Northeastern Gray Wolf
Distinct Population Segment

By Certified Mail

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U. S. FISH AND WILDLIFE SERVICE
UNITED STATES DEPARTMENT OF THE INTERIOR

Defenders of Wildlife 1101 14th St. NW, Suite 1400 Washington, D.C. 20005 Tel: (202) 682-9400 and Sierra Club Legislative Office 408 C St., N.E. Washington, DC 20002 and RESTORE: The North Woods P.O. Box 1099 Concord, MA 01742 and The Wildlands Project P.O. Box 455 Richmond, VT 05477	)	Petition to list a distinct population segment of gray wolves (16 U.S.C. § 1533 and 5 U.S.C. § 553) generally recognized as the Northeastern United States

Submitted by,

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I. INTRODUCTION

Defenders of Wildlife, Sierra Club, RESTORE: The North Woods, and the Wildlands Project (Petitioners) hereby petition the U. S. Fish and Wildlife Service (FWS) to list a Distinct Population Segment (DPS) of wolves as endangered under the Endangered Species Act (ESA) (16 U.S.C. § 1533) and the Administrative Procedure Act (5 U.S.C. § 553). The DPS is defined in Section III but generally represents the northeastern United States. The gray wolf (*Canis lupus*) in the northeastern U.S. (Maine, Vermont, New York, New Hampshire) has recently been designated a part of the Eastern Gray Wolf DPS and is currently classified as threatened under the ESA (Fed. Reg. Vol. 68, No. 62, Tuesday, April 1, 2003, pp. 15804-15875). In addition, the FWS, in an advance notice of proposed rulemaking, has indicated its intent to delist the species and to forego an active recovery effort in this region (Fed. Reg. Vol. 68, No. 62, Tuesday, April 1, 2003, pp. 15876-15879).

In this petition, we will present several factors that establish the significance and discreteness of a Northeast population to the conservation of gray wolves in the lower 48 states. We will also present documentation of vast areas of suitable habitat and favorable conditions for the establishment of viable populations of wolves in this region. Recent studies indicate that suitable habitat and sufficient prey exist for wolves in New England, from northern Maine across northern New Hampshire and Vermont to Adirondack Park in New York (Mladenoff 1998, Wydeven et al. 1998, Harrison and Chapin 1997, Hosack 1996). These studies suggest that the Northeast could support at least 1,200 wolves and perhaps as many as

1,800. In the Northeast, the distance from extant wolf populations in the Great Lakes region, combined with anthropogenic and geographic barriers between the U.S. and Canadian wolf populations, preclude the reasonable expectation that wolves will naturally recolonize the region (Wydeven et al 1998, Harrison and Chapin 1997). It is to these areas that we wish to see active wolf recovery initiated by the U. S. Fish and Wildlife Service. Finally, we will show that a wolf population located in the northeastern U.S. would qualify as an endangered species under the ESA. We believe that the FWS is legally obligated to establish a Northeast DPS and to expeditiously complete and implement a recovery plan that addresses the entire geographic area encompassed by this proposed DPS.

A. The Petitioners

Defenders of Wildlife (Defenders) is a non-profit, science-based, conservation organization with more than 430,000 members and an extensive involvement in wolf restoration and protection in North America. For more than 30 years Defenders has been directly involved in making gray wolf recovery a reality in the lower 48 states. Our activities in this arena include:

- lobbying Congress and various administrations for wolf recovery actions and funding;
- litigating on behalf of wolves as well as intervening on behalf of the government to protect the Yellowstone and Mexican gray wolf recovery efforts;
- operating a privately funded wolf compensation trust in the northern Rockies and other regions since 1987;
- offering and paying rewards for information leading to the conviction of illegal wolf killers;

- working with current and potential cooperating tribes often providing technical training and funding for equipment or personnel;
- funding and training field staff to manage and protect wolves in recovery areas;
- sponsoring educational symposia and activities such as the annual North American Interagency Wolf Conference and Wolf Awareness Week to educate and organize wolf supporters and others;
- financing and participating in numerous scientific studies to gauge habitat suitability and public support for wolf recovery, documenting wolf-related ecological phenomenon, and testing the efficacy of many management approaches and techniques;
- providing emergency funding and staff during the government shutdown of 1996 to complete the second Yellowstone reintroduction; and
- providing support for captive breeding facilities.

In December 1999, Defenders published *Places for Wolves: A Blueprint for Restoration and Long-term Recovery in the Lower 48 States* (Ferris et al. 1999) as our formal and detailed response to early drafts of the FWS gray wolf reclassification proposal. This document, which was recognized as the Natural Resource Council of America's 1999 Conservation Publication of the Year, lays out our science-based vision for what federally-led wolf recovery should entail. The publication identifies several areas that offer outstanding opportunities for wolf recovery, including the northeastern United States. To help enable wolf recovery in this area, Defenders has agreed to extend The Bailey Wildlife Foundation Wolf Compensation Trust to this region until wolves no longer require federal protection. We have launched a national public

education and outreach program that includes traveling education booths, a wolf curriculum and a biennial international predator conference.

RESTORE: The North Woods (RESTORE) is a regional non-profit conservation group devoted to restoring and preserving wilderness and wildlife in the North Woods of New England. Their major programs include: (1) promoting grassroots efforts to restore imperiled wildlife species; (2) rallying public support and purchasing land to create a 3.2-million-acre Maine Woods National Park; and (3) inspiring a wilderness revival by raising awareness of and working to protect wild forests in New England.

Since the organization was founded in 1992, RESTORE has become a leading voice for endangered wildlife in this region. They were the first local organization to launch a campaign to restore the eastern wolf to the northeastern United States. They initiated a citizen petition to protect the Atlantic salmon, which led to a federal protection of the species as endangered. And, they are working with a national coalition of groups that used administrative and legal means to win Endangered Species Act protection for the Canada lynx. RESTORE is also spearheading efforts to protect core habitat for the full range of native wildlife. Toward this end, they have worked with a philanthropist to purchase and protect nearly 15,000 acres in the Maine Woods. RESTORE has more than 1,500 members, runs offices in Concord, Massachusetts and Hallowell, Maine and a seasonal Maine Woods Visitor Center in Bar Harbor, Maine, and employs seven staff members.

Sierra Club is the oldest and largest grassroots conservation organization in the United States with more than 700,000 members in all 50 States and Puerto Rico. The Sierra

Club works to explore, enjoy and protect the wild places of the Earth; practice and promote the responsible use of the Earth's ecosystems and resources; and educate and enlist humanity to protect and restore the quality of the natural and human environment.

The Wildlands Project is working to restore and protect the natural heritage of North America. Through advocacy, education, scientific consultation, and cooperation with many partners, they are designing and helping to create systems of interconnected wilderness areas that can sustain the diversity of life. Wild Earth—the quarterly publication of the Wildlands Project—inspires effective action for wild nature by communicating the latest thinking in conservation science, philosophy, policy, and activism, and serves as a forum for diverse views within the conservation movement.

B. Current Legal Status

Until recently, under provisions of the ESA (43 Fed. Reg. 9607-9615 March 9, 1978), all gray wolves south of the United States–Canada border (including Mexico) were listed as endangered, except in Minnesota (where they were listed as threatened) and in the three non-essential and experimental areas of Yellowstone, central Idaho, and Arizona. Since its initial listing, the gray wolf has made some progress in parts of its historical range. In July, 2000, the FWS proposed a reclassification of gray wolves under the ESA that would establish four Distinct Population Segments (DPSs) covering all or parts of 19 states and Mexico (65 Fed. Reg. 43450 - 43496, July 13, 2000). These proposed DPSs were: Western Gray Wolf DPS (threatened status: WA, OR, ID, MT, WY, UT, CO, northern NM, and northern AZ); Southwestern (Mexican) Gray Wolf

DPS: (endangered status: southern AZ, southern NM, west TX, Mexico); Western Great Lakes Gray Wolf DPS (threatened status, ND, SD, MN, WI, MI); and Northeastern Gray Wolf DPS (threatened status: NY, NH, ME, and VT).

On April 1, 2003, the FWS released its final rule on gray wolf reclassification, which differed substantially from the proposed rule. In the final rule, the FWS reclassified the gray wolf under three DPSs: the Eastern Gray Wolf DPS (Minnesota, Wisconsin, Michigan, North Dakota, South Dakota, Kansas, Nebraska, Iowa, Missouri, Illinois, Indiana, Ohio, Pennsylvania, New York, New Jersey, Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire and Maine); the Western Gray Wolf DPS (Montana, Idaho, Wyoming, Washington, Oregon, California, Nevada, northern Utah, and northern Colorado); and the Southwestern Gray Wolf DPS (Arizona, New Mexico, southern Colorado, southern Utah, western Oklahoma, western Texas, and Mexico). For the Eastern and Western Gray Wolf DPSs, the gray wolf has been downlisted to threatened, while in the Southwestern DPS, the classification remains endangered. Gray wolves lose all ESA protection in any state not included within one of these DPSs. On April 1, 2003, the FWS also published an advance notice of proposed rulemaking, announcing the agency's intent to propose delisting both the Eastern and Western Gray Wolf DPSs within the next two years. In effect, this means that when populations are reestablished in no more than 6 of the 48 conterminous United States, the gray wolf will lose all federal protections under the proposed plan (Fed. Reg. Vol. 68, No. 62, April 1, 2003, pp. 15804-15882).

The goal of endangered species protection is to recover endangered species. Before wolves in the lower 48 States can be considered recovered and then delisted, continued threats to and negative attitudes toward the wolf must be adequately addressed. The FWS decision to remove and reduce federal protections for the gray wolf will increase the probability of extinction for many existing small and isolated populations due primarily to the wolf's dispersal behavior. Regardless of the protection a wolf population has within the boundaries of a recovery zone, nature reserve, or park, wolves will disperse to new territories beyond reserve boundaries in search of prey and mates–areas where they will not receive adequate legal protection (Mladenoff et al. 1995, Gese and Mech 1991).

While many wildlife biologists and conservationists cautiously celebrate the success of the gray wolf in the northern Rocky Mountains and Great Lakes recovery areas, population sizes are still far from what they were prior to the twentieth century. In the lower 48 states, wolves currently occupy less than 2 percent of their historic range. For example, early estimates of the Yellowstone region wolf population exceed thirty-five thousand animals, while today, recovering populations number only a few hundred (Fischer 1995). In addition to the low numbers of wolves currently found throughout the species' former historical range, present-day wolves are separated by enormous distances and numerous anthropogenic barriers that impede natural dispersal and movement between populations (65 Fed. Reg. 43450 - 43496, July 13, 2000).

For recovery purposes, the FWS final rule combines the Northeast region with existing wolf populations in the Great Lakes, even though the two regions are geographically

disconnected. Since the FWS considers wolves to be sufficiently recovered in Minnesota, Wisconsin and Michigan, federal protection will be downgraded in all states within the proposed Eastern Gray Wolf DPS–despite the fact that wolves are absent from most states in this region. Further, wolf recovery in the states where wolves do currently exist, will continue to be hampered by curtailment of the species' range, negative human attitudes, and environmental stochastity. Because metapopulations, such as those of the gray wolf, are less likely to become extinct when there are more local populations established (Gotelli 1998), the FWS should promote recovery over a larger geographic area and strive to protect dispersing individuals recolonizing new areas. For these reasons, we propose to create a Northeastern Gray Wolf DPS.

C. DPS and ESA Criteria

Under the FWS DPS policy, 61 Fed. Reg. 4722-25 (Feb. 7, 1996), three elements are considered in a decision of whether to list a DPS as threatened or endangered under the ESA. First, the population must be discrete based on one of the following criteria: (1) the population is markedly separated from other populations of the same taxon, or (2) the population is delimited by international governmental boundaries. Second, a population's significance can be established based on the following factors: (1) persistence of the DPS in an ecological setting unusual or unique for the taxon, (2) evidence that loss of the DPS would result in a significant gap in the range of the taxon, (3) evidence that the DPS represents the only surviving natural occurrence of a taxon within its historic range, or (4) evidence that the discrete population segment differs markedly from other populations of the

species in its genetic characteristics. Lastly, if a population is determined to be both discrete and significant and therefore a "species" under the ESA, its status as endangered or threatened is then evaluated. The standard for listing species under the ESA is fairly straight forward, 16 U.S.C. § 1533 (a)(1); 50 C.F.R. § 424.11. The ESA requires the Secretary to determine, "solely on the basis of the best scientific and commercial data available..." whether a species is endangered or threatened based on any one or a combination of five factors: (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) the inadequacy of existing regulatory mechanisms; and (5) other natural or manmade factors affecting its continued existence.

D. Overview and Current Issues

Currently, the northeastern states are contained within an Eastern Gray Wolf DPS and are part of this region's recovery plan. In accordance with the *1992 Recovery Plan for the Eastern Timber Wolf* recovery criteria, at least two viable populations of wolves within the eastern range of the gray wolf must be re-established in order to proceed with any reclassification or de-listing objectives. The Petitioners believe that wolves present in Wisconsin and Michigan are too closely associated and geographically proximate to threatened wolf populations in Minnesota to be considered a separate and viable population. Although we support the down-listing of the gray wolf in portions of the Eastern Gray Wolf DPS (Wisconsin, Michigan), we cannot support expanding these criteria to states outside the realm of the current recovery area.

Inclusion of the northeastern states of Maine, New Hampshire, Vermont and New York in the delisting process without additional and site-specific recovery goals in these states is unacceptable.

Delisting of the Eastern Gray Wolf DPS without the creation of a separate Northeastern DPS would leave an area about 26 million acres devoid of wolves, a region that historically maintained healthy and viable wolf populations. Gray wolves are very unlikely to recolonize the region on their own because of the distance (about 500 miles) and the multiple anthropogenic barriers (highways, farmland, and urban development) between the northeastern states and existing wolf populations in the Great Lakes states. The northern boundary of the Northeast region is legally isolated along the international border with Ontario and Quebec, Canada. The closest significant wolf populations to the Northeast are found in Algonquin Park, Ontario and the Laurentides region in Quebec. The wolf populations in these regions of Canada are quite low at this time and are continually under pressure from lenient hunting and trapping regulations, so probably would not provide a source population for natural recolonization.

Delisting the Eastern Gray Wolf DPS would remove federal protection for gray wolves and give responsibility for their continued protection to the individual states included under that DPS region. None of the four northeastern states have any laws in place to protect wolves if federal ESA protections are lifted nor do any of these states have any management plans in place for wolves if they ever to return to the region. In Maine, eastern timber wolves (*Canis lupus lycaon*) are listed as a “Species of Special Concern” (Maine Dept. of Inland Fisheries and Wildlife, 2002) but have no designated state

endangered or threatened classification. In May, 2001, the Maine state legislature ruled that no reintroduction of gray wolves (*Canis lupus*) can take place without the consent of both houses of the legislature and the Commissioner of Inland Fisheries and Wildlife. It also declared that the U.S. Fish and Wildlife Service must allow the legislature to prohibit the reintroduction of wolves into Maine if it so decides (LD-736, Maine Legislature). In New Hampshire, legislators passed a bill in 1999 making it illegal to introduce any wolf populations to this state (HB 240 - New Hampshire Legislature). At the same time, the House issued a Joint Resolution asking the U.S. Fish and Wildlife Service to prohibit the reintroduction of wolves in the Northeast, including New Hampshire. The gray wolf is not protected by any New Hampshire state wildlife laws. In New York, the gray wolf is listed as a species that no longer occurs in a wild state within the State. There are no endangered or threatened designations for this species in New York. Two counties bordering Adirondack Park have banned the reintroduction of gray wolves within their boundaries. In Vermont, the gray wolf is not listed under the Vermont Endangered Species Law as endangered or threatened, nor is it listed as a rare or uncommon animal under the State Non-game and Natural Heritage Program. Several efforts have been made within the Vermont legislature to ban the reintroduction of wolves into this state, but no law has yet been passed. While these state laws are relatively meaningless because they would be superceded by federal authority, they nonetheless demonstrate the prevailing negative attitudes towards wolves by state officials.

Little can be done to significantly increase the amount of suitable habitat available for wolf recovery in the lower 48 states.

Consequently, the best that can be done for the wolf is to make the most use of what habitat remains. The only way to maximize the species' chances of long-term survival is to utilize remaining habitat to the extent possible to restore populations that can provide adequate representation, resiliency, and redundancy (Shaffer and Stein 2000). Representation refers to establishing populations across the full array of appropriate potential habitats. Resiliency refers to maintaining populations in each habitat at levels large enough to survive any negative consequences of demographic stochasticity and inbreeding. Redundancy refers to providing several populations in each habitat type as a hedge against extreme environmental events (Shaffer and Stein 2000). Wolf populations should be established in remaining habitat based on these principles in order to maximize the long-term viability of the gray wolf in the lower 48 states. In practice, the above would call for a minimum of two (preferably three or more) populations of not less than several hundred wolves in each ecologically or environmentally distinct area of its former range.

With the states showing no indication of restoring wolves, and considering the importance of the Northeast to overall wolf recovery, the only solution for recovery of a viable long-term population of gray wolves is through continued federal oversight including the establishment of a Northeastern Gray Wolf DPS. The FWS should develop a comprehensive recovery plan for this region and follow this action with whatever steps are deemed necessary to encourage the restoration of this species.

II. NATURAL HISTORY

A. Description of the Species

Physical description – Gray wolves are the largest member of the dog family *Canidae* (Mech 1970). Female average weight ranges from 80 - 85 lbs. and males average from 95 - 100 lbs. (Mech 1970), though considerable clinal variation in size and pelt color exists from the Arctic to central Mexico (Young and Goldman 1944). The heaviest recorded wolf was a 175- pound male from east-central Alaska, though males seldom exceed 120 lbs. and females are seldom over 100 lbs. (Mech 1970).

Pack Behavior – Wolves live, travel, and hunt in packs averaging four to seven animals, consisting of an alpha, or dominant pair, their pups, and several other subordinate or young animals. The alpha female and male are the pack leaders, tracking and hunting prey, choosing den sites, and establishing the pack's territory (Mech 1970). Wolves prey mainly on ungulates, such as deer, elk, moose, caribou, bison, bighorn sheep and muskoxen. They also eat smaller prey such as snowshoe hare, beaver, rabbits, opossums and rodents. Wolves will prey on livestock, although wild prey are their preferred food (Mech 1970).

Wolf pups romp and play fight with each other from a very young age. Scientists speculate that even these early encounters establish hierarchies that will help determine which members of the litter will grow up to be pack leaders. All adults share parental responsibilities for the pups. They feed the pups by regurgitating food for them from the time the pups are about four weeks old until they learn to hunt with the pack. Pups remain with their parents for at least their first year, while they learn to hunt. During their second year of life, when the parents are raising a new set of pups, young wolves can remain with the pack, or spend periods

of time on their own. Frequently, they return in autumn to spend their second winter with the pack (Mech 1970).

By the time wolves are two years old, they leave the pack permanently to find mates and territories of their own. Not all the pups in a litter live to the age of dispersal. Biologists have determined that only one or two of every five pups born live to the age of 10 months, and only about half of those remaining survive to the time when they would leave the pack and find their own mates. Adult wolves, on the other hand, have fairly high rates of survival. A seven year-old wolf is considered to be relatively old, and the maximum lifespan is about 16 years (Young and Goldman 1944).

Reproduction.– The alpha pair mate in January or February and give birth in spring, after a gestation period of about 65 days. Litters can contain from one to nine pups, but usually consist of around six. Pups have blue eyes at birth and weigh about one pound. Their eyes open when they are about two weeks old, and a week later begin to walk and explore the area around the den. Wolf pups grow rapidly, reaching 20 pounds at two months. A wolf pup is the same size as an adult by the time he or she is about a year old, and reaches reproductive maturity by about two years of age (Mech 1970).

Communication.– Wolves communicate through facial expressions and body postures, scent-marking, growls, barks, whimpers and howls. Howling can mean many things: a greeting, a rallying cry to gather the pack together or to get ready for a hunt, an advertisement of their presence to warn other wolves away from their territory, spontaneous play or bonding. Pups begin to howl at one month old. The howl of the wolf can be heard for up to six miles. When

wolves in a pack communicate with each other, they use their entire bodies: expressions of the eyes and mouth, set of the ears, tail, head, and hackles, and general body posture combine to express excitement, anxiety, aggression, or acquiescence. The wolf's acute hearing and exceptional sense of smell—up to 100 times more sensitive than that of humans—make them well-adapted to their surroundings and to finding food (Mech 1970).

Wolves wrestle, rub cheeks and noses, nip, nuzzle, and lick each other. They also leave "messages" for themselves and each other by urinating, defecating, or scratching the ground to leave scent marks. These marks can set the boundaries of territories, record trails, warn off other wolves, or help lone wolves find unoccupied territory. No one knows how wolves get all this information from smelling scent marks, but it is likely that wolves are very effective at distinguishing between many similar odors.

B. Taxonomy

Confusion and disagreement exist over the identity and taxonomy of the wolf that historically occupied the Northeast region of the United States (Fascione et al. 2001). Goldman (1937) classified the eastern timber wolf as *Canis lupus lycaon*, a smaller subspecies of gray wolf, and for years its historic range was thought to be the northeastern United States as far west as the Great Lakes states and north into southern Ontario and Quebec (Goldman 1944, FWS 1992, Nowak 1995). In 2001, Wilson et al., based on DNA analysis of several specimens, hypothesized that *C. l. lycaon* had a common origin with the red wolf (*Canis rufus*), a species whose historic range has long been considered to be the southeastern U.S. as far west as Texas and as far north as Pennsylvania (Nowak 1995). The ranges of

the eastern wolf and the red wolf would have originally overlapped in the mid-Atlantic states (Nowak 1995). The most recent morphological evidence, presented by Nowak (2002), speculates that *C. l. lycaon* might have resulted from the hybridization between *C. rufus* and *C. lupus nubilus*, the larger wolf that formerly inhabited the western U.S. and much of Canada. The regions in far northern Ontario contain predominantly western gray wolf, but the boundary between the eastern wolf and the western gray wolf is not well established (P. Wilson, personal communication).

To confound the issue, the eastern timber wolf has shown a tendency to hybridize with coyotes (*Canis latrans*) (Wilson et al. 2000). Coyotes were historically absent from the East but moved in from the West by the 1930s (Parker 1995). Genetic testing of the relatively large coyotes from the Adirondack Park and central New York indicates a history of interbreeding with wolves. The degree of wolf genetic material varies across these samples, with some being more "wolf-like" than others (Chambers 2000). Genetic testing on northern New England coyotes shows interbreeding as well, though more sampling is needed (Fascione et al. 2001). In the Frontenac Axis region, southeast of Algonquin Park, a slightly larger canid commonly called the "Tweed wolf," is probably a hybrid containing more wolf genes than coyote genes (Edwins et al. 2000). A coyote-wolf mix is commonly found west of Algonquin Park (Wilson et al. 2000). The result is a canid genetic gradient in the northeastern U.S. and southeastern Canada, with a mix of eastern timber wolf, western gray wolf and coyote genes (Fascione et al. 2001).

Given the radical changes that have occurred in the Northeast ecosystem since colonial times, and the lack of remaining physical

evidence of the presence of wolves, it is difficult to determine which species may have been present historically. For now, scientists can only speculate, but it is generally accepted that the northeastern U.S. was primarily a moose-caribou ecosystem before European settlement (D. Harrison, personal communication). It is questionable whether the deer-adapted eastern timber wolf would have thrived in this environment, indicating that perhaps both canids— the larger gray wolf and the smaller eastern wolf—might have inhabited the northeast at various points (P. Wilson, personal communication).

Because of the fluid nature of gray wolf taxonomy and the FWS's goal to afford protection to all gray wolves south of the U.S.-Canada border, the FWS listed all gray wolves as threatened (Minnesota) or endangered (remaining 47 contiguous states and Mexico) at the species (*Canis lupus*) level in 1978 (43 Fed. Reg. 9607-9615, March 9, 1978). In its 2000 proposal to reclassify gray wolves by DPSs, the FWS states: "We recognize that gray wolf taxonomy at the subspecies level is subject to conflicting opinions and continuing modification. For this reason, we will not base our gray wolf recovery efforts on any particular portrayal of gray wolf subspeciation. Instead we have identified geographic areas where wolf recovery is occurring or is feasible, and we will focus recovery efforts on those geographic entities, regardless of the subspecific affiliation of current or historical gray wolves in those areas." The FWS also states that "it is likely that a separate form of the gray wolf historically occupied the northeastern United States and adjacent Canada. Establishing a Northeastern DPS maximizes the ability of the Service, States, and Tribes to reestablish this form, or its current-day equivalent. The wolves in

Canada...are thought to be taxonomically and genetically similar to the wolves that once populated the northeastern United States," 65 Fed. Reg. 43451-43452 (July 13, 2000). Any wolf restoration in the Northeast would have to include a detailed analysis of the best source population as part of the recovery process.

C. Historical Distribution in the Northeast

The historic range of the eastern wolf, one of the smallest subspecies of *Canis lupus*, once extended throughout the entire northeastern United States, from Hudson Bay to northern Florida and west into Minnesota (Mech 1970). As European settlers first arrived and began to "tame" the forests of the Northeast by cutting, burning and plowing, the persecution of wolves was set into motion (McKibben 2000). Beginning in 1630 in the Massachusetts Bay Colony, a system of government-sponsored wolf bounty payments was developed, which pervasively spread throughout the Northeast, until all of these large predators had been exterminated. The last report of a wolf in Maine was approximately 1880 (Maine Dept. of Inland Fisheries and Wildlife) and the last known northeastern wolf was killed in upstate New York in 1897 (Fascione et al. 2000).

Today, the eastern wolf can only be found in parts of Quebec, Ontario, and the Great Lakes states (Mech 1970). A few observations of wolves or wolf-like animals have been made in recent years throughout the Northeast, including Vermont, New York and Maine, but most of these reports are anecdotal and have not been readily verified. Recently, a large canid was killed in northern New York and initial DNA testing indicates that the animal was a wolf and might have originated in the Great

Lakes region (Inslerman, pers. comm) A wolf killed by a Quebec trapper in 2001, was apparently traveling with a few other wolves just north of the Maine-Canada border (Associated Press, 2002). In Maine, there have been several reported sightings of large canids (Smith, personal communication), indicating the possibility that wolves might be present in this state. A large female wolf was shot in 1993, although physical and behavioral evidence suggested the animal had a history of captivity. In 1996, an 86-pound canid was captured; genetic testing proved inconclusive (Fascione et al. 2000, Maine Dept. of Inland Fisheries and Wildlife). No evidence has yet been found of an established wolf population in Maine or elsewhere in the Northeast. Indeed, several studies have indicated that the barriers a wolf would have to cross to establish a population in the Northeast are almost insurmountable (Harrison and Chapin 1997). For the few individuals that might actually make it across the border, the result would likely be either persecution by humans or genetic swamping with the larger eastern coyote (Wydeven et al. 1998.)

III. WOLF ECOLOGY

A. The Role of the Wolf as a Top Carnivore

Energy transfer between trophic levels.–The gray wolf, along with other top predators such as the bear, cougar, and coyote, help regulate prey populations such that a landscape may support multiple trophic levels in a healthy ecosystem. When populations of large herbivores are kept in check by predators, the amount of primary production available to smaller animals increases, allowing for increased biodiversity. A basic principle of ecology

states that only ten percent of the vegetable or prey's biomass is retained in the biomass of the grazer or predator, respectively. For example, only one tenth of the vegetation consumed by an ungulate in a year will be assimilated into the molecular building blocks of the ungulate itself. The other ninety percent is converted into energy used for metabolic processes and is eventually lost to the environment. Large browsing herbivores such as deer and elk require a great quantity of woody stems, herbaceous plants and lichens to fuel their metabolisms and to reproduce. Left uncontrolled, large herbivores that require such a large amount of primary productivity to survive will deplete a landscape of its primary productivity. Without predators to regulate the number of ungulates, ecosystems are simplified. Ungulate population explosions simplify the food web and ultimately reduce biodiversity. (Terbough et al. 1999).

Mesopredator release.– Another harmful ecological effect of removing wolves from an ecosystem is the expanded niche for mesopredators such as the coyote, raccoon and fox. Mesopredator release can be responsible for decreased biodiversity because mesopredators tend to prey heavily on a wide variety of smaller animals, including songbirds. Coyotes and other mesopredators are generalists and can survive after they deplete a preferred food source. Normally, when wolves are present, coyote populations are suppressed by territorial aggression and by predation (Crabtree and Sheldon 1999), relieving small mammals and birds from the risk of coyote predation (Fischer 1998, Wilkenson 1997). Additionally, wolves increase the amount of carrion available in an ecosystem, potentially benefiting scavenger species such as bear, foxes, weasels, and raptors.

Availability of carrion may increase biodiversity, as it provides an alternate food source for generalist mesopredators (Crabtree and Sheldon 1999).

Regulation of prey genetic health.– In addition to the role carnivores play in increasing biodiversity, they also improve the gene pool of their prey species over time by culling genetically inferior individuals. The gray wolf, in particular, exerts this positive force on the prey gene pool, as it often chases after a herd of ungulates until a slower animal is left behind. This "coursing" technique may more effectively reduce the chance of a genetically weak animal from reproducing than other hunting strategies (Mech 1970). A cougar, by contrast, will usually hide in a hunting bed until its prey comes within springing distance. The prey in this case is almost as likely to be healthy as it is to be weak. Because all carnivores occupy a distinct niche in an ecosystem and employ different hunting strategies, they play a unique role in the management of the lower trophic levels. The wolf, however, may have a more direct effect on prey gene flow than other carnivores.

Wolf behavior and population dynamics.– Wolves hunt, live, and travel in packs averaging four to seven animals consisting of an alpha, or dominant pair, their pups, and several other subordinate or young animals. The alpha male and female are the pack leaders, whose role it is to track and hunt prey, choose den sites and to establish the pack's territory (Mech 1970). Wolves prey primarily on ungulates such as deer, elk, moose, caribou, bison, bighorn sheep, and muskoxen depending on the distribution of these prey species. They also eat smaller prey such as lagomorphs, beaver, opossums,

and rodents. Wolves will take livestock, though wild prey is their preferred food (Mech 1970). Pups will remain with their parents for at least their first year while they learn to hunt. During the second year when parents may be raising a new set of pups, young wolves can remain with the pack or spend time on their own, frequently returning in autumn to spend their second winter with the pack. Biologists have determined that only one or two of every five pups born live to the age of ten months, and only about half of those survive to the age of dispersal (Young and Goldman 1944).

By the time wolves are two years old, young wolves leave the pack permanently to find mates and territories of their own. Because dispersal is an important stage in wolf development, wolf populations can be viewed as a dynamic mosaic of populations or a metapopulation (65 Fed. Reg). Metapopulations are simply a group of smaller populations linked by immigration and emigration (Levins 1970). The basic structure of wolf populations at small and large scales allows wolves to be described in this way. On a small scale, wolves travel in family units, but depend on dispersal to find mates and new territories. On a large scale, especially in the Northern Rocky Mountain recovery areas, wolves disperse from one population center to another, and wildlife officials expect individuals will interbreed with members of populations in distant areas (65 Fed Reg).

B. Ecological Importance of Dispersal and Management Considerations

Gray wolf dispersal.– Dispersal is a fundamental aspect of wolf ecology that should be addressed when designing wildlife reserves or planning for wolf management. Pups remain with their parents for at least

their first year while they are learning to hunt and then both sexes disperse with the same frequency (Gese and Mech 1991). During the second year when parents may be raising a new litter of pups, young wolves can remain with the pack or spend time on their own making predispersal forays (Gese and Mech 1991), frequently returning in autumn to spend their second winter with the pack. Adults disperse as well as yearlings and pups, but not with the same frequency. When they do disperse, they are often more successful than younger wolves in finding vacant territory within a shorter distance of their natal territory (Gese and Mech 1991). Some researchers estimate that a wolf can run as fast as 40 miles an hour. Wolves have been known to travel 120 miles in a day, but they usually travel an average of 10 to 15 miles a day (Mech 1970). Wolf dispersal rate (and overall wolf abundance) is negatively correlated to prey abundance (Fuller 1989, Gese and Mech 1991, Messier 1985, Ballard et al. 1987, Peterson and Page 1988, Hayes and Harestad 2000). The number of wolves within a region can be estimated by finding the number of prey in the area, according to the prey biomass: wolf index developed by Fuller (1989) and tested by other studies (Hayes and Harestad 2000).

Movements and population fluctuations of prey are the major causes of wolf dispersal and the determining factors determining dispersal distance. Even when prey density is adequate, however, most wolves disperse from their natal pack territories as pups or yearlings (Gese and Mech 1991). Factors other than prey density that can influence dispersal are social strife within a pack and the unavailability of genetically unrelated mates. The search for mates may be one of the most important reasons for dispersal because wolves avoid inbreeding to the

point where they will not breed if they cannot locate a mate from a sufficiently distant pack. For this reason the number of packs occupying an area partially determines dispersal distance and dispersal success. If there are very few packs in an area, a dispersing wolf might not be able to locate a mate that is genetically unrelated, and therefore may have to disperse long distances to find a suitable mate.

Landscape characteristics of dispersal paths.– Because of this close relationship between wolves and their prey, designing wildlife reserves for wolves is difficult. Ungulates, the most common prey species for wolves (Mladenoff et al. 1995), are often more dense at the edges of wilderness areas than they are within the boundaries of preserves because disturbed areas usually provide more browse. Although they may have habitat preferences when prey density is high and they are able to select certain habitat characteristics over others, wolves are not specific to any one particular habitat type and are able to survive in almost any type of landscape as long as there is adequate prey and contact with humans is minimal.

Dispersal mortality.– Because wolves will stray beyond the boundaries of protected habitat if their prey moves to other areas, and because prey species such as deer often move across the landscape seasonally, wolves can be expected to travel seasonally as well. As wolves follow their prey into disturbed areas where deer are able to find more browse and cover from winter conditions, they may be moving toward human population centers (Haight et al. 1998). This behavior poses a severe threat to individual wolves and to overall population numbers within protected areas.

Dispersal mortality greatly affects overall population size and probability of local extinction (Fritts and Carbyn 1995). If wolves within protected areas must stray into agricultural or semi-rural regions in order to find prey, they may not survive long enough to return when prey moves once again into protected wolf habitat.

If human threats to wolves were limited by federal protection, dispersal patterns of wolves would not be such a danger to overall populations. However, wolves are often extremely vulnerable to human-caused mortality because they are able to adapt to almost any type of environment, including areas with relatively high human populations. A dispersing wolf may encounter many dangers it had not been exposed to while living within a protected habitat. One of the biggest threats to a dispersing wolf may be human-caused mortality in the form of illegal taking and legal depredation control measures (Mladenoff et al. 1995, Mech 1970, Fuller 1989).

Because wolves are able to adapt to almost any type of environment, including areas with relatively high human populations, wolves dispersing out of protected reserves will likely encounter humans if they do not quickly settle. Mortality caused by humans includes accidental killing by motor vehicles, legal depredation control measures, and illegal takings. Dispersal mortality greatly affects overall population stability, especially if there are few immigrants into the population and if the initial population size is small (Haight et al. 1998). Furthermore, dispersal has been found to be a key factor limiting population growth (Hayes and Harestad 2000).

As wolves recover within the protected boundaries of Yellowstone National Park, individual wolves dispersing into

agricultural areas are exposed to increased threats posed by humans. Increased wolf mortality during and after wolf recovery programs illustrates that the greatest number of human-caused mortalities occurs at or near the boundaries of protected reserves where wolves disperse into more fragmented habitat (Hayes 2001, Mladenoff et al. 1995). One reason for this trend is that the present reserves in the Midwest and in the northern Rockies are in close proximity to, if not completely surrounded by, agricultural land. Human attitudes of those surrounding the protected wolf habitat can determine whether or not wolves will successfully disperse (Fritts and Carbyn 1995). Whereas the reserve boundary areas adjacent to agricultural land might actually represent some of the most favorable habitat for wolves due to the presence of foraging ungulates at field edges, it also introduces wolves to another, more dangerous type of prey: domestic livestock. Cattle ranching and dairy farming puts pressure on wolf populations, especially if there are mosaics of forest interlaced with ranching and farm lands because wolves are enticed to explore further away from their natal territories when dispersing (Fritts and Carbyn 1995).

Human actions account for approximately 80-90 percent of all wolf mortalities (Weaver 2001). Between 1995 and July of 2002, 64 of the 118 known wolf mortalities within the Yellowstone wolf population were confirmed to be human-caused, three were unknown and the remainder were natural deaths. Illegal shooting or poisoning was responsible for 10 deaths, legal control claimed 37 wolves, road kills caused another 12 deaths and five of the remaining losses were human-related (Maughan 2002). Similarly, when wolf populations increased in Minnesota between the years of 1988 and 1993, the number of wolves killed through

government-sponsored programs for depredation control increased by 223 percent (Mech 1995).

Dispersal distance.– The risk of mortality during dispersal increases as dispersal distance increases. There is much variability in wolf dispersal distances. While some wolves travel very short distances before settling, most wolves seem to travel several hundred kilometers before finding suitable vacant territory (Gese and Mech 1991, Wabakken et al. 2001). Wolves are capable of dispersing hundreds of miles, with the longest known dispersal exceeding 550 miles (Fritts 1983). Gese and Mech (1991) found that the mean dispersal distance for 316 dispersing gray wolves was 47.8 miles, with a range of 5-220 miles. Dispersal distance is important to the survival probability of a wolf population because individual wolves have a greater chance of survival if their dispersal distance is short (Weaver 2001). Long dispersal distances increase the risk of mortality due to conflicts with humans or starvation and reduce the chance that a disperser will settle and find a mate.

The factors that initiate dispersal are the same that ultimately determine the distance a wolf will disperse: social interactions between wolves, availability of mates, spatial distribution of available territories, and prey density (Gese and Mech 1991, Hayes and Harestad 2000, Fuller 1989). If conditions are favorable, a dispersing wolf may only need to travel to nearby areas to successfully establish a new territory. However, if a wolf travels through areas with low prey abundance and few potential mates, it will search much longer before locating food and a mate, becoming increasingly vulnerable to human-caused or natural mortality (Gese and Mech 1991,

Fritts and Carbyn 1995, Mladenoff et al. 1995 Mech 1995, Fuller 1989).

C. Minimum Viable Population Size

Although there is some debate over what the minimum viable population size is for gray wolves and how much gene flow through immigration is required to maintain genetic diversity, most wildlife ecologists agree that the probability of population extinction is high when the number of individuals is low (Franklin 1980, Thomas 1990, Wabakken et al. 2001). Minimum viable population is defined as the number of individuals necessary to insure the population's survival and genetic diversity over a specified time period, regardless of harsh environmental conditions, fluctuating prey base, succession of forest plant species, and dispersal (Fritts and Carbyn 1995).

If a population of wolves is isolated without frequent genetic exchange with immigrating wolves, an ideal population size should be anywhere from several hundred to two thousand individuals (Franklin 1980, Wabakken et al. 2001, Lande and Barrowclough 1987, Soule 1980, Thomas 1990). Five to six hundred individuals, or approximately 100 breeding pairs, may be sufficient to maintain genetic diversity within a population closed to immigration (Wabakken et al. 2001, Soule 1980, Fritts and Carbyn 1995), but dispersal and environmental stochastity may strain a population of this small size (Franklin 1980, Thomas 1990).

For a relatively small population of 280 to 300 wolves in Italy, which is approximately the same size of that in the northern Rockies, population viability analysis showed that populations of this size are vulnerable to extinction if there are any dramatic changes in percent adult mortality. If adult mortality increased beyond 10

percent, the model showed that the population would likely become extinct within 60 to 100 years (Ciucci and Boitani 1991). Small populations that barely meet the minimum viable population requirements such as the Italian population and that of the northern Rockies are more vulnerable to extinction when the mortality rate increases even by a small amount (Wabakken et al. 2001). Also, these small populations may experience inbreeding pressure, as there is probably a significant decline in genetic variability over time (Wabakken et al. 2001).

IV. NORTHEASTERN GRAY WOLF DPS PETITION PROPOSAL

A. Distinct Population Segments under the Endangered Species Act

Discreteness and significance.–Individual populations of a species should be managed separately if there is sufficient reason to believe that there are factors threatening their persistence, according to the FWS DPS policy (61 Fed. Reg. 4722-25 Feb. 7 1996). To be designated as a DPS, a population must be discrete based on the fact that the population is markedly separated from other populations of the same taxon, or it is delimited by international or governmental boundaries. If a population is determined to be discrete, then it must meet one or any combination of the following factors to prove that it is significant to the overall taxon: 1) the species is persisting in an ecological setting that is unusual or unique for its taxon, 2) there is evidence that loss of the particular population would result in a significant gap in the range of the taxon, 3) there is evidence that the population represents the only surviving natural occurrence of a taxon within its historic range, and 4) there is evidence that the population differs markedly from other populations of its species in its genetic characteristics.

Determination of federal protections.– If a population is determined to be discrete and significant based on these criteria, the Secretary will then determine the level of Federal protections given to the Distinct Population Segment. Congress then can give a mandate to the FWS to develop recovery plans where appropriate and where chance of success is high. Recovery efforts should give priority to areas with adequate resources. The Endangered Species Act requires the Secretary of the Interior to

determine if a species should be listed as endangered or threatened according to whether they meet one or any combination of the following five criteria (16 U.S.C.§1533 (a) (1); 50 C.F.R. § 424.11): 1) there is present or threatened destruction, modification, or curtailment of its habitat or range, 2) the species is over-utilized for commercial, recreational, scientific, or educational purposes, 3) the species is greatly threatened by disease or predation, 4) existing regulatory mechanisms are inadequate, and 5) other natural or manmade factors are affecting its continued existence.

B. DPS Boundaries and Habitat Description

To build a landscape scale metapopulation it is necessary to manage each distinct subpopulation separately because of the differences in regional landscape attributes such as local climate, geology, and prey base. Therefore, the northeastern United States and the few wolves that may inhabit this vast and favorable habitat should be designated as a DPS under the ESA. The region that should be defined by the Northeastern Gray Wolf DPS includes the states of Maine, New Hampshire, New York and Vermont. Several areas of core habitat, containing few roads and low human population density are located within the proposed DPS (Mladenoff and Sickley 1998, Harrison and Chapin 1997).

The Northeastern DPS, encompasses an area know as the Northern Forest, a 26 million acre tract of land, comprised of remote, pristine lakes, rugged mountain ranges, and the headwaters of a few large eastern rivers. This region stretches from Maine's St. Croix River westward through the White Mountains of New Hampshire, the Green Mountains of Vermont and into New York's Adirondack Mountains.

Maine, the largest of the New England states, stretches from the Atlantic Ocean in the east to Canada in the north and New Hampshire to the west and south, and is approximately 89 percent forested. Most of the topography is relatively flat with a mean elevation of 600 feet, although Baxter State Park hosts one of the highest points in the region, 5268-foot Mt. Katahdin. Maine can be divided into three major geographical areas: the coastal lowlands, an area characterized by sandy beaches, small inlets, salt marshes and tidal creeks; the eastern New England uplands, a region that rises from sea level to about 2000 feet in the west and is marked by lakes, fast streams, and fertile soil; and the White Mountains, an extension of New Hampshire's range that cover a portion of northwestern Maine. The Allagash Wilderness Waterway stretches along a 92-mile corridor of lakes and rivers and connects several large public reserved land units in northern Maine.

New Hampshire, one of the smallest states in the U.S., features rugged mountains, clear lakes, and a sandy coastline. With an mean elevation of 1000 feet, this state is bordered by Vermont on the west, the Atlantic Ocean and Maine on the east, Canada to the north and Massachusetts on the south. Like Maine, New Hampshire is influenced by three main geographic areas: the Coastal Lowlands, which characterize the southeastern section of the state and extend from 15 to 20 miles inland; the Eastern New England Upland, a region comprised of the fertile and hilly Merrimack River Valley, the Hills and Lakes region that includes most of the state's major lakes, including the largest, Lake Winnipesaukee, and the Connecticut River Valley, a region comprised of fertile farmland and hardwood forests; and the White Mountain Region, which covers the northern portion of the state and includes

rugged mountains, narrow valleys and the White Mountain National Forest. Mount Washington, part of the Presidential Range and the highest point in New England, is 6,288 feet high and home to some of the worst weather in the world.

Vermont, the Green Mountain State, is known for its fertile valleys and picturesque mountain ranges. Bordered by Canada on the north, New York to the west, New Hampshire to the east and Massachusetts to the south, Vermont has an average elevation of 1000 feet and is approximately 80 percent forested. The Green Mountains, an important source of minerals such as granite and marble, cover most of central Vermont, and are home to the highest peaks in the state and to the Green Mountain National Forest. The northern region of the state is known as the northeast highlands, a region that is characterized by granite mountains that reach heights of 2,700 to 3,330 feet and are divided by swift flowing streams. Lake Champlain comprises much of the northeastern part of the state and the lowland areas surrounding the lake are dominated by fertile agricultural lands. In southern Vermont, the Taconic Mountain range stretches in to Massachusetts and is a region of rolling hills, lakes and streams. Most of eastern Vermont is covered by the western New England upland, a geographic land area that is covered by the fertile lowlands of the Connecticut River Valley and populated with many lakes in the north.

New York, the largest of the proposed DPS states, has the most diverse geography. Bordered by two of the Great Lakes to the north and west, by Canada to the north and the Atlantic Ocean to the east, New York's topography averages approximately 1000 feet in elevation. In the northern part of the state, between Lake Champlain and Lake Ontario, stand the highest and most rugged

mountains in the state, the Adirondack Mountains, that are part of the 6.1 million acre Adirondack State Park. Mt. Marcy, located in the High Peaks region, has an elevation of 5,344 feet. South of the Adirondack mountains, lies the Hudson-Mohawk lowlands and in the southeast, is the Atlantic coastal plain. In the western part of the state, west of the Hudson River, are the Appalachian Highlands, which include the Catskill Mountains and the Finger Lakes region. The St. Lawrence-Champlain lowlands can be found on the shores of Lake Ontario and running northeast along the St. Lawrence River and the Canadian border.

Two distinct forest community types are represented within the DPS region (Marchand 1987, Kricher 1998, Thompson and Sorenson 2000). The Northern hardwood forest, generally present at elevations less than 3000 feet, is dominated by yellow birch (*Betula lutea*), sugar maple (*Acer saccharum*) and American beech (*Fagus grandifolia*) with a well-developed understory of striped maple (*Acer pennsylvanicum*) and Hobble bush (*Viburnum alnifolium*), including many wildflower and fern species. Eastern hemlock (*Tsuga canadensis*) and white pine (*Pinus strobus*) can also be found in abundance within this community type. The northernmost part of the DPS is included within a Boreal Forest community type, generally found above 3000' elevations. This area is characterized by large tracts of balsam fir (*Abies balsamea*) and white spruce (*Picea glauca*) intermingled with species such as paper birch (*Betula papyrifera*) and aspen (*Populus spp.*). The soil is in this community type is highly acidic and winters are usually prolonged with extended snow cover. In the ecotone where the boreal forest meets the northern

hardwood forest, there is considerable species overlap although this region is generally characterized by spruce-fir-northern hardwood associations (Thompson and Sorenson 2000). At higher elevations, above timberline, the "krummholz"natural community consists of gnarled and stunted trees that manage to survive the harsh winter elements on the exposed mountainsides (Marchand 1987).

C. Suitability of the Northeast for Gray Wolf Restoration

Land availability.– Studies have demonstrated that significant areas of potential gray wolf habitat exist throughout the proposed Northeast DPS region (Mladenoff and Sickley 1998, Wydeven et al. 1998, Harrison and Chapin 1997, Hosack 1996.) Harrison and Chapin (1997) estimated that as much as 78,000 km^2 could potentially be used as core and dispersal habitat for gray wolves, with the majority of this habitat, almost 69,000 km^2, contained within Maine and New York. In the *1992 Eastern Timber Wolf Recovery Plan*, the FWS proposed three areas for potential wolf recovery in the Northeast: Adirondack Park, approximately 11,300 square miles in northwestern Maine and northern New Hampshire, and a portion of eastern Maine consisting of approximately 2,500 square miles. Potential wolf habitat in the Northeast is contiguous throughout Maine, northern New Hampshire and northern Vermont, however, habitat in the Adirondack Mountain region is relatively isolated (Mladenoff and Sickley 1998, Harrison and Chapin 1997.) While much of the potential habitat in the Northeast is under either state or private ownership, most of it is uninhabited and relatively inaccessible.

Road density.–Another benefit of this region as favorable wolf habitat is that roads are relatively sparse over most of the terrain. Of the potential suitable habitat areas identified in several studies on northeast wolf restoration, 84 percent of the total area was identified as core habitat with road densities of less than 0.7 km of roads/km^2 passable by 2-wheel-drive vehicles and less than 4 human residents/km^2. Sixteen percent of the potential habitat was identified as suitable wolf dispersal habitat with similar road density criteria and less than 10 human residents/km^2 (Harrison and Chapin 1997, Mladenoff and Sickley 1998).

Prey base.–Wolves rely primarily on ungulates for food and to a lesser degree, beaver and snowshoe hare (Paquet et al. 1999). Ungulate populations in the northeastern states fluctuate depending on winter severity, harvest levels, disease, and predation. In Maine, the white-tail deer population has increased to 255,000 wintering deer with deer abundance ranges from 2 to 5 deer/mile^2 in the north to 15 to 25 deer/mile^2 in central and southern areas. Some locations, in which access to recreational deer hunters has been limited or denied entirely, support deer populations of 40 to 100 deer/mile^2 (Maine Dept. of Inland Fisheries and Wildlife). In the Adirondack Mountains of New York, deer densities range from 2-3/km^2 and in the White Mountains of New Hampshire, from 3-4/km^2 (Mladenoff and Sickley 1998). Moose populations in the Northeast were very low in the late 1800's to early 1900's due to unregulated hunting. Since the 1970's, moose populations have been increasing steadily in all the northeastern states. From a low of 2,000 in the early 1900's, Maine's moose population is currently estimated at 29,000. Moose are

beginning to re-colonize the Adirondack region in New York State, and New Hampshire estimates its moose population at 9,600 individuals. Overall, population estimates indicate that moose densities are 0.1-0.5/km^2 in New England (Wydeven et al. 1998).

Recent studies have documented that the proposed recovery areas in the Northeast could support a minimum of 1,200 wolves and up to 1,800 wolves, based primarily on prey density levels (Harrison and Chapin 1997, Mladenoff and Sickley 1998). With the current prey biomass, the potential wolf recovery areas could support wolf densities of 10 or fewer wolves/km^2 (Wydeven et al. 1998).

Human Attitudes.– A review by Williams et al. (2002) of quantitative surveys conducted in the past thirty years on public attitudes towards wolves reported that 60 percent supported wolf restoration. Another review by Buckley (2000) clearly shows a national trend of growing support for restoration of viable wolf populations. Specific to the Northeast, a December 2002 opinion poll conducted for the Henry P. Kendall Foundation found that 63 percent of northern New England residents believe it is important to reintroduce the wolf back to the region for the balance of nature (BRS 2002). Kellert (1995) found that only 36 percent of the general public had a negative attitude towards wolves, while 40 percent had a positive attitude and 20.9 percent neither liked or disliked the species.. According to a poll conducted by Responsive Management (1996), 85 percent of New England residents and 80 percent of New York residents supported wolf reintroduction in Adirondack Park. A later survey showed that 60 percent of New York residents supported the restoration of wolves into the park while 34

percent neither approved or disapproved (Enck et al. 2000).

Ecosystem Impacts.– The impacts of wolves in ecosystems have never been comprehensively studied, due to the difficulty of establishing controls and replication (Smith et al. 1999). It has been noted, however, that removal of large predators releases herbivores and mesopredators, causing overgrazing, vegetation recruitment failure, declines in ground-nesting birds, and in general, ecosystem simplification, extinctions, and decreased biodiversity. (Terbough et al. 1999). Wolf effects on their herbivore prey species, as well as the resultant vegetation response, have been investigated. In three-level trophic systems, wolves are responsible for maintaining vegetation levels; for instance, on Isle Royale in Lake Superior, predation by wolves releases balsam fir from browsing by moose (McLaren and Peterson 1994). The interruption of these trophic cascade interactions have been speculated as causing the decline of aspen (*Populus spp.*) trees in Yellowstone National Park following wolf extirpation in the 1920s. However, it is too soon to determine if there has been a vegetation recruitment response in Yellowstone Park since wolf reintroduction (Ripple and Larsen 2000).

Estimates based on population size indicated that wolf presence in Yellowstone Park would triple available carrion (Garton et al. 1990), with potentially positive effects for a wide range of scavenging species, including foxes, bears, weasels and raptors (Crabtree & Sheldon 1999). Wolves have killed a number of coyotes in Yellowstone and altered their behavior and home ranges (Crabtree and Sheldon 1999). Once the ecosystem is released from extreme coyote

and ungulate pressure it has been speculated to give a positive impact on numbers of ground squirrels, pocket gophers, hawks, owls, eagles, pronghorn, beaver, wetlands, moose, aspen, willows, and songbirds (Fischer 1998, Wilkinson 1997).

Economic Impacts.– Eco-tourism is quickly moving to the forefront of recreational activities. In areas where many animals roam freely, none is more sought after than the elusive wolf. The longing to see this magnificent animal has created an economic boom in areas such as Yellowstone National Park, Algonquin Provincial Park, North Carolina, and northern Minnesota.

Since wolves returned to Yellowstone National Park in 1995, they have stimulated significant economic activity. Visitors to the park now rank the wolf as the number one animal they come to see, thereby creating new demand for lodging, guided wolf-watching tours and a variety of wolf-related merchandise. In Cooke City, adjacent to the northeast entrance, 22 percent more tourists passed through the town the summer after wolves were restored than the year before. In a survey of the city's business owners, 71 percent thought wolf recovery was responsible for increased tourist traffic. It is estimated that the wolf reintroduction program has brought an additional $23 million annually to Yellowstone Park.

Algonquin Provincial Park in Ontario, Canada, has had success in using wolves to attract visitors to the park. Since 1963, one of the most popular events in Algonquin has been public wolf howls. During any given summer evening, an audience of about 2,400 people will attend one of these events. A 1997 study of North Carolina indicates that 71 percent of those interviewed were interested in visiting the red wolf recovery

area. More significantly, respondents would be less likely to visit the recovery area if red wolves were removed from the region. More recent research by Cornell University suggests that red wolves have benefitted northeastern North Carolina's economy anywhere between $40 million and $184 million directly due to increased tourism. In northern Minnesota, 56 percent of tourists visiting the town of Ely had visited the International Wolf Center. The Center produced a $3 million impact on the local economy in one year and either directly or indirectly provides the equivalent of 66 full-time jobs. Wolves attract a great deal of attention and any area with a wolf population will likely see an increase in tourism revenues.

D. Qualifications of the Northeastern Gray Wolf Population as a DPS

Discreteness.–Northeastern populations of eastern gray wolves should be designated as a DPS based on the criteria determined by the FWS (61 Fed. Reg. 4722-25 Feb. 7 1996). The gray wolf population in the northeastern United States is discrete according to the language of the FWS policy because it is markedly separated from the natural and recolonizing populations in the Great Lakes due to distance separating the populations by 500 -1000 miles. In addition, the Service states that "the existing geographic isolation of wolf populations between these four areas [proposed DPSs] fully satisfies the Vertebrate Population Policy's criterion for discreteness of each DPS," (65 Fed. Reg. 43450 - 43496, July 13, 2000. The distance separating the Great Lakes recovery areas and the westernmost part of the proposed Eastern Gray Wolf DPS is 6-7 times the average dispersal distance for a gray wolf (Gese and Mech 1991). While occasional wolves may disperse

across this distance, recolonization of the northeastern states is very unlikely within the foreseeable future.

Any gray wolves that appear in the northeastern United States may be lone dispersers from Canada. While several wolf populations exist in Canada within dispersal distance of the Northeast, the numerous obstacles, both geographic and anthropogenic, these animals face as they attempt to move into unoccupied habitat in the U.S., are virtually insurmountable. Since no wolves have formed packs or established territories over the course of the past few decades in the northeast region, there is little reason to believe that they will do so in the future. Wolves in Canada are subject to less protective wildlife management plans and the ESA recognizes population discreteness based on international borders. Also, the FWS criteria for "discreteness" states that a population can be considered discrete if it is isolated from other populations of its taxon by international boundaries.

Significance.–The Northeast represents a significant portion of the wolf's historical habitat and represents the easternmost extent of the wolf's range in the lower 48 states. Wolves once roamed throughout New England but were eliminated from the region by the late 1800's. The region currently encompasses over 26 million acres of suitable habitat and sufficient prey for wolves in a swath of forest that includes northern Maine, New Hampshire, Vermont and New York's Adirondack Park. Studies have shown that the Northeast could support at least 1,200 wolves and perhaps as many as 2000 (Mladenoff 1998, Harrison and Chapin 1997). The current classification of this region under the Eastern Gray Wolf

DPS ignores the potential of this vast region to wolf recovery and restoration.

The FWS developed its *1992 Eastern Timber Wolf Recovery Plan* to specifically recover *C. l. lycaon* throughout its historic range, which included the Northeast. In its 2001 *Proposed Rule to Reclassify the Gray Wolf in the Conterminous U.S.*, the FWS acknowledges the complexities associated with gray wolf taxonomy but emphasized the agency's commitment not to base gray wolf recovery efforts on any particular portrayal of gray wolf subspecies, but to instead identify geographic areas where wolf recovery is feasible, regardless of subspecific affiliation of current or historical gray wolves in the recovery areas. The proposed rule also states that the FWS recognizes the benefits to the species of focusing recovery efforts across a large expanse of the species' range in order to recover and retain as much of the remaining genetic variation as is feasible (65 Fed. Reg. 43451-43452, July 13, 2000).

The northeastern states - Maine, New Hampshire, New York, and Vermont - are currently considered part of the Eastern Gray Wolf DPS and are combined with existing wolf populations in the Great Lakes states. The FWS believes that wolves in this DPS have met the recovery criteria set forth in the *1992 Eastern Timber Wolf Recovery Plan*, which called for a stable and growing wolf population in Minnesota and a second population outside of Minnesota and Isle Royale. Wolf populations in Michigan and Wisconsin are considered by the FWS to be a separate population from wolves in Minnesota. The Petitioners disagree since the movement and dispersal of wolves among these three states indicates that this is effectively only one population of wolves in the Great Lakes region. In order to meet the requirements of the Recovery Plan, a

separate population should be established outside this region and within the DPS. Only the states in the northeastern portion of this DPS have enough habitat to sustain another wolf population. Unfortunately, the likelihood of wolves naturally recolonizing the Northeast from the Great Lakes region is highly unlikely given the extensive anthropogenic and natural geographic barriers separating the two regions (Harrison and Chapin 1997, Wydeven et al. 1998). The only alternative is to develop a separate recovery plan for the Northeast region.

E. Northeastern Gray Wolf DPS Qualifications for ESA Listing

Because this wolf population meets the requirements of discreteness and significance to its taxon, it should be designated as the Northeastern Gray Wolf Distinct Population Segment and managed accordingly. To increase the probability that gray wolf populations will be successful in this region, the Northeastern Gray Wolf DPS should be afforded federal protection under the ESA and given endangered status. The threats to gray wolves are significant as they disperse through the northeastern states and as they recover within core regions of Maine and New York. The ESA requirements for listing a Distinct Population Segment as threatened or endangered include manmade factors that affect its continued existence and the inadequacy of existing regulatory mechanisms to sufficiently protect the species. If the final version of the proposed Fish and Wildlife rule to reduce ESA protections for wolves includes the northeastern states, then the regulatory mechanisms will not be adequate to maintain large enough wolf populations to protect them from environmental stochastity

and the greatest threat to wolf populations: human-caused mortality.

Conservation Status.-- If a population is determined to be discrete and significant (i.e., a Distinct Population Segment), the FWS must then determine whether it meets the definition of an endangered or threatened species under the ESA. That determination must be based solely on an evaluation of the best available scientific information and the ESA's five listing factors. Gray wolves in the northeastern United States are currently listed as endangered. Before the FWS can legally downgrade the gray wolf in this area, it must demonstrate that progress has been made toward its recovery, and that threats to its continued existence have been reduced or removed. While there have been sporadic observations of individual wolves in this region over the last 20 years (most likely domesticated animals or a rare transient from Canada), there is no evidence to-date of reproducing pairs or pack formations despite vast areas of suitable habitat and several feasibility studies that indicate the potential for successful restoration. An analysis of the ESA's five listing factors and the best available scientific evidence support retaining an endangered classification for the Northeastern Gray Wolf DPS.

1. The present or threatened destruction, modification, or curtailment of it's habitat or range.

The Northeast represents an expanse of suitable habitat that provides an excellent opportunity to restore significant wolf numbers and range. However, the availability and utilization of that existing range is jeopardized by a number of factors. As in most regions, increasing urbanization and human populations are reducing the

amount of suitable wolf habitat. In the last ten years, population growth in the four northeastern states included in the proposed DPS has increased by an average of seven percent. The areas within this region designated as future recovery areas by the FWS are home to over two million people (U.S. Census Bureau 2001). With population growth expected to expand in a similar manner in the next 20 years, development pressure on non-populated areas will certainly increase. Experts estimate that we are losing up to 70,000 acres of wildlife habitat a year to conversion to human use. A large portion of the land in the Northeast is privately owned and management of any wildlands within these holdings is subject to individual or corporate decision-making, a situation not often in favor of endangered species protection. In addition, recreational development in and around federal forest lands and state parks severely diminishes the value of these lands for wolf recovery. There are significant geographical and legal barriers that prevent wolf recolonization from any adjacent areas. The end result is that these available habitats are not being utilized, which constitutes a significant curtailment of range.

2. Overutilization for commercial, recreational, scientific, or educational purposes

Commercial take of wolves is currently illegal, though should wolves lose their ESA protection it could become a significant factor in preventing the reestablishment of wolves within this region. The amount of poaching for commercial purposes is unknown but will be totally dependant upon the regulatory status of the gray wolf (i.e. protected or not). For example, bounties still exist on the books in some states that could make harvesting wolves profitable.

Recreational take is also dependant upon the regulatory status of the wolf. Currently, hunting is restricted but without federal protections some states have already signified their intention to hunt wolves. We would expect a few research-related mortalities (capture and handling mortality) though it is unlikely that these will present any significant impact on the population. All these issues indicate the need for continued federal protection under the ESA until wolves are clearly established, and the need for implementing a recovery plan that can monitor and regulate the take from the above factors and make management adjustments accordingly.

3. Disease or predation

Many diseases and parasites are found among the canids and some of these can create significant problems in wolf recovery, and require monitoring and appropriate treatment to ensure that they do not spread and impact the entire population. While some individuals may die from diseases, disease is generally not considered a significant problem for wolf recovery in the northeast. Most wolves in North America have had regular exposure to many of the canine diseases over the years and survive. Of course, any gray wolves that become reestablished in the Northeastern Gray Wolf DPS should be monitored for disease or parasite problems and treated as necessary. If wolves were reintroduced they would be vaccinated or treated for canine diseases and parasites.

Natural predation from other wolves, bears and mortality from the defensive tactics of prey species is relatively rare and would not be expected to significantly affect gray wolf recovery. However, the risk of human-caused predation can be substantial even while under federal management and protection (64 - 96 percent of all mortality among the reestablished wolves in the Western US, 65 Fed. Reg. 43467). Wolf populations in the Northeast were extirpated largely due to human-caused mortality and there continues to be a high level of malevolence towards the wolf from relatively small elements in the private and state government sectors. Some states currently offer bounties for wolf kills and agricultural interests are advocating against wolf recovery. Clearly the threat of human predation has not been reduced or eliminated in any substantive way, therefore we must have the continued presence of federal management and ESA protection until wolves have achieved some recovery

goal as defined by a Northeastern Recovery Plan.

4. The inadequacy of existing regulatory mechanisms

The proposed Northeastern Gray Wolf DPS contains a mix of primarily private and state-owned land with very little land under federal ownership. None of the appropriate state agencies have yet addressed wolf management issues or wolf protection adequately. There is no recovery plan in place for gray wolves, nor does FWS intend to develop one. Instead, the FWS proposes to downlist gray wolves in this area based on the attainment of goals in the Great Lakes region identified in *Recovery Plan for the Eastern Timber Wolf* (USFWS 1992). Gray wolf recovery in the Northeast is not addressed in that plan even though the region is geographically discrete. Any move to downlist gray wolves in this area in the absence of a scientifically credible recovery plan for that area and demonstrable progress toward the attainment of recovery goals established under such a plan, is inappropriate or illegal. Without a coordinated recovery plan that involves lands controlled by the Forest Service, FWS, state agencies and private landowners, it appears highly unlikely that any management plans for the region will adequately address wolf conservation. All this indicates the need for federal management in this area with a specific recovery plan and continued protection for the wolves under the ESA.

5. Other natural or manmade factors affecting its continued existence

Environmental Stochastity.– Natural wolf populations in Montana that were being monitored before the northern Rockies reintroduction were in decline, and it was

found that extreme weather in the winter of 1996-1997 killed an unusually large percentage of the ungulate populations, leaving the gray wolf with scarce food supplies. The food shortage that began in that winter resulted in a steep decline in wolf populations, partly due to increased wolf depredation on livestock. Nearly 50 percent of all confirmed wolf depredations and lethal control actions in the period from 1987 to 1999 were documented during this one harsh winter. In the years since wolves were reintroduced in Yellowstone and central Idaho their populations have been growing steadily, but there has not been a winter as severe as that of 1996-1997, so we do not yet know the effects of a harsh winter on these populations. When the FWS developed recovery plans for the gray wolf and set goals that would determine when level of protections could be reduced, no realistic cycle of environmental stochastity was considered. All successful wolf recovery zones are in areas where winter conditions are harsh enough to kill natural wolf prey, and where there are alternate food sources of livestock available.

The strong dependence of wolves on prey density also causes instability in wolf populations because ungulate populations are sensitive to environmental stochastity (McRoberts et al. 1995). In the simplest predator-prey models, predator populations cycle with prey populations, reacting to and causing the prey population's increases and decreases. This model cannot describe wolf-prey relationships because ungulate populations are much more dependent on climate than on pressure from predators (McRoberts et al. 1995). However, as described earlier, wolf populations are greatly affected by shifts in their prey's populations. Therefore, when ungulate populations are reduced dramatically by a

harsh winter as they were in the winter of 1996-1997 wolf populations can be expected to decline in response due to starvation and by increased contact with humans while foraging through agricultural land (Fed Reg. 65). In the winter of 1996-1997 there was a decline in wolf numbers in the natural Montana population, and it has been speculated that low prey density due to harsh winter conditions was the cause.

Negative Human Attitudes.– The Northeastern Gray Wolf DPS still qualifies for federal listing as an endangered species because it meets criteria established by the language of the ESA. The most important factor threatening gray wolf persistence in the northeast is negative human attitudes about wolves. Negative human attitudes, which result in unnecessary legal and illegal killing of wolves, are the primary factor limiting the growth of new populations (Wabakken et al. 2001) primarily in rural areas where wolves may come into contact with livestock (65 Fed. Reg.). The illegal taking of wolves can result in the depletion of an entire population (Young and Goldman 1944). This threat against wolves meets the fifth criteria for protecting a species under the ESA as a manmade factor affecting its continued existence.

Success of wolf programs depends highly on the attitudes of the humans the wolves may encounter while dispersing. Wolves symbolize many different things for people across North America, and whether these symbols are positive or negative depends on highly varied individual concepts of wildness. For centuries, fairy tales and legends have perpetuated superstitions about the menacing nature of wolves and have spread the fear throughout human settlements that wolves prey on human children. But because there has never been

> a documented case of a human being killed by a wild wolf in the United States, establishment of such widespread negative attitudes about wolves through the middle of the twentieth century was more likely due to the relationship between the rancher and the wolf. Ranchers were determined to eliminate the threat of wolf depredation on their livestock and were eventually successful, as wolf populations were extirpated from almost all of the conterminous forty-eight states except Montana, Minnesota and Washington State by the 1930s. Currently, ESA endangered status notwithstanding, human-caused mortality is the primary cause of death (80-90 percent) for gray wolves within and beyond the boundaries of recovery zones (Weaver 2001). If humans with negative attitudes about predators are concentrated in dispersal paths for wolves, they can thwart recovery efforts even if they represent a minority of the overall opinion of people residing in the recovery region (65 Fed. Reg.).

To illustrate that wolves are often maligned without justification, Forest Service records

> show that depredation control activities against wolves may not always be warranted. After wolves began recovering in Idaho after reintroduction programs, ranchers applied for permits to harass or kill wolves that had allegedly killed livestock. Thirty-six incidents of wolf depredation on livestock were reported, but the Forest Service determined that wolves were to blame for only eleven of these incidents (US Forest Service website). Ranchers claimed that wolves preyed on their livestock, yet when livestock carcasses are partially consumed or if carcasses are not found until they are partially decomposed, it is difficult to determine the cause of death. It is postulated that as humans become more

aware of wolf presence due to media coverage of wolf recovery projects, more livestock depredation incidents are wrongfully blamed on wolves (US Forest Service website). Another added incentive for misidentifying wolves as the cause of death arises because ranchers only receive compensation for their livestock that are killed by wolves (and grizzly bears).

Dispersal is an important factor to consider when forming wolf management plans because it defines wolf population structure. Because almost all wolves disperse from their family units after their second year, the probability is high that they will encounter humans in rural areas where negative opinion of wolves is most concentrated (65 Fed Reg.). As populations grow and it becomes more difficult for individual wolves to find unoccupied territory, dispersal distances increase. Wolves will travel over almost any type of terrain, and studies show that only human persecution and low prey densities limit their distribution (Mech 1995). Because wolves are not specific to certain habitats, the possibility of encountering humans is high because they do not necessarily avoid human population centers (Mladenoff et al. 1995). For example, five or six gray wolves have attempted dispersal into eastern Washington and Oregon, but most of these attempts have not been successful.

Development and human population growth.--In the decades since gray wolf extirpation, the human population in the northeast has increased dramatically. This increase in development and human population growth will prevent the expansion of a recovering population of gray wolves because risk of mortality increases with proximity to human population centers (Mladenoff et al. 1995).

Without sufficient regulations protecting wolves that disperse into semi-rural and agricultural land, the extermination of wolves by landowners could affect the survival probability of the entire wolf population (Haight et al. 1998, Hayes and Harestad 2000).

IV. SUMMARY AND CONCLUSIONS

The ongoing restoration of gray wolves in the lower 48 states is one of the most important conservation success stories during the last quarter century under the protections of the Endangered Species Act. While much progress has been made, there still remain significant gaps in the historical distribution of gray wolves. While some of these areas are lost forever to development and degradation, others still contain vast tracts of land that contain suitable wolf habitat. The northeastern United States, with areas of relatively low human population density, large areas of federal lands and abundant prey populations, is one area where tremendous potential exists to restore this important ecological actor.

The gray wolf must be managed on a landscape scale within the conterminous United States scale to avoid local population extinction due to environmental stochastity and human-caused mortality. A survey revealed that wildlife scientists were not unanimously in favor of the northern Rockies recovery plan for wolves because it managed for a relatively low number of individuals and breeding pairs when compared to recommendations of most wolf biologists. Also, many felt that the generations following the founding breeding pairs were too genetically related, compromising the health of the gene pool (Fritts and Carbyn 1995). Success with

> maintaining wolf populations anywhere within the conterminous forty-eight states will be increased if several populations are maintained over their historical range because management decisions must be made on a small scale to conserve wolf populations at a larger landscape scale (McLaughlin 2001 pers. comm., Haight et al. 1998). Small "insignificant" populations should be protected even if they do not substantially contribute towards the goal of a minimum viable population because they can provide dispersers to other populations that may be stressed. (Fritts and Carbyn 1995).

In this document and others cited in this text, the Petitioners have presented evidence that wolves can, and should, be returned to the Northeast. We have provided materials that indicate that wolves will benefit ecosystems in this region, that they have provided economic benefit in other areas**,** and that well-managed wolf recovery is supported by a majority of the region's citizens. We have shown that the northeastern United States is an ideal region to restore a wolf population because of its favorable wolf habitat and vast areas of low road density. We also demonstrated that the northeastern wolf population meets the definition of a DPS under the ESA. We have clearly shown that this region and its wolves are discrete from the Great Lakes recovery area and that the Northeast region constitutes a significant portion of the gray wolf's range.

Lastly and perhaps most importantly, we have demonstrated that no measure of wolf recovery will occur in this region without federal leadership. Our understanding of the latest proposed reclassification rule would end federal involvement in the Northeast and leave the few naturally recolonizing wolves with no recovery plan and little chance of survival. Moreover, these wolves

would be wandering into an area where the federal government has done little or nothing to alleviate threats to the animals or to encourage their recovery.

For all of the above reasons, the northeastern gray wolf must be designated as a distinct population segment, with an endangered designation, whereby the FWS, in consultation with a recovery team, draws up a recovery plan and takes the steps necessary to restore this animal to its important ecological role in the Northeast region.

V. LITERATURE CITED

Ballard, W. B., J. S. Whitman, and C. L. Gardner. 1987. Ecology of an exploited wolf population in South-central Alaska. Wildlife Monographs 98.

Belden, Russonello, and Stewart. 2002. Nature conservation in northern New England: findings from a survey conducted for a collaboration coordinated by the Henry P. Kendall Foundation. Pp. 69-70. BRS, 1320 19th Street, Washington, D.C.

Brewster, W. G. and S. H. Fritts. 1995. Taxonomy and genetics of the gray wolf in Western North America: a review. Pp. 353-37. *In* L. N. Carbyn, S. H. Fritts, and D. R. Seip, eds. Ecology and conservation of wolves in a changing world. . Canadian Circumpolar Institute, University of Alberta, Edmonton, Alberta.

Burroughs, R. D. 1961. The natural history of the Lewis and Clark expedition. University of Michigan Press, East Lansing, MI. 340 pp.

Chambers, R. C. 2000. Taxonomic and dietary characteristics of eastern coyotes (*Canis latrans var*.) in New York state. Unpublished manuscript.

Ciucci, P. and L. Boitani. 1991. Viability assessment of the Italian wolf and guidelines for the management of the wild and a captive population. Ricerche di Biologia della Selvaggina No. 89

Crabtree R. L. and J. W. Sheldon. 1999. Coyotes and canid existence in Yellowstone. Pp. 127-163. *In* Clark, T. W., A. P. Curlee, S. C. Minta and P. M. Karieva. Carnivores in ecosystems: The Yellowstone experience. Yale University Press, New Haven, Connecticut. 429 pp.

Defenders of Wildlife web site URL: www.defenders.org

Dietz, M. 1993. Initial investigation of potentially suitable locations for wolf reintroduction in the contiguous United States. Unpublished paper.

Environmental Studies Department, University of Montana, Missoula, Montana.

Edwins, P., M. de Almeida, P. Miller and O. Byers. 2000. Population and habitat viability assessment workshop for the wolves of Algonquin Park: final report. IUCN/SSC Conservation Breeding Specialist Group: Apple Valley, Minnesota.

Fascione, N., L. Osborn, S. R. Kendrot, and P. C. Paquet. 2001. Canis soupus: Eastern wolf genetics and its implications for wolf recovery in the Northeast United States. Endangered Species Update, University of Michigan, 18(4): 159-163.

Federal Register Vol. 68, No. 62/April 1, 2003/Final Rule to Reclassify and Remove the Gray Wolf From the List of Endangered and Threatened Wildlife in Portions of the Coterminous United States.

Federal Register Vol. 68, No. 62/April 1, 2003/Removing the Eastern DPS of Gray Wolf from the List of Endangered and Threatened Wildlife.

Federal Register Vol. 65, No. 135/ Thursday, July 13, 2000/ Proposed Rule to Reclassify the Gray Wolf

Ferris, R., M. Shaffer, N. Fascione, H. Pellet, and M. Senatore. 1999. Places for Wolves: a blueprint for restoration and long-term recovery in the lower 48 states. Defenders of Wildlife, Washington, DC. 31 pp.

Fischer, H. 1995. Wolf wars. Falcon Press Publishing Co., Inc., Helena, Montana. 183 pp.

Fischer, H. 1998. The wolf settles in at Yellowstone. Defenders 73(3): 21-28.

Franklin, I. A. 1980. Evolutionary change in small populations. Pp. 135-150. *In* M. E. Soulé and B. A. Wilcox, eds. Conservation biology: an evolutionary ecological perspective. Sinauer Associates, Sunderland, Massachusetts.

Fritts, S. H. 1983. Record dispersal by a wolf from Minnesota. Journal of Mammalogy, 64:166-167.

Fritts, S., and L. Carbyn. 1995. Population viability, nature reserves, and the outlook for gray wolf conservation in North America. Restoration Ecology 3(1): 26-38.

Fuller, T. K. 1989. Population dynamics of wolves in north-central Minnesota. Wildlife Monographs 105.

Gese, E. M. and L. D. Mech. 1991. Dispersal of wolves (*Canis lupus*) in northeastern Minnesota. Canadian Journal of Zoology 69: 2946-2955.

Garton, E. O., R. L. Crabtree, B. B. Ackerman, and G. L. Wright. 1990. The potential impact of a reintroduced wolf population on the northern Yellowstone elk herd. Pp. 3-59. *In* Wolves for Yellowstone? A report to the United State Congress, vol. 2, research and

analysis. National Park Service, Yellowstone National Park, Wyoming.

Goldman, E. A. 1937. The wolves of North America. Journal of Mammalogy 18:37-45.

Goldman, E.A. 1944. Classification of wolves. Pp. 389-636. *In* S. P. Young and E. A. Goldman. The wolves of North America. American Wildlife Institute, Washington, D.C.

Gotelli, N. J. 1998. A primer of ecology, 2nd Edition. Sinaur Associates, Inc., Sunderland, Massachussetts.

Haight, G. H., D. Mladenoff, and A. P. Wydeven. 1998. Modeling disjunct gray wolf populations in semi-wild landscapes. Conservation Biology 12(4): 879-878.

Hall, E. R. 1981. The mammals of North America, Volume II. John Wiley and Sons, New York, New York. 90 pp.

Harrison, D. J. and T. G. Chapin. 1997. An assessment of potential habitat for eastern timber wolves in the northeastern United States and connectivity with habitat in southeastern Canada. 12 pp. Working Paper No. 7 - Wildlife Conservation Society, New York, New York.

Hayes, R. D. 2001. Wolf functional response and regulation of moose in the Yukon. Canadian Journal of Zoology 78(1).

Hayes, R. D. and A. S. Harestad. 2000. Demography of a recovering wolf population in the Yukon. Canadian Journal of Zoology 78(1): 36-48.

Hosack, D. A. 1996. Biological potential for eastern timber wolf re-establishment in Adirondack Park. *Proceedings from Wolves of America Conference*, November 14-16; Albany, NY. Defenders of Wildlife, Washington, D.C. Pp. 24-30.

Kellert, S. R. 1985. Public perceptions of predators, particularly the wolf and coyote. Biological Conservation 31:167-189.

Kricher, J. 1998. Eastern Forests: a field guide to birds, mammals, trees, flowers and more. Houghton Mifflin, New York, New York.

Lande, R., and G. F. Barrowclough. 1987. Effective population size, genetic variation, and their use in population management. Pp. 87-123. *In* M. E. Soule (Ed.). Viable Populations for Conservation. Cambridge University Press, New York, New York.

Levins, R. 1970. Extinction. *In* Gerstenhaber, M. (Ed.). Some mathematical problems in biology. American Mathematical Society, Providence, Rhode Island. Pp. 75-107.

Licht, D. S. and S. H. Fritts. 1994. Gray wolf (*Canis lupus*) occurrences in the Dakotas. American Midland Naturalist 132:74-81.

Maine Department of Inland Fisheries and Wildlife web site. URL: www.state.me.us/ifw

Maine Wolf Coalition and Center for Research and Evaluation, University of Maine. Wolf Attitudes Survey. Unknown date.

Marchand, P. J. 1987. North Woods: an inside look at the nature of forests in the Northeast. Appalachian Mountain Club, Boston, Massachusetts.

Maughan, R. 2002. Ralph Maughan's Wildlife Reports Web site, Yellowstone Wolf Mortalities. http://www.forwolves.org/ralph/deadwolf.htm

McKibben, B. 2000. Human restoration. Pp. 5-22. *In* J. Elder, (Ed.). The return of the wolf: reflections on the future of wolves in the Northeast. University Press of New England, Hanover, New Hampshire.

McLaren, B. E. and R. O. Peterson. 1994. Wolves, moose, and tree rings on Isle Royale. Science 266: 1555-1558.

McRoberts, R. E., L. D. Mech, and R. O. Peterson. 1995. The cumulative effect of consecutive winters' snow depth on moose and deer populations: a defense. Journal of Animal Ecology 64:131-135.

Mech, L. D. 1970. The wolf. The ecology and behavior of an endangered species. University of Minnesota Press, Minneapolis. 384 pp.

Mech, David. 1995. The challenge and opportunity of recovering wolf populations. Conservation Biology 9(2): 270-278.

Messier, F. 1985. Solitary living and extraterrestrial movements of wolves in relation to social status and prey abundance. Canadian Journal of Zoology 63: 239-245.

Mladenoff, D., T. A. Sickley, R. G. Haight, and A. P. Wydevens. 1995. A regional landscape analysis and prediction of favorable gray wolf habitat in the northern Great Lakes region. Conservation Biology 9(2): 279-294.

Mladenoff, D. J. and T. A. Sickley. 1998. Assessing potential gray wolf restoration in the northeastern United States: a spatial prediction of favorable habitat and potential population levels. Journal of Wildlife Management 62:1-10.

NETSTATE geography. URL: www.netstate.com

Nowak, R. M. 1995. Another look at wolf taxonomy. Pp. 375-398. *In* L.N. Carbyn, S.H. Fritts, and D.R. Seip, (Eds.). Ecology and conservation of wolves in a changing world.. Occasional Publication No. 35, Canadian Circumpolar Institute, University of Alberta, Edmonton, Alberta.

Nowak, R. M. 2002. The original status of wolves in eastern North America. Southern Naturalist 1(2): 95-130.

Paquet, P. 2001. Adjunct Professor of Ecology at University of Calgary, Alberta. Personal communication.

Paquet, P. C., J. R. Strittholt, and N. L. Staus. 1999. Wolf reintroduction feasibility in the Adirondack Park. Conservation Biology Institute, Corvallis, Oregon.

Parker, G. 1995. Eastern Coyote: the story of its success. Nimbus Publishing, Halifax, Nova Scotia.

Peterson, R. O., and R. E. Page. 1988. The rise and fall of Isle Royale wolves, 1975-1986. Journal of Mammalogy 69: 89-99.

Responsive Management. 1996. Public opinion on and attitudes toward the reintroduction of the Eastern Timber Wolf to Adirondack Park. Presented to Defenders of Wildlife, Washington, DC.

Ripple, W. J. and E. J. Larsen. 2000. Historic aspen recruitment, elk, and wolves in Northern Yellowstone National Park, USA. Biological Conservation 95: 361-370.

Shaffer, M. L. and B. A. Stein. 2000. Safeguarding our precious heritage. Pp. 301-321. *In* B. A. Stein, J. S. Adams, and L. S. Kutner, (Eds.). Precious heritage: the status of biodiversity in the United States. Oxford University Press, 399 pp.

Smith, D. W, W. G. Brewster and E. E. Bangs. 1999. Wolves in the Greater Yellowstone Ecosystem: restoration of a top carnivore in a complex management environment. Pp. 103-126. *In* T.W. Clark, A. P. Curlee, S. C. Minta and P. M. Karieva. Carnivores in ecosystems: the Yellowstone experience. Yale University Press, New Haven, Connecticut. 429 pp.

Soule, M. E. 1980. Thresholds for survival: maintaining fitness and evolutionary potential. Pp. 151-169. *In* M. E. Soule and B. A. Wilcox, (Eds.). Conservation biology: an evolutionary-ecological perspective. Sinauer Associates, Sunderland, Massachusetts.

Terbough, J., J. Estes, P. Paquet, K. Ralls, D. Boyd-Heger, B. Miller, R. Noss. 1999. The role of the top carnivores in regulating terrestrial ecosystems. Wild Earth 9: 42-57.

Thomas, C.D. 1990. What do real population dynamics tell us about minimum viable population sizes? Conservation Biology 4: 324-327.

Thompson, E. H. and E. R. Sorenson. 2000. Wetland, woodland, wildland: a guide to the natural communities of Vermont. University Press of New England, Hanover, New Hampshire.

U.S. Census Bureau. 2001. URL: http://quickfacts.census.gov/qfd/

U.S. Fish and Wildlife Service. 1987. Northern Rocky Mountain Wolf Recovery Plan. U.S. Fish and Wildlife Service, Denver, Colorado. 199pp.

U.S. Fish and Wildlife Service. 1992. Recovery Plan for the eastern timber wolf. Twin Cities, Minnesota. 73 pp.

Wabakken, P., H. Sand, O. Liberg, and A. Bjarvall. 2001. The recovery, distribution, and population dynamics of wolves on the Scandinavian Peninsula, 1978-1998. Canadian Journal of Zoology 79:710-725.

Wayne, R. K., H. Lehman, and T. K. Fuller. 1995. Conservation genetics of the gray wolf. Pp. 399-498. *In* L. N. Carbyn, S. H. Fritts, and D. R. Seip

(Eds.). Ecology and conservation of wolves in a changing world: Proceedings of the second North American symposium on wolves. Canadian Circumpolar Institute, University of Alberta, Edmonton, Alberta.

Weaver, J. L. 2001. The Transboundary Flathead: A critical landscape for carnivores in the Rocky Mountains. Wildlife Conservation Society, New York. 59 pp.

Wilkinson, T. 1997. Yellowstone's changing of the guard. Defenders 72(4): 6-11.

Williams, C. K., G. Ericsson, and T. A. Heberlein. 2002. A quantitative summary of attitudes toward wolves and their reintroduction (1972-2000). Wildlife Society Bulletin 30(2): 575-584.

Wilson, P. J., S. Grewal, I. D. Lawford, J. N. M. Heal, A. G. Ganacki, D. Pennock, J. B. Theberge, M. T. Theberge, D. R. Voigt, W. Waddell, R. E. Chambers, P. C. Paquet, G. Goulet, D. Cluff, and B. N. White. 2000. DNA profiles of the eastern Canadian wolf and the red wolf provide evidence for a common evolutionary history independent of the gray wolf. Canadian Journal of Zoology 78: 2156-2166.

Wydeven, A. P., T. K. Fuller, W. Weber, and K. MacDonald. 1998. The potential for wolf
recovery in the northeastern United States via dispersal from southeastern Canada. Wildlife Society Bulletin 26(4): 177-185.

Young, S.P. and E. A. Goldman. 1944. The wolves of North America. Part I and II. Dover Publications, Inc. New York. 636 pp.