Wolf Research in the Isle Royale Wilderness: Do the Ends Justify the Means?

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AbstractóIsle Royale National Park is a remote island ecosystem in Lake Superior. A long-term research program investigating the wolf and moose populations in the Park has provided the public and scientific community with valuable information on the ecology of these species in this wilderness setting. A persistent decline within the wolf population led to a change in the direction of the research program and research methods used, leading to concerns about the impacts of the research efforts to the wilderness values in the Park. An expert panel review was used to review the issue and provide recommendations to Park management.

Isle Royale National Park is a wilderness archipelago in northwest Lake Superior, consisting of one large island surrounded by hundreds of smaller islands (fig. 1). The Park (or ìislandî) contains 224,500 ha, a mix of Lake Superior waters and a 52,400 ha land base. Much of the island wilderness lies under a mantle of boreal and northern hardwood forest. Due to the Parkís isolation, a distance of 24 km at the closest point across the cold waters of Lake Superior to Ontario or Minnesota, species numbers are significantly less than on the mainland. The Park has long been recognized as an outstanding natural laboratory because of this relatively simplified ecosystem and, in 1980, was designated as a U.S. Biosphere Reserve under the United Nations Man and the Biosphere Programme.

Approximately 98% of the land base was designated as wilderness in 1976 and later expanded to include 99% of the land base. Visitors come to the Park expecting to achieve a quality wilderness experience. Significant features of the Park wilderness include the gray wolf (*Canis lupus*) and moose (*Alces alces*) populations, which are the focus of a long-term research program that has provided over four decades of data for this predator-prey system. As changes have occurred within this system and research techniques have advanced, however, concerns have arisen over the appropriateness of the type of research being conducted within the Park wilderness, particularly in terms of the need to handle wolves.

The potential impact of the research methods on the wilderness values has confronted Park management for over a decade. The Park chose to seek the recommendations of an external, expert review panel to help resolve the issue of the appropriateness of the research program within the park wilderness. This paper summarizes the issues in the debate and the use of the expert review panel to address the issues.

Historical Context

Although wolves and moose are the dominant carnivore and herbivore in the terrestrial island ecosystem, there is no archeological evidence that either species was present prior to the 20th century (Clark 1995). Moose arrived at Isle Royale by approximately 1915, and ultimately replaced the caribou (*Rangifer tarandus*); the gray wolf arrived in the winter of 1948–1949, and eventually eliminated the coyote (*Canis latrans)* (Mech 1966*)*.

Wolf and Moose Populations on the Island

For the 35–40 years that moose were present on the island without a predator, at least one major population crash occurred in the moose population (1934), the result of severe overbrowsing of the limited food supply (Mech 1966). The

Figure 1—Isle Royale National Park, Michigan.

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gray wolf arrived in 1948 and inserted some influence over the moose population (Mech 1966; Peterson 1977). Both populations have varied dramatically since research began in 1958 (fig. 2). Moose population estimates during 1959-1988 were based on population reconstruction from recoveries of dead moose, whereas estimates from 1989-1999 are based on aerial surveys (Peterson and Page 1988; Peterson 1999a). Wolf population counts are total counts from aerial surveys.

The wolf population crashed from 50 to 14 animals between 1980 and 1982, which led to a major change in the dynamics of this predator-prey system. Low wolf numbers well into the 1990s allowed the moose population to grow significantly. This wolf crash also led to a change in the methods and direction of the research program, from a "hands-off" approach to one requiring the handling of animals. The handling of wolves generated information that in turn added new priorities to the type of information collected in the research program, by emphasizing the importance of genetic information. By the early 1990s, wolf extinction became accepted as a likely outcome, because of the highly inbred nature of the population and failure of the population to increase despite an apparently adequate food supply. However, increased pup production in the mid-1990s nudged the population into the mid-20s, comparable to its long-term average. The population stood at 25 animals by March 1999 (Peterson 1999a).

The moose population has experienced equally dramatic swings since the research program began, with a major crash during the severe winter of 1996. The population dropped from 2,500 to 500 animals then, largely due to a combination of starvation and parasites (Peterson 1999b). Since then the population has begun to slowly rebound and stood at 750 animals by March 1999.

Wolf Research Program on the Island

The formal wolf research program began in 1958 (Allen 1979; Mech 1966) and has continued with the aim of determining annual population numbers for both wolves and moose (Jordan and others 1967; Mech 1966; Peterson 1977; Peterson and Page 1988). A primary long-term objective has been to understand population regulation for wolves and moose in this insular ecosystem isolated from human-caused mortality. With the exception of a nonnative virus introduction into the wolf population around 1980, both populations have been free of virtually all direct human impacts (hunting, human-induced habitat changes, road/vehicle impacts). Since the research program began, all monitoring activities were done remotely, from aerial observation. No handling of the wolves was permitted because of the perceived wilderness value placed on maintaining an "untouched" wolf population. In the late 1980s, the value of the wolf population for gaining insights in conservation biology was heightened as the population dropped to 12 and remained low for several years.

The wolf population crash of 1980-82 and subsequent failure to rebound created concern about the future of the Park's wolf population. In 1988, at the request of the National Park Service (NPS), researchers initiated handling and radio-collaring of wolves in the Park for the first time, in order to determine individual causes of mortality. The findings added interest in the effects of disease and genetics on wolf population dynamics. The studies documented introduced disease (canine parvovirus) on the island during the 1980s, and the wolves were found to be highly inbred descendants of a single maternal ancestor (Wayne and others 1991; Lehman and others 1991; Peterson and others 1998).

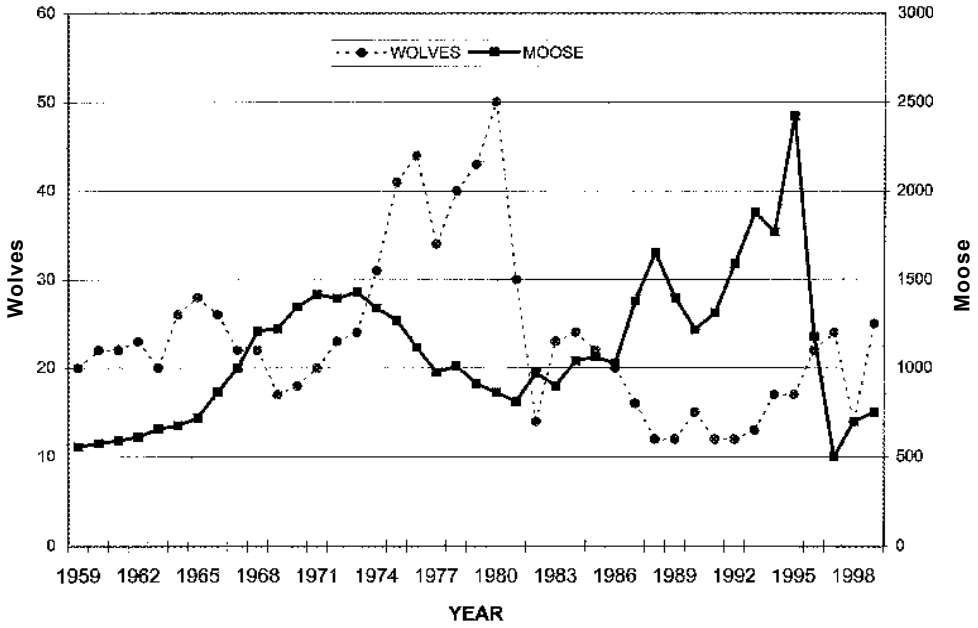

Figure 2—Wolf and moose populations, Isle Royale National Park, 1959–1999.

During 1988–1999, as many as six wolves were radio-collared at a single time, while the population fluctuated from 12 to 25. Seventeen wolves were handled and radio-collared from 1988–1999. Live-capture efforts were aimed initially (1988–1992) at as high a proportion of the population as possible (10 of the 12 wolves present in 1988 were live-captured for study). During 1993–1998, capture efforts were reduced to target no more than two wolves in each of the three packs on the island during this time.

Values Associated With the Wolf Research Program

The NPS recognizes several positive outcomes of the long-term wolf research program. Park management has made several substantive decisions based on the research findings and needs, including: 1) a complete Park closure to visitor use from November 1–April 14 of each year, largely to facilitate the research program and prevent harassment of the wildlife during winter recreational activity, 2) prohibition of overnight camping in approximately 50% of the Park to protect wolf denning sites and to keep visitors from coming into close contact with wolf pups, thus preventing habituation to humans, and 3) a prohibition of mammalian pets on the island to reduce disease introductions.

Other recognized values of the research program have included the wide dissemination of natural history information on the wolf and moose populations of the Park, particularly as it has described these populations in an environment free of human harassment and interference. An adoring global public now awaits the annual updates of these populations. Some information indicates that visitor sightings of wolves in the Park have increased in the last 30 years as research information has been communicated to the public (Vucetich and Vucetich 1999, unpublished data), perhaps the result of a public much more aware of these animals due to the research efforts.

Similarly, the long-term monitoring data have complemented the NPS mission of long-term protection of the Park resources by providing status and trends. Finally, 30 years of population data provided a compelling argument that significant change had occurred, and when wolf numbers dropped so low in the late 1980s more intensive investigation was warranted. This database enabled Park management and the research community to assess the need for intensive handling of the wolf population.

The Park recently completed a General Management Plan (USDI 1999), a planning effort to focus management direction for the next 15 to 20 years. That process included the identification of Park Significance statements (which describe the Park's *distinctiveness* on a national and international scale), and Park Purpose statements (which describe *why* Isle Royale was set aside as a national park). One of three Significance statements included the statement that "Isle Royale is world renowned for it's long-term wolf/moose predator/prey study. The park offers outstanding possibilities for research in a remote, relatively simple ecosystem where overt human influences are limited." One of five Park Purpose statements states the Park will "provide opportunities for scientific study of ecosystem components and processes, including human influences and use, and share the findings with the public."

Description of Study Area

Wilderness Values of the Park

The remote location and difficulty in accessing the island has protected Isle Royale from excessive development and recreational use. Park visitation in the 1990s ranged from 15,000 to 18,500 annually. Many of the recognized values of wilderness—opportunities for solitude, unconfined recreation, a landscape largely devoid of the human imprint—are found at Isle Royale. Recreational activities associated with wilderness, including backpacking, kayaking and canoeing, represent the largest user groups of the Park.

In the 1931 Senate report that recommended Isle Royale for national park status, NPS Director Horace Albright described Isle Royale as having "the appearance of being almost entirely in its primeval state," and later referenced the "wilderness character of the park." Noted wildlife biologist Adolph Murie, who spent time in the Park in the late 1920s studying the moose population, wrote of the need to minimize development within the new Park to protect its wild character, even to the point of recommending no trail development to avoid damaging the wilderness character of the island (Murie 1935). Park management ultimately ignored his recommendations in response to growing visitation, and today 165 miles of trail cross the island.

Isle Royale represents a wilderness landscape unique in North America. It is a landscape with no adjacent terrestrial land boundaries and thus avoids the conflicts of neighboring lands management practices, political considerations or immigration/emigration of wildlife, which often heightens the need for management of the wildlife resources. This isolation is a critically important distinction for this Park and its wildlife populations. It allows for consideration of a "hands-off" approach to wildlife management, wherein manipulation or intervention—even to the point of strictly non-intrusive research and observation—should be minimized to the greatest extent possible, based on concerns for wilderness values. It allows for consideration of protecting the wildlife populations to keep them completely untouched by humans, as a baseline of *wilderness* wildlife management at one end of the wildlife management spectrum.

Related to wilderness, the park's General Management Plan included one Park Purpose statement stating the need to "preserve and protect the park's wilderness character for use and enjoyment by present and future generations," and one Park Significance statement stating "this maritime park, a US biosphere, encompasses a remote and primitive wilderness archipelago isolated by the size and power of Lake Superior."

Clearly, from the early days of the Park through the present intensive planning activities by the NPS, "wilderness" has remained the unifying theme that captures the essence of these remote islands.

Potential Conflicts Between the Wolf Research Program and Wilderness Values of the Park

The decision to handle wolves for the first time in Park history in 1988 was a difficult one for the NPS. Advice was sought both internally within the NPS and from the research community. Besides being responsive to the "minimum tool" requirements for research actions within wilderness, both researchers and the Park recognized the near-mythical status of this population, due to its existence completely free from human harassment. As early as the 1960s popular magazine articles recounted the wolf and moose story on this "remote wilderness island" (Allen and Mech 1963). But as the wolf population decline persisted in the late 1980s, a peer-reviewed proposal in 1988 recommended the need to handle wolves on the island to assess the persistent wolf population decline and high mortality rate. The practice of handling wolves continued following a meeting of specialists that reviewed the first-year findings. During that period, no "end-date" for how long the handling was to continue was discussed; rather, most experts involved believed that answers to the questions of the wolf decline would be gained quickly and resolve the issue. Disease as a major factor in the Isle Royale wolf decline was eventually implicated in the persistent decline (Peterson and others 1998).

However, results of genetics and disease testing of these handled wolves led to a much broader understanding of issues related to wild canid populations. Indeed, it is now recognized that the wolves of Isle Royale provide an unprecedented opportunity to determine the significance of genetic losses for long-term viability in small, isolated populations, one of the major tenets of conservation biology.

As wolf handling continued, the need to consider the "minimum tool" requirement for the wolf research project, in terms of whether to continue to handle wolves or revert to strictly "hands-off" monitoring, continued to confront Park management in the 1990s. This debate is rooted in the wilderness management policies of the NPS (USDI 1988) and the NPS tradition of a "hands-off" wildlife management approach (Peterson 1999b). Concerns have been often voiced by NPS employees involved in wilderness management at Isle Royale and other wilderness areas, but also by wilderness philosophers (Turner 1997).

Methods

As the value of the research information increased, particularly in terms of tracking the genetic decay of this highly inbred population, it was suggested that an independent scientific panel be convened to assess the issue and recommend a course of action to the NPS. It was felt an outside panel could provide an objective and scientifically valid opinion on the merits of continued handling. The scientific review followed the suggestions outlined by Meffe and other (1998). The panel convened in April 1999, and consisted of three experts (two from the USGS Biological Resources Division, one from the Aldo Leopold Wilderness Research Institute), with participation from NPS employees and the principal investigator for the wolf research project (Dr. Rolf Peterson). Panel members were selected based on expertise in wolf research and wildlife management and/or familiarity with wilderness and wildlife management in the NPS.

The expert review panel was asked to review pertinent information on the Isle Royale wolf population and the wilderness values associated with the Park and provide a recommendation to Park management on the following issues:

> Given the past and current wolf population status in the park, anticipated future research needs, and the wilderness designation of the park, is it necessary to continue to livetrap and handle wolves on the Island? Or can the research/monitoring program return back to a "non-handling" monitoring? Have we answered the important questions through the handling of wolves over the past 10 years?

Results

Discussion Summary From the Expert Panel Review

The panel reviewed the relevant issue information and identified the advantages of handling wolves and of not handling wolves as a means to determine a recommendation. That information, with a recommendation, was submitted to Park management in a summary report (Isle Royale National Park 1999a), and is summarized as:

Gains of Handling Wolves—

- Handling wolves maintains the ability to monitor the genetic deterioration that may result from small population size and absence of immigration. Because the Isle Royale wolves are the smallest, most isolated population in the world (with the possible exception of a small Swedish population), they may be more prone to inbreeding depression and elevated extinction risk. Contrary to conventional belief in biological science that such populations will not persist, the Isle Royale wolf population has persisted for 50 years and thus provides a very valuable scientific experiment.
- Research information provides a higher quality level of natural history interpretation for visitors. There is significant public value to the island wolf/moose story.
- Handling wolves maintains the ability to test other research techniques for identifying individuals within the population (for example, using wolf scat DNA to identify individuals within the population, which has global applications for other isolated populations).
- Also maintained is the ability to track diseases in the population, including the types, effects, vectors and course of diseases; the relationship of disease to survival; and the detection of diseases and explanation of the effects.
- The ability to monitor survival and causes of wolf mortality (collaring is needed to locate dead wolves) is maintained, although such monitoring is limited by the small number of collared wolves and the ability to look for and study dead wolves only during certain seasons of the year.

Gains of Not Handling Wolves—

- Not handling wolves would contribute to maintaining the Park as pristine. This approach would preserve the mystique of wilderness and the "resource of wilderness" condition "untrammeled" by man called for in the Wilderness Act of 1964 (Public Law 88-577). As an isolated island, Isle Royale provides one of the best opportunities for an untouched wildlife population and contributes to a fuller continuum of wilderness conditions, particularly in terms of wildlife management in wilderness.
- The potential to avoid potential human-caused injury to animals from the livetrapping of wolves through modified leg-hold traps is removed.
- The potential to avoid potential alteration of wildlife behavior through the stress of handling is similarly removed, although there is no scientific evidence of such impacts on behavior.
- This approach preserves the possible scientific value of maintaining baseline conditions for an untouched population. This value is not identified currently, but not handling wolves now would preserve future options if such value is identified. The effects of handling would probably be reversible, as far as we know now.

Panel members noted they were not able to adequately articulate the intangible qualities of "wildness" that are highly valued by some members of the public. There was some interest in encouraging social research to pursue greater understanding of these values and to determine how widely they are held.

Possible Strategies Considered by the Expert Panel Review

From their discussions, the group identified the following possible strategies:

1) Continue collaring and testing a few wolves (two per year) as now. *This strategy was considered attractive by the panel because of the value and success of past research, but the low number of collared wolves limits data collection and research flexibility.*

2) Do no handling except under specified conditions (for example, a significant reduction in wolf numbers). *This strategy was rejected by the panel because it would result in the loss of information related to genetic decay tracking of the population and only an "after the fact" response to disease.*

3) Do no handling under any conditions. *The panel rejected this strategy because the science done with handling has had benefit, and because, in case of a population crash, managers and researchers would have no options for response.*

4) Increase amount of handling in order to improve data collecting (maintain two collared wolves per pack). *This strategy was attractive to the panel because of the tangible benefits of better data, but more handling could increase the risk of injury or mortality.*

5) Continue to handle wolves for a set time period, while looking for data collecting techniques that do not require handling. *This strategy would maintain the genetic data collection, but could help meet an eventual goal of phasing out handling.*

Recommendation of the Expert Panel

Following much discussion, the expert panel agreed on:

- Continue handling wolves for the next five years (2000-2004). Up to four wolves per year should be handled, not to exceed two collared wolves per pack, and no more than 12 wolves total over the five-year period (this is close to the capture rate during 1988-1993, but allows more flexibility each year). These numbers reflect the desire to maximize handling opportunities during livetrapping efforts, given the logistical difficulties of trapping operations in the Park, while still handling only the minimum number of animals necessary for information purposes.
- Over the five years, aggressively look for data gathering techniques that would not require handling, by challenging the NPS and the scientific community to develop and study these new techniques. There are promising techniques being tested elsewhere on other mammals, including the use of hair and fecal material to obtain genetics information. The NPS would have an opportunity to exhibit leadership in this area for wolves.
- If, within the five years, new techniques are found for acquiring genetic data without handling the wolves, convene a panel to evaluate whether disease and counting benefits are worth the continued handling of wolves.
- If no new techniques are found within the five years, convene a panel to reevaluate the handling issue.
- If a sudden population crash occurs, explore different strategies that may be needed to respond to the situation.

Discussion

Park management annually faced an uncomfortable issue of how to balance the research needs of a successful and publicly popular wolf research program with the need to consider the minimal research methods consistent with wilderness values. The use of an expert review panel provided the two parties closest to the issue—the NPS and the principal investigator—an opportunity to step away from the debate and obtain guidance relevant to the issue. Although, ultimately, the final decision on whether to continue wolf handling practices rests with Park management, the independent scientific review provided an unbiased recommendation for consideration.

In this case the review panel process was considered a valuable tool to aid Park management. Park management has largely adopted the panel's recommendations, with the exception of being unwilling to permit the live-capture of more than two wolves per year, reflecting a very conservative attitude intended to minimize possible injury to individual animals (Isle Royale National Park 1999b). The key information needs critical to the research program will remain obtainable.

The public attitude regarding the handling of wildlife with the Park wilderness was identified by the panel as a key information need. The lack of this information hampered the panel review of this issue. Informal discussion with some Park visitors in the summer of 1999 indicated that many visitors are willing to accept some impacts to their wilderness experience, such as seeing collared animals or knowing

wildlife is being handled, provided they are informed of the efforts and agree the research is necessary. However, many other visitors expressed concern regarding wildlife handling activities for the reasons of impacts on the wilderness values of the Park. The recommended public attitude research would more clearly identify how serious the wildlife handling issue is outside of the NPS agency.

For the near term at least, wolf handling will remain an important element of the wolf research program. Meanwhile, the challenge of balancing the wilderness values of a wild wolf population at Isle Royale with the agency and research needs will continue to provide a fascinating case history for review.

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