Wolverine Population Assessment in Glacier National Park, Montana

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Abstract

Field work began in summer 2002 with selection of wolverine (*Gulo gulo*) trap sites and trap building at 7 locations on the eastern front of Glacier National Park, located along the Continental Divide in northwestern Montana. Study area and trap locations were selected by reviewing historical park sighting and track information. Field work continued into the fall with completion of log box traps, hiring of technicians, and logistical preparations (housing, food, firewood, bait, and equipment) in portions of the study area with limited winter access. Prebaiting of traps began on 17 December 2002 and trapping commenced on 22 January 2003, with 4 traps set in the Many Glacier Valley. The first wolverine capture occurred on 26 January. A total of 6 wolverine (3 male & 3 female) were captured between 26 January and 8 April, all in the Many Glacier Valley. Traps at Lee Creek and Two Medicine were not set and a single trap at Cut Bank Creek did not capture a wolverine. All captured wolverine were instrumented with intraperitoneal VHF transmitters. ARGOS/GPS satellite collars were also fitted on 4 individuals, but only functioned for several weeks. One individual removed its collar. Morphometric data, blood, and tissue samples were also collected. Male weights averaged 12.87 kg (n=3) and females 8.97 kg(n=3). Study animals were relocated by ground triangulation and via aerial monitoring. Two adult females were found pregnant at their initial capture but only one of these produced kits.

Introduction

The wolverine is one of North America's rarest mammals and least known large carnivores, with only two previous long-term field research projects in the lower 48 United States (Banci 1994). Lack of basic ecological information leaves the wolverine increasingly vulnerable to human impacts throughout its reduced present-day range.

A paucity of information on the basic ecology of wolverine, the potential listing as an endangered species, and impending construction projects that may impact wolverine and their habitat make it imperative that research be undertaken to provide the scientific foundation for managing wolverine habitat in Glacier National Park (GNP) and other areas of the Rocky Mountain west. Glacier is one of the few national parks with wolverine, and may have the highest density among park units. One hundred years ago the status of wolverine in the region of Montana that now includes Glacier National Park was perilous as they were believed to be extirpated from the park (Bailey and Bailey 1918). Excessive harvest and widespread use of poison baits to control predators suggests that wolverine were easily trapped-out from large areas

of their range. Recreational activity, especially during winter and spring, may affect reproductive potential by displacing animals at den sites during the most sensitive period of their life cycle. Specific knowledge of den site locations and characteristics, and more general knowledge of how wolverine use the landscape, may help prevent impacts to this secretive forest carnivore. Impending National Park Service (NPS) plans to reconstruct the Going-to-the-Sun Road and repair park hotels and facilities, perhaps expanding visitor use during wildlife-sensitive spring and fall seasons, may impact wolverine unless more reliable information is gathered for use in the planning process,

Wolverine distribution, abundance, survival, dispersal patterns, habitat use, food habits, and other ecological and demographic factors, as well as their sensitivity to human activity, are poorly understood in the park. Anecdotal sightings and records from periodic track surveys provide the basis for assessing general occurrence and distribution. But more in-depth knowledge, both at the broad scale and site-specific level, is lacking. The NPS has an obligation under the Organic Act (1916) to protect wildlife, including wolverine, "unimpaired for the enjoyment of future generations." NPS Management Policies (2001) clarify the mandate of "resource protection as the primary goal", and require that "decisions regarding the treatment and use of park resources will utilize scientific, technical, and scholarly analysis."

Glacier National Park is engaged in developing a Commercial Services Plan and EIS, and an EIS on reconstructing the Going-to-the-Sun Road. These and other plans aimed at addressing infrastructure and other visitor service needs may have unintended impacts on wolverine. A specific concern is that winter use activities may inadvertently displace female wolverine from den and/or rendezvous sites and, could reduce survival of young or prevent reproduction altogether. Population status, long-term viability, and habitat needs of wolverine require baseline information as well for assessment of park and region-wide management efforts.

Degradation and loss of habitat through increased human use and road building is a current and future threat to the sustainability of wolverine populations throughout its range. Other demands on habitat, such as commercial backcountry use and increased motorized vehicle use may have a direct impact on the reproductive potential of wolverine, limiting the capacity of certain areas to support viable populations (Krebs and Lewis 1999). Therefore, core populations in areas such as Glacier National Park are increasingly important in sustaining long-term viability of metapopulations.

This 3-year project will employ both conventional and satellite telemetry to monitor the movements and activity of wolverine, with a focus on the reproductive ecology of female

wolverine. Efforts will also be made to document distribution and movement of wolverine and to identify those habitats critical to the species.

Study Objectives-

- Live-trap, radio-instrument and monitor wolverine to describe their distribution and reproductive status.
- Locate natal and maternal dens, and rendezvous sites, and characterize associated landscape features.
- Examine the feasibility of satellite telemetry, exploring wolverine demographics and social character, further defining the relationship between wolverine presence and distribution relative to human recreation.
- Describe wolverine home ranges, movement, and habitat use.
- Wolverine population assessment including relatedness of captured individuals.

Study Area.--Glacier National Park encompasses over 1 million acres, consisting of numerous, diverse habitats covering east and west slopes of the Continental Divide in northwestern Montana. Elevations range between 960 m. and 3190 m. ASL. The park is a core component of the biologically rich Northern Continental Divide Ecosystem which has been characterized as a refuge for wolverine, serving as a source for dispersers into surrounding areas of the Northern Rockies (Ruggiero, et al, 2000; Newby and Wright, 1955). Wolverine in Glacier also may serve as a genetic storehouse for the Northern Rockies, and as part of a source population for wolverine in other areas of Montana.

Winter track surveys initiated in Glacier National Park in 1994 (Yates 1994), historical sighting records from park files, and subsequent track surveys (Buhler et al. 2001) provided insight into the seasonal distribution of wolverine especially along the eastern slope of the park which initially formed the core of our study area (Fig. 1). The Many Glacier Valley stood out as an area of high wolverine density. Logistically, the Many Glacier Ranger Station complex offered better access, housing, communication, and equipment storage and proved to be the focus of trapping operations during winter 2002/03. Expansion of the study area to include most of Glacier National Park may be necessary due to extensive movements of instrumented individuals.

Methods

Capture, immobilization, and handling.--Wolverine were captured using log box-traps (Copeland et al. 1995). The number and location of traps was determined based on habitat values and historical presence of wolverine in Glacier National Park. Seven log traps were constructed of lodgepole pine (*Pinus contorta*) logs 15-20 centimeters in diameter. Heavy lids were used as doors and were tripped by triggers attached to beaver (*Castor canadensis*) bait. Safety latches were placed on each lid to prevent a wolverine from escaping by lifting the lid. Traps were also fitted with remote trap monitors (TBT-600HC, Telonics, Mesa, AZ) that provided an electronic signal when the trap door shut allowing remote monitoring on a daily basis. Prebaiting of traps began on 17 December 2002 and trapping was conducted between 22 January and 9 April 2003. Captured wolverine were immobilized by jab stick with a Domitor/Ketamine solution. Study animals were weighed and standard measurements taken; blood, hair, and tissue (DNA profiling) samples were collected. Heart rate, respiration, and body temperature were monitored during processing. Animals were inspected for injuries and ectoparasites. All captured wolverine were surgically implanted with intraperitoneal VHF radio-transmitters (Telonics Mod. 400). Implant transmitter surgery was conducted on site by a licensed veterinarian using standard aseptic surgical procedures. Completing surgery and processing required about 40 minutes. In addition, radio collars, using a combination of ARGOS and/or GPS technology, were placed on 4 wolverine.

Study animal monitoring.--We relied on conventional VHF telemetry to locate study animals when satellite telemetry proved ineffective. Due to concerns regarding aircraft over-flights and potential disturbance to park visitors, telemetry flights were kept to a minimum, occurring primarily in months of reproductive denning (March through May). Telemetry data gathering was conducted by ground-tracking methods whenever possible.

Home range, movements, distribution, and habitat use.--Study animals were located opportunistically by ground tracking and several times monthly by aerial tracking (fixed-wing Cessna 185). Weather conditions, especially on the east side of Glacier National Park, are highly variable and often not conducive to safe fixed-wing flights. Collared animals provided only minimal ARGOS locations before the collars ceased to transmit data. Habitat data were recorded during opportunistic snowtracking sessions on a Trimble Explorer XL GPS.

Reproduction and Denning.--Reproductive success was measured by direct field evidence of reproduction and measures of serum progesterone (Mead et al. 1991) collected from captured

females. The reproductive status of adult females was determined at the time of capture by palpation and inspection of teats and mammary tissues.

Wolverine generally den in late February or early March. We closely monitored (several telemetry flights per week) movements of reproductively mature females during that period to document localization at a den site. When a site was identified and a den suspected, we continued to monitor the site via aerial and ground telemetry to record the female's duration of stay and movement to maternal dens (rearing dens used prior to weaning other than the site of parturition) if such occurred. We also monitored changes in the snow-water equivalent (SWE) index (NRCS National Water and Climate Center). Magoun and Copeland (1998) reported that den abandonment in Idaho wolverine appeared to correlate with a decrease on the SWE.

Results

During fall 2002, contracts were initiated for cutting and delivery of logs for trap building materials to 7 sites within the park, and for assembly of traps (Fig. 1). We also began collection of data layers for development of a project GIS. Our primary expenditure at that time was the purchase of study animal telemetry equipment including 7 satellite transmitter collars (Habit Research Inc., Victoria, B.C.), 7 implant transmitters, and related telemetry equipment (receivers, antennae, trap transmitters).

Wolverine traps were conducted on site in October and November 2002. Four traps were placed in the Many Glacier basin, one in Lee Creek, one in the Two Medicine Valley, and one in the Cut Bank drainage. Two technicians were employed during the trapping field season and 1-2 volunteers were used as needed.

Capture results.--Six individual wolverine (3 male & 3 female) were captured during 80 trap nights in the Many Glacier Valley for a capture rate of 1 individual wolverine/12 trap nights (Table 1). Including recaptures, 20 wolverine captures produced an overall capture rate of 1 wolverine/4 trap nights. All initial wolverine captures occurred in 2 of 4 traps. Weights of males ranged from 12.0-14.0 kg (mean =12.9 kg, n=3) and females 8.2-10.1 kg (mean = 9.0 kg, n=3) (Table 2).

Transmitters and relocations.--All wolverine were instrumented with intraperitoneal implant transmitters. Satellite collars were placed on 4 individuals. Wolverine retained collars for periods ranging from 10 to at least 43 days (documented by on-board VHF signals). A subadult male (M3) dropped his collar after 10 days. The collar provided no relocations. The 3 others

(M1, F4, and M6) have continued to wear their collars through the study period. None of the collars produced any GPS points. The 3 remaining collars provided ARGOS locations but only for 4 to 6 days before all had failed. Approximately 250 relocations of all study animals have been collected to date. Locations were classified as ARGOS by accuracy class, and as aerial or ground locations with subjective estimates of accuracy (100 meter, 300 meter, > 300 meter).

Movement and Spatial Relationships.--Instrumented animals were snow-tracked opportunistically to assess the accuracy of location data collected by ground telemetry and to monitor patterns of movement and associated behavior. We collected approximately 10 km of GPS snow-track data. Those data have not been analyzed. Home range estimates are provided but are preliminary and likely underestimate actual spatial use due to relatively few spatially and temporally independent locations collected to date (Table 3, Figure 2).

Productivity and denning.--Two adult females were pregnant at the time of capture. Elevated serum progesterone (11 ng/ml) at her initial capture on 30 January indicated pregnancy in F2. Recapture of a lactating F2 on 20 March confirmed parturition. F2 used 2 den sites prior to weaning. The sites were separated by 360 m on an eastern aspect in subalpine forest. Both dens occurred in large woody debris in small forest openings. Den sites were visited in June after weaning and den abandonment had occurred. Dens were identified, mapped, and photographed. Scats and hair were collected from the sites as well. Attempts to capture and instrument the kits have been unsuccessful.

Female F4 was first captured on 17 February and confirmed pregnant during implant surgery. Subsequent recapture on 21 March found her not lactating confirming the kits had been lost. During a physical examination at this capture we found indication of an injury. She appeared to have sustained trauma causing a fracture to the xyphoid and possibly a rib injury, however a veterinarian was not present to examine the injury or speculate as to its possible contribution to the loss of kits. At a subsequent recapture on 3 April, with a veterinarian present, evidence of the injury was no longer pronounced.

DNA Analysis.—Tissue and hair samples were provided to the RMRS Forest Sciences Lab/University of Montana Genetics Lab for banking, DNA extraction and analysis. Analysis is presently underway.

Discussion

Trapping success for this study was the highest recorded in North America (studies using similar trapping technique generally report capture rates of 30-40 trap nights/capture). The presence of 2 reproductively active females confirms residency. Study animal morphometrics were consistent with that reported in other studies (Table 2). We found no individuals that appeared unhealthy, parasitic, or lacking in nutrition. Recaptures of 67% of our study animals (one as many as 7 recaptures) was also consistent with what others have reported substantiating our belief that wolverine are not overly susceptible to trap shyness (Table 2). Capture and processing did not appear to be a deterrent to recapturing. Capture and marking in additional sites next year should be feasible and would enhance understanding of GNP wolverine ecology.

Even with lack of success in acquiring locations from satellite collars, successful development and deployment of these systems for wolverine is close to being a reality. One objective, in addition to acquiring unbiased satellite relocations, was to develop a collar system tolerable to wolverine. To date, 3 of 4 wolverine instrumented are still wearing their collars. We will continue to investigate collar systems of all manufacturers in preparation for the coming winter capture season. In the absence of a functional satellite collar, the study will continue to focus on ground-based and aerial telemetry.

Reported home range sizes vary from 422 km^2 to over 1400 km^2 for male wolverine in NW Montana (Hornocker and Hash 1981) and Idaho (Copeland 1996), respectively. Our preliminary data indicate home ranges that are spatially segregated within expectations as reported from similar study areas. Adult females F2 and F4 maintained relatively exclusive home ranges and appear to be most closely associated with resident adult male M1. Subadults F5, M3 displayed more overlap suggesting they are likely siblings. Their relatedness to resident adults should be confirmed by DNA analysis. Subadult female F5 was located with M1 on at least 1 occasion while M1 was located in close association with both F2 and F4 on several occasions. Adult male M6 appears spatially disassociated with the other study animals suggesting he may be connected with a northern, possibly Belly River area, kinship group. Future trapping in the Belly River drainage should clarify that speculation.

Only 2 studies in North America report reproductive parameters of free-ranging wolverine. Magoun (1985) and Copeland (1996) reported reproductive rates as represented by the number of post-weaning age kits per adult female as 0.69 and 0.89 per year, respectively. In contrast to this, *in utero* studies of Canadian trapper collected carcasses report pregnancy rates as high as 90%. These lower realized rates of offspring presence raise concerns about wolverine population persistence. Contributing to this lack of knowledge is the apparent nature of the

wolverine to persist at a widely distributed low population density. As such, it is difficult to capture and monitor an adequate number of females to measure demographic variables within statistical constraints. But we also recognize that any additional information on reproduction will add significantly to our knowledge-base. Information on wolverine den site selection is rare in North America. Only one study in the contiguous U.S. has provided data on wolverine reproductive dens (Copeland 1996) and only 15 den sites associated with 5 females have been described (Magoun and Copeland 1998) in North America. Copeland (1996) reported den sites occurring in boulder talus and under fallen trees in or near subalpine cirque habitats as described by the denning habitat model provided by Hart et al. (1997). Both GNP den sites occurred under fallen trees but in sites that would not be identified directly by this denning habitat model. This probably reflects the limitations of the data used to develop the model but will contribute to our ability to refine and improve such models.

Scheduling

May – June '03

Radio tracking and monitoring of study animals
Fixed-wing telemetry flights to monitor reproductive status of female F2
Confirm presence of kits – capture and mark
Visit reproductive dens

June – September '03

Radio tracking and monitoring of study animals
Investigate and test satellite transmitters
Locate and describe rendezvous sites

September - December '03

Radio tracking and monitoring of study animals
Locating additional trap sites and building traps
Maintenance of existing traps
Logistical preparation for winter field season
Annual Report preparation

December '03 - April '04

Radio tracking and monitoring of study animals

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Kate and Jason Wilmot provided the initiative and inspiration to bring this project to reality. Jason applied his considerable knowledge of wolverine movement and presence in GNP, and park geography in the selection of trap sites, and supervised the collection and transportation of materials for trap building. Kate lent her services through the winter's trapping efforts as a capable and resourceful field technician. Rachel Wolstenholme provided assistance in trapping and invaluable experience in radio-tracking. Drs. David Hunter and Dan Savage ably performed implant surgery. Dr. Savage also helped with tracking and radio telemetry. John Waller and Steve Gniadek were pivotal contacts for Glacier National Park. Also, park employees Dona Taylor, Pete Lundberg, Al Hoffs, Michelle Madland, Paul Downey and Sis Vail were especially supportive. Lanny Stubson assisted with building of log traps. We thank pilot Dave Hoerner for his mountain flying experience and skill, Amy Hinken and Bobbie Newbury of the Rocky Mountain Research Station for administrative support, and Cheryl Copeland for her GIS support and volunteer hours in the field.

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Table 1. Trapping results for 7 traps in Glacier National Park, 2003.

TRAP	DATE SET	TRAP NIGHTS	TOTAL CAPTURES	INDIVIDUALS
Josephine	1/22	13	8	M1=3 Adult Male F2=2 Adult Female (pregnant) M3=3 Subadult Male
Swiftcurrent	1/22	23	2	M1=1 F4=1
Fishercap	1/23	19	10	M3=4 F4=4 Adult Female (pregnant) F5=1 Subadult Female M6=1 Adult Male
Apikuni Flat	1/29	17	0	
Cut Bank	2/18	8	0	
Lee Creek	Not Set			
Two Medicine	Not Set			
Total		80	20	1 wolverine/4TN 1 individual/12TN

Table 2. Capture history and morphometrics of 6 wolverine live-trapped in the Many Glacier Valley, January-April 2003.

Animal ID	Capture date	Capture location	Sex	Age	Weight (kg)	Total Length (cm)	Tail length (cm)	Chest girth (cm)	Neck girth (cm)	Head girth (cm)
M1	1/26/03	Josephine	M	Adult	12.0	93	18	45	34	37
F2	1/30/03	Josephine	F	Adult	8.2	87	18	41	31	32
M1	2/7/03	Josephine	M	Adult						
M1	2/13/03	Josephine	M	Adult						
M3	2/14/03	Josephine	M	Subadult	14.0	107	16	50	33	35
M3	2/16/03	Fishercap	M	Subadult						
F4	2/17/03	Fishercap	F	Adult	10.1	96	18	45	31	31
M3	2/28/03	Josephine	M	Subadult						
M3	3/1/03	Fishercap	M	Subadult						
F5	3/1/03	Fishercap	F	Subadult	8.6	91	17	40	27	30
F4	3/4/03	Fishercap	F	Adult						
M3	3/4/03	Fishercap	M	Subadult	13.6					
M1	3/18/03	Swiftcurrent	M	Adult	12.5					
F2	3/20/03	Josephine	F	Adult	8.0					
F4	3/21/03	Fishercap	F	Adult	8.8					
M3	3/29/03	Fishercap	M	Subadult						
M3	4/2/03	Fishercap	M	Subadult						
F4	4/3/03	Fishercap	F	Adult	9.0					
M3	4/4/03	Josephine	M	Subadult						
F4	4/4/03	Swiftcurrent	F	Adult						
M6	4/8/03	Fishercap	M	Adult	12.6	103	22	50	33	35

Table 3. Home ranges of wolverine in Glacier National Park, 2003.

Animal ID	Age/Sex	N (locations)	Home Range (km^2)
M1	Adult Male	31	216
F2	Adult Female	41	128
M3	Subadult Male	38	152
F4	Adult Female	36	128
F5	Subadult Female	11	121
M6	Adult Male	16	51

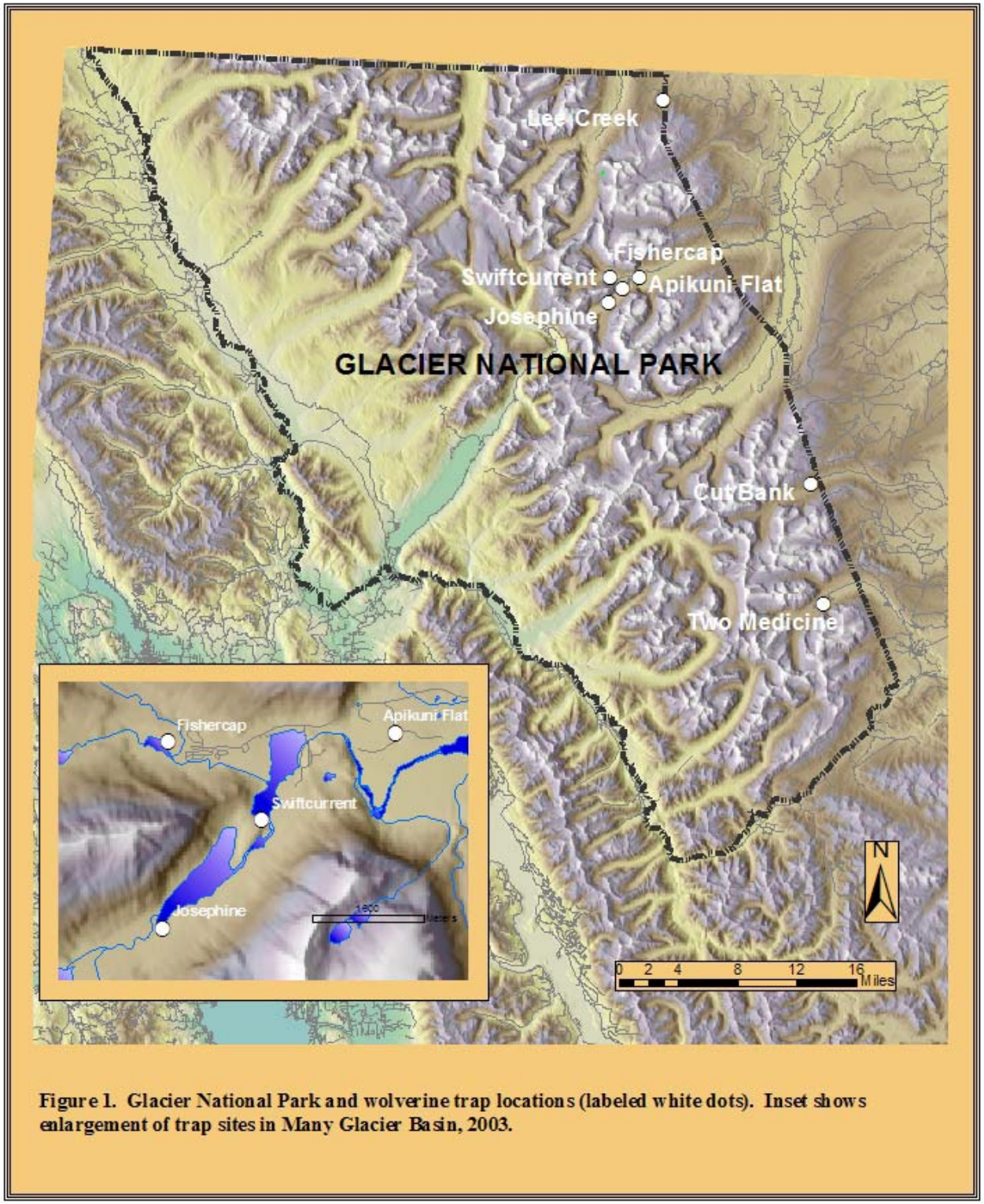

Figure 1. Glacier National Park and wolverine trap locations (labeled white dots). Inset shows enlargement of trap sites in Many Glacier Basin, 2003.

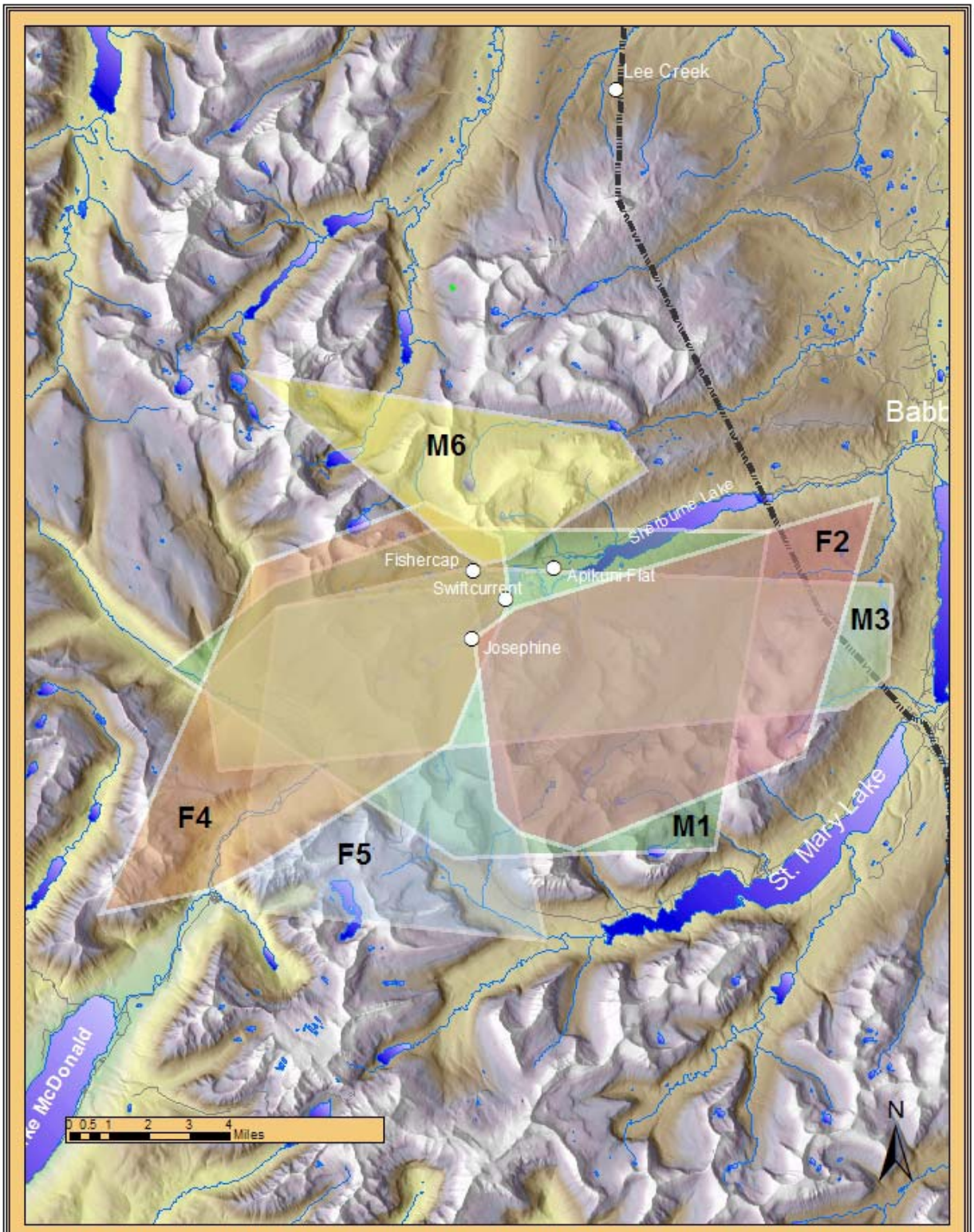

Figure 2. Minimum convex polygon home ranges and Many Glacier Basin trap sites of Glacier National Park wolverine, 2003. M1 and M6 are adult males, F2 and F4 are adult females, and F5 and M3 are subadults.