Preserving a Natural Wolf Population in Yellowstone National Park, USA

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> There is no question, though, that wolves living in Yellowstone National Park are the largest assemblage of protected packs living in the northern Rockies of Idaho, Montana, and Wyoming. This is as it should be and, because it is national park policy, we take this responsibility seriously.
>
> — *Smith et al. 2013*

Introduction

A fundamental goal of national parks in the United States is conservation of wildlife in a natural, unimpaired state for the benefit of people (NPS 2006; Ross 2013). "Naturalness," the avoidance of artificiality, should be the rule (Robbins et al. 1963). However, the no-impairment standard can be violated by external threats to park wildlife and by management actions to abate conflicts between wildlife and people in parks.

In this paper I examine how trophy hunting of wolves near Yellowstone National Park (YNP) and wolf habituation management within the park (YNP 2003) threaten a unique assemblage of naturally occurring wolves (*Canis lupus*). I suggest ways to address these threats.

The gray wolf was re-introduced to YNP in 1995–1996 as part of a recovery program for this species in the US (Smith et al. 2012). The number of park wolves peaked at 174 individuals in 2003 and then decreased and stabilized at 96–98 wolves from 2009–2011, indicating rapid growth in response to abundant prey and a subsequent decline suggesting interaction between predator and prey abundance (Sinclair et al. 2006). In 2012, wolf trophy hunting occurred for the first time in all three states surrounding YNP (Idaho, Montana, and Wyoming). In preceding years, state wolf hunts were limited and constrained by legal challenges (Mech 2013). Efforts within the park to deter wolves from being near people began soon after re-introduction (YNP 2003).

Study area and methods

YNP became the world's first national park in 1872 and one of the first international biosphere reserves in 1976 (UNESCO 2014). It is located mainly in the US state of Wyoming (44°08' to 45°07'N; 109°10' to 111°10'W) and includes 8,983 km^2 (3,468 mi^2).

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More than 90% of the land surrounding YNP is federally owned and managed, largely by the US Forest Service (Corn and Gorte 1986). YNP is at the core of the greater Yellowstone area, which, at 72,520 km^2 (28,000 mi^2), is considered the largest relatively undisturbed ecosystem in the coterminous US.

Data on park wolf mortality and aversive conditioning were obtained from YNP through a Freedom of Information Act (FOIA) request (November 7, 2013) and from Yellowstone Wolf Project annual reports (2007–2012). Records provided on human-caused mortality of wolves appeared on a spreadsheet that included a wolf identification number, specific cause of death, date, and location. A second spreadsheet on wolf habituation and aversive conditioning included date and location of encounter, a description of the wolves and people involved, and actions taken. To compare human-caused and natural wolf mortality, I drew upon annual report tabulations for radio-collared animals for which cause-of-death documentation was complete.

Wolves are routinely fitted with radio collars by park biologists to obtain information on their travel, behavior, habitat use, demography, physical condition, and other aspects of wolf biology (Smith et al. 2003). Attempts are made to radio-collar at least one wolf from each pack to facilitate overall wolf population monitoring. Wolves with pack territories primarily within YNP are considered to be park wolves.

Information from the US Forest Service on interagency communications on wolf management near YNP (2009–2013) was also solicited through a FOIA request. Quotas for wolf hunting units adjacent to YNP were obtained from state fish and game agency websites.

As used in this paper, the term "wolf hunting" includes both hunting and trapping as legally permitted. State-authorized hunting of wildlife does not apply to national parks but has been traditionally allowed on most other federal lands, including national forests.

Results

Hunting. At least 23 wolves of YNP were legally harvested during the period 2008–2012, with 14 of these removed in 2012 (Table 1). Legal hunting losses accounted for 55% of total human-caused mortality of collared park wolves during the period. Other causes included control actions (11 instances), vehicle strikes (4), and poaching (2).

In 2012, hunting mortality of wolves matched that from natural causes, based on data for radio-collared animals (Table 2). Hunting mortality appeared additive to natural wolf mortality because the latter in 2012 was comparable with that of the three previous years (Table 2). By year's end, the park wolf population was 83, or about 14 animals fewer than in previous years. Seven of 11 packs living primarily in YNP had lost wolves (Smith et al. 2013).

For 2009–2012, at least five YNP wolf packs lost two or more individuals to trophy hunting (Smith et al. 2010, 2013) (the number of wolf packs varied from 10–14 annually, with some turnover between years). Three wolf groups—Cottonwood Creek, Lamar Canyon, and "642F"—were significantly disrupted or eliminated by the hunts. The Cottonwood Creek pack formed in 2008 with five wolves, producing six pups in 2009. Four members were killed during the fall 2009 hunt, including both the alpha male and alpha female and both

Table 1. Records of human-caused mortality of Yellowstone National Park wolves, 2008–2012.						
Cause of death	*2008*	*2009*	*2010*	*2011*	*2012*	*Total*
Legal hunting	1	4	2	2	14	23
Control actions	5	3	1	2	0	11
Other	2	1	0	4	1	8
Total	**8**	**8**	**3**	**8**	**15**	**42**

Table 2. A comparison of human and natural causes of death in radio-collared wolves of Yellowstone National Park, 2008–2012.						
Year	*2008*	*2009*	*2010*	*2011*	*2012*	*Total*
Legal hunting	1	4	0	1	8	14
Other human-caused	4	2	1	4	1	12
Natural or unknown	16	7	9	7	8	47
Total	**21**	**13**	**10**	**12**	**17**	**73**

radio-collared wolves. What remained of the Cottonwood Creek group apparently moved to the north of YNP (Smith et al. 2011).

The Lamar Canyon pack formed in YNP's Lamar Valley after the long-lived Druid pack (1997–2009) naturally disbanded. It included 13 wolves in 2012 before hunting eliminated the alpha female and beta male (Smith et al. 2013), and caused the alpha male to disperse (Lynch 2014). The group's leadership was reformed by a male from outside the park who paired with a surviving two-year-old daughter of the alpha female. Other members of the pack dispersed or perished, leaving only two Lamar Canyon wolves (Lynch 2014).

The newly formed "642F" group consisted of five adults and a number of pups in 2011. Hunting removed two females. Conflict with another wolf group and hunting losses evidently eliminated the group (Smith et al. 2012).

Aversive conditioning. To instill a fear of humans in them, YNP wolves are subject to intentional harassment ("habituation management") mainly by park personnel (YNP 2003). There were 72 reported attempts (an average of 12 per year) by people to chase away or aversively condition wolves between 2007 and 2012 (Table 3), with most (58%) occurring during 2011–2012.

Fifty-six (78%) of incidents occurred on or near a park road, ten (14%) in the backcountry, and six (8%) in developed areas. In 26 cases (36%), a wolf was reported to approach or move in the direction of people prior to treatment.

Non-lethal shotgun-fired munitions (rubber bullets, cracker shells, bean bags) were used on 21 occasions (29% of total) (Table 3). On 31 (43%) other occasions, wolves were hazed using vehicles or horses, by paint balls being fired at them, or by humans chasing them or throwing objects at them. Fifteen instances (21%) involved vehicle noise or human gestures only, such as shouting and arm waving. Pepper spray was used in five cases (7%), all in the backcountry and all involving wolves that approached people.

Table 3. Characterization of "habituation management" of wolves in YNP, 2007–2012. Where multiple methods were used, incidents are tallied by the most assertive (forceful) method. Figures in parentheses indicate cases where wolves moved in the direction of people prior to treatment.

Method	*On or near road*	*Developed areas*	*Backcountry*	*Total*
Munitions (non-lethal)	16 (4)	5 (0)	0 (0)	21 (4)
Vehicle or horse hazing	7 (1)	0 (0)	1 (1)	8 (2)
Paint balls	6 (3)	1 (1)	0 (0)	7 (4)
Pepper spray	0 (0)	0 (0)	5 (5)	5 (5)
Human chasing or object throwing	12 (3)	0 (0)	4 (4)	16 (7)
Vehicle noise (horn, siren, etc.)	8 (1)	0 (0)	0 (0)	8 (1)
Human gestures or noise	7 (3)	0 (0)	0 (0)	7 (3)
Totals	**56 (15)**	**6 (1)**	**10 (10)**	**72 (26)**

Wolves commonly (86%) responded to aversive treatment by running, loping, or walking away. However, "recidivism" appeared high, as 42% of wolves identified during the incidents were considered "repeat offenders."

Aversive treatment typically involved wolves that ignored people (or showed limited interest or curiosity) but did not flee from them, as exemplified by the Lamar Canyon and Canyon wolf packs, both popular with park visitors. Available records indicated that no members of the Lamar group were aggressive toward or directly engaged humans. Yet during 2011–2012, this group accounted for 56% (18 of 32) of instances of aversive conditioning on or near roads. Likewise, the Canyon pack (2009–2010) never actively approached people (Smith et al. 2011) but was hazed (at least seven instances), in part to deter denning near a developed area. Upon harassment, the group moved its denning site in 2009 but reared only one pup that was later lost.

Relatively few park wolves have threatened people or appropriated human objects. From reintroduction to 2012, two wolves showed blatant aggression, one defending a den site, by approaching a person at close range and vocalizing, and the other chasing a bicycle and motorcycles. The latter and another wolf that repeatedly approached people for food where the only wolves destroyed by park authorities. Park wolves fed or likely fed on human food items on six reported occasions. These included a wolf examining a garbage can, chewing a plastic wrapper, shredding tote bags, and consuming a hot dog bun tossed by a park visitor.

Discussion

Natural wolves. National park policy recommendations emphasize preserving ecological integrity in our changing world, including self-sustaining and self-regulating ecosystems, native wildlife populations and life cycles, and naturally functioning ecological processes such as predation (NPS 2012). National park resources, including wolves, should be maintained in "a natural wild state" (Dilsaver 1994), absent of artificiality (Robbins et al. 1963) and creating

the mood, a "vignette," of primitive America (Leopold et al. 1963). Prevention of both internal and external impairment of park resources and their attendant values has been central to park policy (NPS 1992, 2006).

To park wolves unaffected by artificial stimuli (be they tossed hot dog buns or rubber bullets), people may more closely resemble neutral objects than natural predators or primitive wolf hunters. "Natural" wolf behavior is for the most part neither avoidance nor attraction to park visitors, accounting for some variation in individual wolves such as innate wariness or curiosity (Haber and Holleman 2013).

Current YNP policy sees normal wolf behavior differently (YNP 2003). Wolves are considered innately shy and generally afraid of people, and as such they are "wild." A wolf is considered "habituated" and a candidate for aversive conditioning if it does not exhibit fear of people. Yet wolves with little negative experience with people often do not fear people (Fritts et al. 2003).

The late Gordon Haber, noted Denali National Park wolf biologist, addressed the misconception that wolves should inherently fear people (Haber and Holleman 2013):

> Free-ranging adult wolves generally show little fear of other nonhuman species. They typically approach other creatures in markedly bold, inquisitive, investigative way.... [T]here is little reason to assume that, absent some highly unusual, unnatural, and powerful incentive, such as persecution, they should behave in an entirely different way around people. It is also apparent from historical literature and accounts from frontier areas, at least where open terrain predominates, that wolves generally show little fear or wariness of people at initial contact, unless and until there is persecution or harassment.

Hunting consequences. The biological costs of wolf hunting near national parks can extend beyond seasonal reductions in the number of park wolves and disruption or elimination of family groups. Continued hunts risk reducing overall wolf population size (Creel and Rotella 2010), longevity of family lineages, and intergenerational transfer of adaptive genetic and cultural information (Haber 1996; Haber and Holleman 2013).

Losses of park wolves to hunting also have recreational, social, ethical, scientific, and potentially economic costs (Table 4). Wolf watching in YNP and Denali National Park and Preserve in Alaska has reportedly become more difficult in recent years, coinciding with increased nearby wolf hunting (Downey and Landis 2014; DNP 2014; Lynch 2014). With reduced wolf viewing opportunity, communities surrounding these parks and park concessioners risk losing tourist-related revenues and employment opportunities. The loss of the Cottonwood and Lamar Canyon wolves to hunting drew widespread public concern and consternation (for example, Murphy 2009 and Schweber 2012).

While urging state game agencies to limit nearby wolf hunting, YNP officials have indicated that a "modest harvest" would not undermine efforts to preserve a natural wolf population (YNP 2013). Opposition to nearby hunting might jeopardize whatever influence the park has with state authorities on wolf management, and even risk non-related cooperation

Table 4. Impacts of trophy hunting of wolves near Yellowstone National Park.		
Impact	*Mortality level required*	*Degree of certainty*
Fewer wolves — short term	Any amount. Wolves killed during fall/winter hunts cannot be replaced by reproduction and recruitment at least until the following summer	Absolute, barring replacement through immigration into the park
Fewer wolves — long term	A level that reproduction cannot replace over time (non- compensatory)	Possible, unknown (professional opinions differ)
Disrupted pack structure and demography	Removal of high-ranking, experienced wolves	Absolute, with possible long-term effects on wolf biology
Altered wolf behavior	None required. Fight distances for wolves that are shot at but not killed will likely increase	Absolute short-term, probable long-term
Effect on wolf viewing public	Removal of any wolf likely to be seen by park visitors, especially those in prime viewing areas	Absolute. Emotional response can vary greatly
Economic	A level reducing wolf viewing opportunities	Possible to probable, depending on changes in wolf numbers and behavior, and on public perception of whether wolf hunting is undermining the park experience
Ethical	Any amount. A benign coexistence between people and wolves is abruptly terminated at the park boundary	Absolute
Scientific	Loss of radio-collared wolves compromising or constraining research	Probable, given that 6 park wolves with collars were killed in 2012–2013

(D. Hallac, P.J. White, D. Wenk, pers. comm.). Nevertheless, National Park Service (NPS) acceptance of wolf hunting next to YNP lends validity to the practice as the appropriate policy norm.

The public interest. In 2012, YNP had over 3.4 million recreational visits involving $400 million in local spending by park visitors (Cullinane Thomas et al. 2014). Based on a 2005 study, a large share of visitors (44%) listed wolves as a species they would most like to see (second only to grizzly bears), and stated that they personally benefit from seeing or hearing wolves (41%) (Duffield et al. 2006). Visitor spending due exclusively to wolf presence in YNP was estimated at $35.5 million. Wolves are among those park assets most likely to offer visitors a transformative experience, a recommended primary goal for national parks (NPSAB 2012).

By comparison, hunting of wolves near YNP benefits a relatively small number of people seeking a trophy. For the 2012 hunting season, 6% (23 of 396) of wolves taken in Idaho and Wyoming came from hunting areas immediately adjacent to YNP (based on IDFG and Nez Perce Tribe 2013 and WGFD 2013). In Montana, 8% (18 of 225) of hunted wolves were located within 20 miles of the park (MFWP 2013). Beyond the YNP area, hunters have ample opportunity to harvest wolves across large areas of Idaho, Montana, and Wyoming. On the other hand, the wolf viewing public has primarily YNP in the US (outside of Alaska), with

its unique open vistas and accessibility. Nonetheless, for state wildlife agencies, hunting is of primary interest, while wolf watching is of secondary concern (Wuerthner 2013).

Wildlife in the US is publicly owned and held in trust for all citizens with both federal and state governments sharing management responsibility (Bean and Rowland 1997). Fair application of the public trust doctrine favors wolf protection on national lands surrounding YNP, given broad public interest in park wolves, the no-impairment standard for national parks, and consequences of undermining that standard.

Some people find hope in the fact that, in response to public pressure, Montana authorities had restricted the number of wolves to be hunted in the immediate vicinity of the park's northern boundary to seven (GYC 2014), while Wyoming limited its wolf harvest quota in a trophy zone west of the park to ten (in both cases, for 2013–2014 hunting seasons). More broadly, however, a total take of 47 wolves had been authorized for hunting units adjacent to YNP in Idaho, Montana, and Wyoming (with one additional Montana unit, on the park's west side, having no quota). State quotas may provide some limited protection for park wolves. On the other hand, protective measures entirely dependent on state game authorities can rapidly be undone (Medred 2013).

Wolf hunting near YNP will likely continue indefinitely without a re-balancing of wolf policy on national lands by the federal government. Elected officials and political appointees of states surrounding YNP have shown little tolerance, and sometimes open hostility, toward wolves (Bruskotter 2013). For example, Idaho has begun lethal wolf control projects on public lands, Wyoming has a virtual wolf free zone across much of the state, and Montana has legislated against a no-hunting zone for wolves near YNP.

Protecting park wolves. NPS is the authorized lead agency to address external threats to national parks (NPS 1992, 2006). In the case of YNP, its essential partner is the US Forest Service (USFS) which manages the vast acreage surrounding the park.

Park wolves may be protected by establishing wolf sanctuaries or buffer zones around national parks (Mech 2013). For YNP, the effort could be undertaken through the Greater Yellowstone Coordinating Committee (2011), with an advisory group representing all Americans as "co-stewards" of the national parks (NPSAB 2012). The committee was created to facilitate coordination between USFS, NPS, and other federal agencies in the greater Yellowstone area.

Memoranda of understanding between USFS, state game agencies, and NPS highlight the need for collaboration on important management issues near YNP. However, USFS records (2009–2013) indicate an absence of dialogue with state authorities and with NPS on the matter of wolf trophy hunting. USFS has authority to recommend hunting and trapping regulations to state game agencies while recognizing the traditional authority of the latter to manage wildlife populations on national forest lands (USFS 1995). Ultimately, federal law allows USFS to designate areas of the national forest system where, and for established periods, no hunting will be permitted (FLPMA 1976).

Within YNP, the Park Service should enforce the no-impairment standard by limiting aversive conditioning of wolves to individual animals that threaten people, and by strictly enforcing or reducing speed limits to lower risk of vehicle collisions with wolves and other

wildlife. Both measures would require heightened education, supervision, and management of park visitors.

Distinguished from other park wildlife, wolves exhibit a remarkable blend of social cooperation, emotional depth, and physical prowess (Haber 1996), making them exceptionally endearing to park visitors. At the same time, they are, among wildlife, uniquely hated by elements of society (Gibson 2013) and vulnerable to extraordinary abuse (Lopez 1978). Wolf preservation is a challenging test of America's resolve to safeguard the integrity of its national parks, holding them to the highest standard as the "crown jewels" of our outdoor heritage, "worthy of rigorous self-imposed restraints," and defense against "stultifying mediocrity" (Penfold et al. 1972). For generations to come, YNP could be among those few places in America with a wholly unexploited wolf population.

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