indicate that two females gave birth during 2002 (F401 and F404). Estimated dates of parturition were 18 Feb (14-21 Feb) for both females. Magoun and Copeland (1998) estimated parturition dates of 16 Feb, 18 Feb, and 23 Feb in Idaho.

Age at First Reproduction: We were able to confirm parous or non-parous condition at specific ages in 18 individual female years (Figure 3). We did not observe any breeding at 2 years of age, similar to wolverines in Scandinavia (Persson 2003). Persson (2003) monitored juvenile wolverines captured and marked at birth through production of a litter, thus their estimates were accurate. Our estimates are based on aging techniques that are imperfect, and may not be as accurate.

Figure 3. Preliminary wolverine age at first reproduction, Greater Yellowstone Area, 2001-2003.



Pregnancy & Birth Rates: Pregnancy rates of females more than 2 years old at the next March 1 after sampling, i.e. they would have to be at least 3 years old at the parturition date for which they were sampled (Persson 2003), averaged 67% and varied by year (Table 4). The four observations of pregnancy have occurred on the TFA. Telemetry data indicate that birth occurred in only 2 of 5 possible observations as described above. In Idaho, pregnancy rate was 46% (Copeland 1996).

Table 4. Percentages of wolverines pregnant and giving birth, 2001-2003.

Year	Females Observed	Females Pregnant	% Pregnant	Females Observed	Females Giving Birth	% Giving Birth
2001	0	.	.	0	.	.
2002	2	2	100	2	2	100
2003	4	2	50	3	0	0
Total	**6**	**4**	**67**	**5**	**2**	**40**

Litter Size, Litter Interval, Natality, Recruitment: Although two females have likely given birth, we were not able to visually confirm with 100% certainty the presence of wolverine kits.

Genetics. In August 2003, we delivered genetic samples from 17 wolverines to the U. S. Forest Service Rocky Mountain Research Station Genetics Lab in Missoula, MT and are in the process of developing a memorandum of understanding in regard to analyses that may include those samples.

Winter Recreation Surveys. Peak hours of snowmobile activity occurred between 11:00-15:00 all week and peak hours of ski activity occurred between 11:00-14:00 all week. Daily levels of snowmobile and ski use were greatest on weekends. Mean amount of snowmobile and ski use differed by access point. Mean snowmobile counts were as low as 36 and as high as 70 and ranged from 11 to 185 snowmobiles per parking area. On weekdays there was no difference in mean amount of use between parking areas ($P = 0.74$). Teton Pass received a higher amount of ski use on weekdays and weekends ($P \leq 0.003$). Weekend ski use on the TFA averaged between 17 and 59 vehicles and ranged from 26 to 96 vehicles. Preliminary analysis from the 2002-03 season was used to modify and improve our survey design for the 2003-04 surveys. Analysis for winter 2003-04 surveys will be available this fall.

We surveyed distribution of snowmobile and ski use once on 2,523 km² in the MFA and once on 3,059 km² in the TFA during February 2003. On the MFA, 18% of the area was impacted by snowmobile use (11% highly impacted), and 4% was impacted by ski use (2% highly impacted). On the TFA, 36% of the area was impacted by snowmobile use (1% highly impacted), and 9% was impacted by ski use (1% highly impacted). In 2004, we increased our survey area to include one flight over the Gravelly and Henry's Lake Ranges of Montana and Idaho, and the Snake Range of Wyoming and Idaho. Additionally, the Madison and Teton Ranges were surveyed on three occasions. Analysis for 2004 flights will be available this summer.

Habitat Use. Wolverine use of elevation ranged from 1,500-3,299 m (4,900-10,800 ft.) during winter, and 2,100-3,599 (6,900-11,800 ft.) during summer and fall. Although statistical tests have not yet been performed, it appears that wolverines use higher elevations (greater than 2,100 m [6,900 ft.]), steep slopes (greater than 16°), and NW and N aspects disproportionately to their availability. Wolverines also used evergreen forest (subalpine fir and doug fir), bare rock, and perennial ice and snow disproportionately to their availability. Wolverines' use of areas above tree-line was high as well.

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WILDLIFE CONSERVATION SOCIETY

FINANCIAL REPORT

TOTAL EXPENDITURES
GREATER YELLOWSTONE WOLVERINE PROGRAM
June 1, 2003 – April 30, 2004

Expense	Amount
Salary: includes project leaders, veterinarian, field technicians; also includes benefits	$89,302
Purchased services: includes aerial flights	$52,781
Printing	$24
Insurance-vehicle	$2,950
Equipment under $5000	$2,872
Equipment over $5000 per item	$26,705
Field supplies & materials	$4,740
Vehicle repairs and parts	$1,385
Office supplies	$753
Telephone/fax/email	$1,997
Travel	$3,993
Conferences and Meetings	$1,070
Postage/Shipping	$162
Rent/lease/utilities	$5,948
Miscellaneous	$46
Total spent	**$194,728**

The $10,000 grant from The Tapeats Fund has been spent in its entirety.

Go To 1998 Project Report
Go To 1999 Project Report
Go To 2000 Project Report
Go To 2001 Project Report
Go To 2002 Project Report