

The Science and Sociology of Hunting: Shifting Practices and Perceptions in the United States and Great Britain

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Introduction

Between the late nineteenth and early twenty-first centuries, both the rationale for and perception of hunting shifted in the United States, coinciding with demographic changes in the U.S. population (Duda 1993). Similar changes in attitude, though largely undocumented, probably occurred in the United Kingdom. (For example, foxhunting did not emerge as a substantial sport until the second half of the eighteenth century; before that, foxes were widely perceived as pests and killed whenever the opportunity arose [Marvin 2000]). Our purpose in this chapter is to compare these two countries in order to reveal some of the science and the sociology relevant to hunting (the latter just one of many interacting environmental issues about which human society faces complicated judgments

within rapidly shifting political and cultural areas).

While hunting was once necessary for the survival of European colonists and Native Americans, the number of people reliant upon subsistence hunting in the United States and Western Europe is now small. For the general public in both the United States and Europe—including non-hunters and hunters—the acceptability of hunting today hinges on ethical considerations such as “fair chase”; whether the hunt is conducted primarily for sport, recreation, trophy, or food; and perceived effects on conservation or animal welfare (e.g., Kellert 1996).

Paralleling changes in public attitudes, the discipline of wildlife management in the United States has shown evidence of a gradual evolution away from “game” management and

toward whole-ecosystem management (Dasmann 1964; Decker et al. 1992; Woolf and Roseberry 1998; Bolen 2000; Peyton 2000). Despite the shift in the focus of wildlife management, as well as a steady decline in the popularity and acceptance of hunting, the generally dwindling stakeholder group associated with sport hunting continues to exert a strong influence on wildlife management (Bissell 1993; Woolf and Roseberry 1998), often encouraging the production of “harvestable surpluses” of favored game species for the sake of providing recreational hunting opportunities (Holsman 2000; Peyton 2000). Consumptive users of wildlife (hunters, trappers, and anglers) have a financial—and perhaps, therefore, influential—impact on wildlife management via the purchase of hunting and fish-

ing licenses and duck stamps, and payment of federal excise taxes on sporting arms, handguns, ammunition, and archery equipment (Schmidt 1996; Holsman 2000). This potential influence of hunters on management decisions has three potential effects: it may (1) promote the killing of wildlife as a form of public recreation; (2) reduce the emphasis by wildlife agencies on non-game species; and (3) affect the movement toward ecosystem management.

In contrast to the United States, mammalian wildlife populations in the United Kingdom exist almost entirely on privately owned land and are managed by individual landowners within the constraints of European and U.K. legislation regarding seasons, permitted methods of killing or hunting, use of firearms, and protected species (Macdonald et al. 2000). The organization of wildlife management is much less institutionalized in the United Kingdom than in the United States. For example, provided that permitted methods are used, strict firearms regulations are followed, and closed seasons recognized, the decision as to how many deer to cull lies almost entirely within the control of individual landowners. No hunting license is required (although individual landowners may charge a fee for the right to hunt on their land) and, except for deer in Scotland, there is no requirement for hunters to report the number of animals killed. There is no legally enforced regulation in the United Kingdom, although landownership and informal groupings (e.g., deer management groups, fox destruction clubs, and shooting syndicates) may achieve a similar effect. Very recently, and as a significant change, many organizations hunting with dogs have submitted themselves to voluntary regulation by the Independent Supervisory Authority for Hunting. However, the U.K. situation generally contrasts sharply with the situation elsewhere in Europe, where wildlife culling is subject to a statutory licensing system and/or cull plans approved by government authorities,

often covering a defined area of land (Gill 1990; Myrberget 1990; Stroud et al. 1999). Of course, management of mammalian wildlife in the United Kingdom is perhaps less complex than elsewhere in Europe or in the United States because there are no remaining populations of large predators and only a handful of larger herbivores.

In the United Kingdom, most available data on public attitudes toward wildlife management are collected through opinion polls for political purposes, and these generally are scientifically wanting (Macdonald et al. 2000). However, one particular aspect of hunting that certainly causes great public concern is the use of dogs to chase and kill wild mammals such as foxes, deer, and hares (Ministry of Agriculture, Fisheries, and Food 2000). A number of European countries, including Germany, Sweden, and Denmark, have banned or partially banned hunting with dogs (Burns et al. 2000). Although hunting with dogs is an ancient occupation in the United Kingdom (Macdonald 1987; Macdonald and Johnson 1996), the longstanding and fierce debate as to whether it should be allowed to continue recently culminated in a ban in Scotland; it is not yet resolved in England and Wales. The Scottish legislation abolished mounted fox-hunting and hare coursing and prevents the hunting of deer, boar, and mink with dogs. In 2002 ministers of Parliament voted overwhelmingly to ban hunting with dogs in England and Wales, but progress was blocked by the House of Lords. Following a period of consultation, new legislation proposed in late 2002 was again supported by the House of Commons but was also likely to face opposition from the Lords when it was to be voted on in late 2003 or 2004. The proposed bill, as amended in committee, bans hunting with dogs unless two tests are passed: first, that the hunting is necessary to prevent serious damage of some kind and, second, that the damage cannot be prevented using a method involving less suffering.

U.S. Wildlife Management and Hunting

Early European colonists considered wildlife on the North American continent to be essentially infinite in abundance (e.g., Mighetto 1991; Posewitz 1999). There was no need to justify hunting to the public. Hunting for subsistence was a way of life and was believed to be justified by the desire to conquer the wilderness of the New World. Thus, little need was seen for restraint in hunting and trapping those wildlife species whose meat could be used or whose hides or fur could be traded within the colonies or sold to financiers in Europe. European colonists saw many wildlife species, as well as the wilderness itself, as hostile and a deterrent to progress. In Connecticut, for example, the first restriction on hunting deer, in the form of a closed season, was not in place until 1698, by which time deer had been nearly wiped out in that area (Conover and Conover 1987). Bounties on wolves and cougars—placed only partly for the sake of protecting livestock—succeeded in extirpating large predators from the East and later from much of what was to become the forty-eight contiguous states (Leopold 1933; Conover and Conover 1987; Mighetto 1991; Paquet and Hackman 1995).

By the late 1800s, however, some hunters began to write about the need for conservation of declining populations of game species—most notably the bison and the passenger pigeon—and to increase public awareness of the loss of wildlife to market hunting (Mighetto 1991). Deer, beaver, wolves, bears, cougars, and other animals killed by hunters or trappers had been nearly extirpated from most of their range in North America, and many waterfowl species were in serious decline (Nichols, Johnson, and Williams 1995; Paquet and Hackman 1995; Woolf and Roseberry 1998). Massachusetts was the

first state to close deer hunting for a number of years; by 1880 state game laws became widespread throughout the country, imposing bag limits, rest days, closed seasons, and buck laws, the latter of which prohibited the shooting of antlerless deer (Leopold 1933; Conover and Conover 1987; Woolf and Roseberry 1998). Restrictions on waterfowl hunting were nonexistent until passage of the Migratory Bird Treaty Act (MBTA) in 1918 authorized the federal government to implement hunting regulations (e.g., Nichols, Johnson, and Williams 1995).

Hunters and anglers around the turn of the twentieth century frequently are credited with kick-starting the early conservation movement that eventually led to passage of the Lacey Act of 1900, the MBTA, and associated treaties, and an end to destructive market hunting (Leopold 1933; Mighetto 1991; Schmidt 1996). Critics point out that these sport hunters-turned-conservationists acted for the “selfish” purpose of providing “abundant sport for themselves” (Grinnell, in Mighetto 1991, 41). Regardless of the motives of the hunters of the past, their actions resulted in the initiation of early wildlife conservation.

While hunters of this era pushed for laws and regulations that would protect the game species they found valuable, they simultaneously refined the “sporting” aspects of hunting by emphasizing particular ethical standards, such as the concept of fair chase and self-imposed restrictions on the number of animals killed to allow wildlife populations to rebuild—and, ultimately, be used by future generations of hunters (e.g., Posewitz 1999). The need to hunt for subsistence was rapidly diminishing, and humanitarians concerned for the welfare of individual animals began to pay attention to the suffering of at least some hunted wildlife species. Mighetto (1991) suggests that the publication in 1859 of Darwin’s theo-

ry of natural selection may have been a catalyst for the concern of humanitarians for animal welfare, because the theory clearly indicated that humans and other animals share a common origin.

During the early 1900s, increasing populations of some wildlife species allowed wildlife managers to move away from a strategy of simply restricting hunting to recover scarce wildlife populations, adopting instead a strategy in which the “cropping” of game species was emphasized. (Cropping, as a management technique, involves encouraging the reproduction and survival of animals so that many will be available to be killed by recreational hunters without decreasing the population beyond the capability of the next reproductive cycle to replenish the population.) This strategy was accomplished through attempts to limit the negative impact on wildlife of hunting, as well as to mitigate the effects of disease and habitat degradation. Refuges and parks were also established on which hunting was prohibited or restricted (Leopold 1933). Sport hunters in the early and mid-1900s were provided with hunting opportunities and in turn provided a means to limit now-increasing deer herds which, though still limited by food and disease, were no longer being held in check by large predators such as wolves and cougars (Woolf and Roseberry 1998). Sport hunters became a self-designated “tool” for wildlife management and began funding state and federal wildlife management agencies through a tax in the form of fees for the purchase of hunting licenses and duck stamps (Migratory Bird Hunting Stamp Act, 1934) and via excise taxes imposed on purchases of sporting arms and ammunition (through the Pittman-Robertson Federal Aid in Wildlife Restoration Act of 1937).

The notion of hunters as the “clients” of U.S. state wildlife agencies has largely persisted to the pre-

sent day, as has the wildlife management strategy of producing wildlife for hunters to kill, in spite of the fact that Leopold’s (1933) embrace of cropping wildlife came at a time when production of wildlife seemed a responsible alternative to the exploitation of scarce wildlife populations. Some authors now suggest that continuation of the cropping strategy as a primary goal of wildlife management may hinder progress toward whole-ecosystem management (Peyton 2000). Even in those regions where some wildlife populations, such as white-tailed deer, are considered too abundant, state wildlife agencies often respond to pressure from sport hunters by continuing to manage habitat to provide increased food and cover for deer so that hunter satisfaction remains high (Woolf and Roseberry 1998). In areas where native predators have returned (e.g., cougars in the West) or have been replaced by others (e.g., coyotes replacing wolves in Maine), hunting and trapping seasons for these predators often are established or liberalized under the generally untested assumption that this will increase populations of popular game species.

The American public, including wildlife managers and some hunters, has begun to question more critically the emphasis of state wildlife agencies on satisfying the desires of hunters (e.g., Williams 1986). In response to this and other criticisms, hunters’ organizations in several states have lobbied for passage of legislation establishing their “right” to hunt (Table 1). It is not yet clear what effect this will have on wildlife management strategies or hunting regulations.

Table 1
States that Currently Have a Constitutional Amendment
Guaranteeing the Right to Hunt for All Citizens

State	Bill or Amendment	Highlights of Text
Alabama	Alabama Constitution, Amendment No. 597(2002)	“All persons shall have the right to hunt and fish in this state in accordance with law and regulations.”
Florida	Section 8, Section 372.002, Florida Statutes (2002)	“The legislature recognizes that hunting, fishing, and the taking of game are a valued part of the cultural heritage of Florida and should be forever preserved for Floridians....”
Minnesota	Minnesota Constitution, Article XIII, Section 12 (2001)	“Hunting and fishing and the taking of game and fish are a valued part of our heritage that shall be forever preserved for the people....”
Missouri	Title XXXVIII. Crimes and Punishment; Peace Officers and Public Defenders Chapter 578.151	“It is the intent of the general assembly of the state of Missouri to recognize that all persons shall have the right to hunt, fish and trap in this state....”
New Hampshire	Title XVIII. Fish and Game Chapter 207 General Provisions as to Fish and Game Jurisdiction. 207:58 (2001)	“...The general court further finds that it is in the best of the state and its citizens that the fish and game recognize, preserve, and promote our special heritage of hunting, fishing, trapping, and wildlife viewing by providing opportunities to hunt, fish, trap, and view wildlife....”
North Dakota	North Dakota Constitution, Article 11, Section 27 (2002)	“Hunting, trapping, and fishing and the taking of game and fish are a valued part of our heritage and will be forever preserved for the people....”
Virginia	Virginia Constitution, Article XI, Section 4 (2002)	“The people have a right to hunt, fish, and harvest game....”

Hunters in the United States

Absolute numbers of hunters (paid license holders) in the United States have decreased over the past two decades, from approximately 16.3 million in 1980 to 15 million in 2000. The popularity of hunting, measured by the proportion of the U.S. population that purchases hunting licenses, has declined steadily, from an estimated 7.18 percent in 1980 to 5.35 percent in 2000 (Table 2a) (U.S. Fish and Wildlife Service 1981; U.S. Census Bureau 1996; U.S. Census Bureau 2001; U.S. Fish and Wildlife Service 2001). Trends in most states follow the national trend, though there is substantial variation in hunting

Table 2a
Percentage of the United States
Population Holding a Hunting License

	1980	1990	2000
Number of Paid Hunting License Holders ¹	16,257,074	15,806,864	15,044,324
U.S. Population ²	226,542,199	248,709,873	281,421,906
Percentage of Population Holding a Hunting License	7.18	6.36	5.35

¹Source: U.S. Fish and Wildlife Service, based on data provided by state wildlife agencies. A paid license holder is one individual regardless of the number of licenses purchased. Some states do not require the purchase of a hunting license by senior citizens, youth, or disabled individuals; some unprotected species, such as prairie dogs or marmots, may be shot without a license in some states.

²Source: U.S. Census Bureau

participation among states (Table 2b). Between 1980 and 2000, nineteen states showed a decrease of 2 percent or more in the percentage of the population that purchased licenses; however, a few states (Montana and the two Dakotas) showed an increase of at least 2 percent in the percentage of paid license holders. (It is not clear the extent to which non-resident trophy hunters may affect state-by-state variation in these trends.) These recent trends contrast with the period 1955–1975, during which the number of paid license holders in the United States increased 46 percent, from 11.7 million to 14.0 million (U.S. Department of the Interior 1997).

Another measure of participation in hunting is the average number of days hunted per year. Between 1991 and 1996, hunters spent, on average, approximately 17 percent fewer days hunting annually than in 1975, 1980, and 1985 (U.S. Department of the Interior and U.S. Department of Commerce 1997). Enck, Decker, and Brown (2000) point out that most of this decrease can be accounted for by a decrease in time spent hunting small game (a 40 percent decrease in days spent hunting); days spent hunting big game and waterfowl actually increased by 28 percent and 5 percent, respectively, between 1980 and 1996 (see also U.S. Department of the Interior and U.S. Department of Commerce 2002). These authors suggest further that the reduced interest in small-game hunting may be indicative of reduced participation by younger hunters, for whom small-game hunting is often part of the introduction to hunting (Enck, Decker, and Brown 2000). Perhaps for this reason, hunter recruitment efforts by state wildlife agencies and non-governmental hunting associations often focus on encouraging young people to begin or continue hunting, though efforts to recruit minority groups and women are also becoming more common (e.g., Matthews 1993; Mangun, Hall, and O’Leary 1996).

Table 2b
States Showing an Increase or Decrease
of 2 Percent or More in Hunting
Popularity, 1980, 2000

	Percent of State Population Holding a Hunting License	
	1980	2000
Hunting Popularity Increases		
Montana	27.64	31.46
North Dakota	15.33	19.23
South Dakota	20.66	30.23
Hunting Popularity Decreases		
Alaska	17.96	15.55
Arizona	7.31	3.83
Colorado	10.81	7.85
Georgia	7.03	4.03
Idaho	25.21	19.26
Kansas	10.51	7.80
Louisiana	9.14	6.23
Maine	21.28	16.37
Mississippi	11.45	8.86
Nevada	6.53	3.02
New Hampshire	9.07	6.17
New Mexico	11.08	6.00
Oregon	14.98	9.09
Pennsylvania	10.73	8.37
Utah	19.68	7.69
Vermont	26.86	16.70
Virginia	8.78	4.45
Washington	8.73	3.65
Wyoming	41.21	29.90

Popularity of hunting is indexed as the number of paid hunting license holders divided by the total U.S. population.

Sources: U.S. Fish and Wildlife Service, based on data provided by state wildlife agencies and the U.S. Census Bureau. A paid license holder is one individual regardless of the number of licenses purchased. Some states do not require the purchase of a hunting license by senior citizens, youth hunters, or disabled individuals; some unprotected species of wildlife, such as prairie dogs or marmots, may be shot without a license in some states.

Several factors may be contributing to the apparent decline in the popularity of hunting in the United States, but urbanization is the factor most frequently cited. The trend toward an increasing concentration of the human population in urban areas was recognized and lamented by hunters and outdoors enthusiasts in the late 1800s. For example, Theodore Roosevelt in 1893 complained that American society was becoming too civilized and was in danger of losing the toughness—or “vigorous manliness”—that only dangerous and physically demanding experiences such as hunting could provide (Roosevelt 1900, 7–8). John Muir, on the other hand, observed that the trend toward urbanization and the “deadly apathy of luxury” had at last awakened in Americans an appreciation for nature (1901, 1). Wildlife management professionals today complain that an increasingly urbanized and suburbanized America is losing touch with nature and holds idealized notions of wildlife populations that can exist free of human intervention (e.g., Organ and Fritzell 2000), an idea supported by Kellert (1996). On the other hand, however, Kellert (1996) asserts that attitudes of rural residents are biased in another direction: these residents are more likely to value wildlife and the land primarily because of their usefulness to humans, rather than through an appreciation of their role in natural ecosystems.

Hunting is, in fact, more popular in rural populations, as indicated by the fact that rural residents are more likely to hold hunting licenses or to have hunted at least once (Duda 1993). In a regression analysis of factors associated with hunting participation, Heberlein and Thomson (1991) found that declining participation was associated with a decreasing percentage of individuals who spend their teens in rural communities, and, in general, an increasing number of people living in urban, as

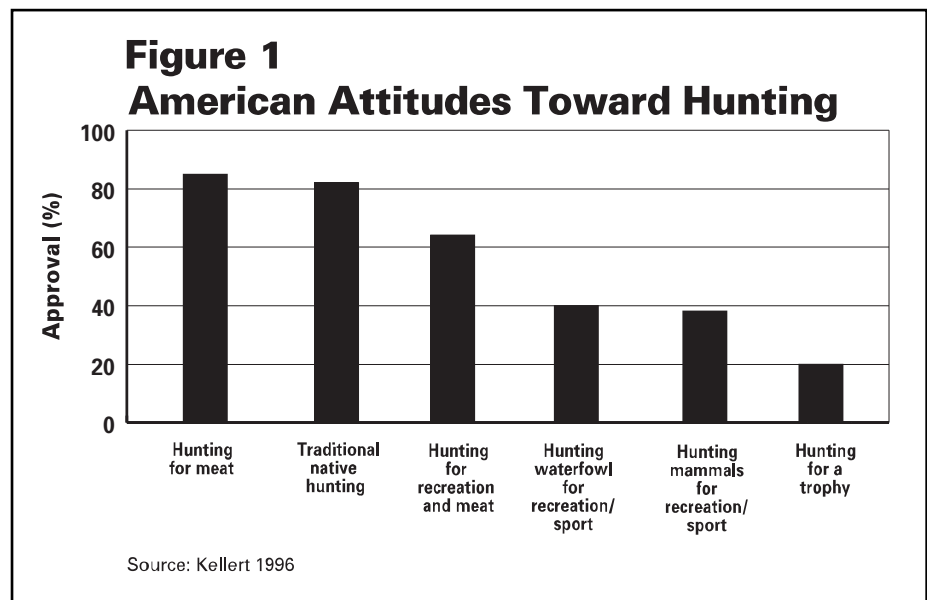
opposed to rural, settings. Other factors correlated with decreasing hunting participation included a declining percentage of the white population and increasing average education level (Heberlein and Thomson 1991). Related factors affecting declining hunting participation may include a lack of a family mentor who hunts and isolation from social systems that support hunting (e.g., Decker, Provencher, and Brown 1984; Brown et al. 1987; Applegate 1991; Organ and Fritzell 2000). Other wildlife-dependent activities, such as bird watching, appear not to be predominantly rural (McFarlane and Boxall 1996).

Public Acceptance of Hunting in the United States

Public acceptance of hunting in the United States hinges on ethical considerations such as fair chase, the perceived humaneness of the hunting method, whether hunting is conducted primarily for sport/recreation, the extent to which hunting is viewed as necessary (e.g., to resolve a human-

wildlife conflict or to provide food), and whether hunters respect laws and regulations (Duda 1993; Posewitz 1994; Kellert 1996). For example, in a survey Kellert (1988) found that more than 80 percent of the general public approves of Native American subsistence hunting as well as any hunting done exclusively to obtain meat. Hunting for sport or recreation is acceptable to most Americans (64 percent) only if the meat is used. However, 60 percent of those surveyed indicated an opposition to hunting done solely for recreation or sport, and 80 percent were opposed to trophy hunting (Figure 1). Results of other surveys have mirrored these findings, indicating that public approval of hunting is stronger when the motivation for hunting is not solely for recreation or a trophy (Bissell, Duda, and Young 1998; Minnesota Department of Natural Resources 1992).

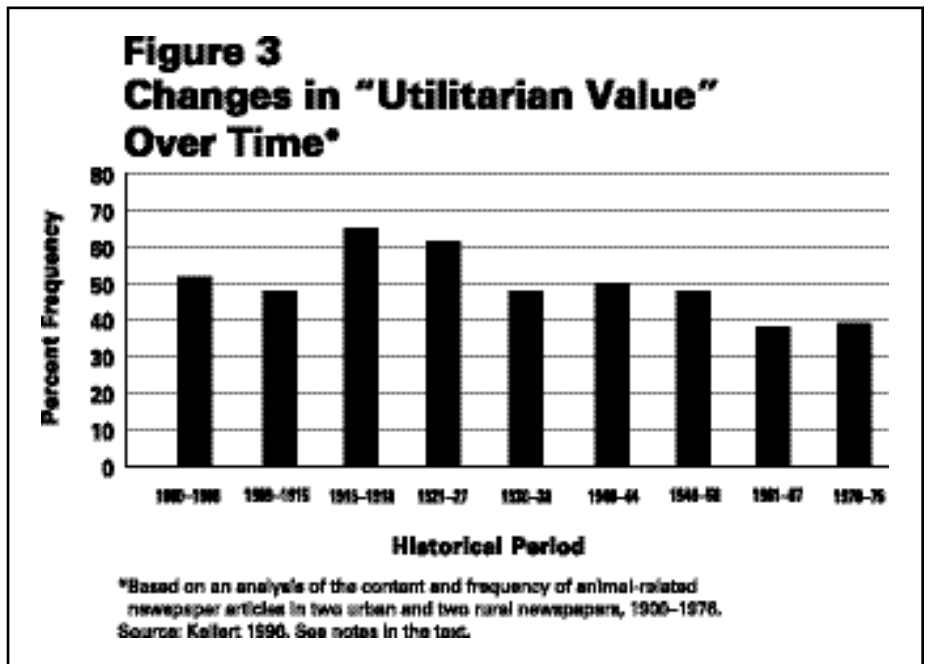
Urban vs. rural residency is correlated with public opinion on hunting in the United States (as elsewhere, see Macdonald and Johnson 2003) and with attitudes toward wildlife and other animals in general. In survey studies, Kellert (1996) found that people who own large amounts of land or reside in open country areas tend to hold a more utilitarian view toward



nature and animals compared with those who live in large cities, own little or no land, or are college-educated, and compared with younger adults. Relatively “urban-oriented” people in the United States tend to express a greater concern for the protection of wildlife and wildlife habitat, and exhibit levels of knowledge about nature that are not significantly different from those of rural residents. Similarly, Manfredo and Zinn (1996) found that urban Coloradoans are more likely than rural residents to have positive value orientations toward wildlife rights or welfare, and are less likely to value wildlife use, including hunting (Figure 2).

Perhaps because of changing demographics, the prevalence of Kellert’s (1988, 143) “utilitarian” attitude, defined as the “practical and material exploitation of nature” for the purpose of “physical sustenance/security,” appears to have declined substantially between 1900 and 1976 (Figure 3). This analysis was based on the frequency of occurrence of the utilitarian attitude in newspaper articles from two rural and two urban newspapers. Interestingly, the decline in utilitarian attitudes depicted by Kellert (1988, 1996) would be more substantial if Kellert had accounted for the fact that the proportion of the human population living in rural areas had changed from 60 percent in 1900 to 25 percent in 1976.

In addition to the urban-rural split, several researchers have found opinions of hunting in the United States that vary with age. Kellert (1996) suggests that changing values of young children may reflect, at least in part, a developmental process similar to Kohlberg’s (1984) stages of moral development in children. For example, very young children view animals in egocentric, exploitative ways. However, by age nine, children appear to “develop a conscience toward the nonhuman world, recognizing animals and nature as having the right not to be selfishly manipulated, a view



motivated by more than just the possibility of being punished for harming other creatures” (Kellert 1996, 49). Utilitarian aspects of children’s attitudes toward animals decrease by their late teens, while attitudes reflecting support for conservation or an interest in animal welfare increase.

Kellert (1996) also found that views toward wildlife differ between young

adults and older individuals. In particular, elderly Americans tend to have less interest in and affection for animals and for nature in general. Manfredo and Zinn (1996) also found differences between young adults and older age groups in Colorado: younger adults (ages 18-30) tended to view wildlife rights or welfare more positively and wildlife use (e.g., hunt-

Attitudes of U.S. Wildlife Management Professionals

Changes in both attitudes and curriculum also are evident in the professional wildlife management community. Organ and Fritzell (2000) conducted a survey of university fisheries and wildlife programs in the United States to assess changes in student interests and attitudes and in the curriculum and course content. Senior faculty members from the twelve programs responding to the survey estimated that approximately 25 percent of fisheries and wildlife program undergraduates participate in hunting. Faculty estimated that as many as 24 percent of the undergraduate students in this discipline are likely have “anti-hunting” views, though this ideology was attributed more often to fewer than 10 percent of the students. Over the past twenty years, the numbers of students who hunt were estimated to have decreased by 10 to 60 percent, while the numbers of students opposed to hunting may have increased by 30 to 50 percent. Changes in course content at the universities surveyed by Organ and Fritzell (2000) include a greater emphasis on conservation biology and rare-species conservation and reduced time devoted to harvest management. These estimates and trends are based solely on the perceptions of senior faculty members at a small number of universities and should be interpreted with caution. However, this brief survey suggests that the ethical views of students going into the wildlife management field are changing along with those of the public as a whole.

Among members of professional associations of wildlife biologists and wildlife managers in the United States, Muth et al. (1998) found that 49.4 percent considered themselves to be hunters; as one would expect, this is a much higher percentage than

ing) more negatively compared with older adults (Figure 4). Manfredo and Zinn interpreted these age-related differences in values as a generational change. Kellert (1996), however, implies that these differences may also reflect continuing moral development in adulthood. Longitudinal studies, in which the same individuals are followed for several years, will be required to determine the extent to which age-related differences in opinions toward wildlife and acceptance of hunting indicate a developmental change within an individual versus a generational change reflective of the changing values of American society.

Clearly, not all non-hunters are “anti-hunter.” However, even people who are not strictly opposed to hunting may be concerned with the suffering of individual animals that can occur as a result of hunting. Based on group interview sessions with individuals claiming to have a neutral opinion toward hunting, Rohlfing (1978) identified and ranked 115 problems associated with hunting and hunters. Of the top ten most bothersome problems, five were related to the suffering of wounded animals left to die a “slow,” “painful,” or “horrible” death. Two of the ten most bothersome problems, including the number one problem, involved hunting

accidents that kill or injure humans.

Many members of the American public are concerned with animal suffering and the unnecessary killing of wildlife, particularly if it occurs as part of a recreational activity. Some types of hunting may be viewed as more purely recreational, even if the animals killed are sometimes used for food or other purposes. Waterfowl hunting, dove hunting, varmint (or “pest”) hunting, and traditional British fox hunting from horseback (see page 119) are examples of more purely recreational forms of hunting for which justification as a form of “management” frequently is weak. Predator hunting is another practice that is less likely to be defended for population management purposes or as a way to provide food. Public attitudes toward predator hunting indicate that this practice may be viewed as less justifiable, especially when hounds are used. For example, Teel, Krannich, and Schmidt (2002) found that Utah residents showed general opposition to bear and cougar hunting. Though rural residents were less opposed than urban residents to bear and cougar hunting in general, a majority of both rural and urban residents was opposed to the use of hounds to hunt cougars and black bears.

is found in the public as a whole (see Table 2a). Surprisingly, however, only a bare majority—52.5 percent—of those surveyed agreed with the statement that “[w]ildlife and fish species are resources to be harvested in a sustainable way and used for human benefit.” This suggests that one of the foundations of the wildlife management discipline (Leopold 1933) has not prevailed in the seventy years or so since its establishment. Organ and Fritzell (2000) cite unpublished data suggesting that wildlife managers who had been in the profession for five years or fewer are much less likely to support consumptive uses of wildlife (e.g., hunting, trapping, and fishing) compared with veterans of twenty years or more. Thus, individuals now entering the wildlife management discipline in the United States appear to represent a change in ethical views. This shift may be reflected in growing consideration for the humaneness of management actions and for management actions that benefit non-game species.

Divisions Among U.S. Hunters

In 1913 Theodore Roosevelt identified three groups of people concerned with wildlife conservation: “the true sportsman, the nature-lover,” and “the humanitarian” (Roosevelt 1913, 161). Today these categories may still approximate, respectively, the subset of hunters concerned with conservation; non-hunting conservationists such as bird watchers; and animal protectionists. However, the distinctions among these categories often are blurred and each could be further subdivided. For example, only some hunters actively participate in conservation, beyond the now-involuntary contributions to wildlife conservation through the purchase of licenses or equipment (Holsman 2000). Bird watchers and other naturalists may be hunters or may lean more toward an animal welfare or animal rights

philosophy. Finally, there is a growing number of people who consider themselves to be both animal protectionists and conservationists.

Divisions among hunters in terms of their concern for conservation, animal welfare, or other ethical considerations have certainly existed since the late 1800s and early 1900s. Mighetto (1991) provides several illustrations of interpersonal differences among hunters. For example, one may contrast Roosevelt’s writings, which focused on the excitement of pursuit and of the kill, with those of Ernest Thompson Seton. Roosevelt particularly relished hunting dangerous predators and, in general, revealed through his writings a “streak of bloodthirstiness” (Mighetto 1991). Seton was also a hunter, but in his writings, such as *Wild Animals I Have Known*, he portrayed animals as individuals and showed concern for their suffering, in part by using anthropomorphism as a literary device. Another contrast can be seen between Aldo Leopold and those hunters who vexed him through their increasing dependence on “gadgets” as a means of facilitating hunting (Leopold 1966, originally 1949). Interestingly, Leopold started off with a Rooseveltian disrespect for wolves and other predators; his attitude toward wolves later changed with his realization of the important role of predators in an ecosystem (Leopold 1966).

More recently, several authors have attempted to differentiate types or subgroups of hunters based on different motivations for hunting and/or the degree of specialization (Duda 1993). Kellert (1980, 1996) characterizes the attitudes and values of three main types of hunters. “Nature hunters” include those who emulate Aldo Leopold in their desire to be a part of nature, filling a role that they consider to be much like that of a nonhuman predator. Nature hunters include a greater proportion of women compared with other categories and are, on average, more likely to be college educated and to engage in non-consumptive wildlife activities such as wildlife watching or hiking (Kellert

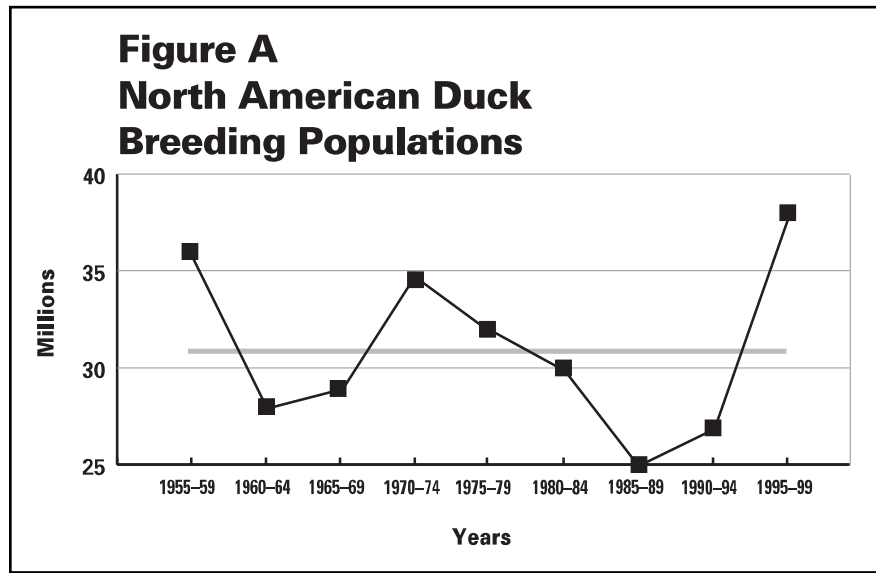
1980). Kellert (1996) estimates that nature hunters make up 10 to 20 percent of all hunters in the United States. Another category, “meat hunters,” includes those whose primary motivation for hunting is obtaining food. These hunters are more likely than nature hunters to be older and male and to live in rural areas. Meat hunters, according to Kellert (1996), make up around 40 percent of all hunters. Of course, most of Kellert’s meat hunters are not true subsistence hunters in that they do not depend upon meat obtained in this way to survive. It is conceivable that some meat hunters use the meat of the animals they kill as a source of protein in much the same way that they would use farm animals; however, it is likely that the use of wild meat as a substitute for farm animals is decreasing in the United States. Finally, “sport hunters,” who account for around one-third of all hunters, hunt primarily for recreation rather than for food or to be close to nature. These hunters primarily cite reasons for hunting that are related to social companionship and a chance for competition. Sport hunters differ from nature hunters in that they tend not to have exceptional knowledge regarding wildlife. Moreover, unlike meat hunters, they are less concerned for the usefulness of the animals they kill (e.g., for meat). Hunting purely to obtain a trophy is included in this category (Kellert 1980; Kellert 1996). Other studies have generally supported these or similar categorizations (e.g., Brown et al. 1987; Allen 1988; but see Causey 1989). Some authors suggest that a temporal progression often occurs in a given individual’s motives for hunting that essentially leads from a sport hunter perspective to one of a nature hunter (e.g., Decker et al. 1987). Others suggest that, when changes in attitude occur over a hunter’s lifetime, this often can be characterized as an increase in specialization, in terms of either the species hunted or the hunting method employed (e.g., Bryan 1979; Ditton, Loomis, and Choi 1992). Some of the more specialized

Data and Observations on Duck Hunting in the United States

For nearly a century, wildlife managers have pointed to waterfowl conservation, an ambitious effort designed to preserve an abundance of ducks across the length and breadth of a continent, as the crown jewel of North American wildlife management.

It began in 1916 with the signing of the North American Migratory Bird Treaty between the United States and Canada. A second treaty with Mexico in 1936 extended these protections south of the Rio Grande. This allowed each North American nation to ban the commercial sale of wild waterfowl and restrict the sport kill to prevent over-shooting.

A second initiative began in the 1930s when severe drought seized the northern prairies, the major breeding ground of North America's continental flocks. Duck populations plummeted. This prompted a drive to protect breeding wetlands in both the northern United States and prairie Canada. Protection of breeding grounds was



accompanied by the establishment of waterfowl refuges across the middle and southern United States to provide wintering habitat and give ducks a measure of protection from hunters. The protection was accomplished via both public and private efforts that continue to this day.

But it was not until the latter half of the twentieth century that the focus shifted to attempts to develop a scientific management approach, based on data collection and mathematical analysis.

The 1950s witnessed the first continental surveys of the breeding and wintering grounds. The breeding grounds extend from South Dakota northward

Figure A. The number of ducks counted each spring across the North American waterfowl breeding grounds has remained essentially stable during the years 1955–2000, as shown by the solid trend line. The populations are five-year averages (Wilkins and Otto 2002).

across the Canadian Prairie provinces and boreal forest to the Beaufort Sea. The wintering grounds extend across the middle latitude and southern United States into Mexico.

These surveys were (and are still today) unprecedented in scope. Although they are still incomplete, they represent the longest-running continental wildlife surveys in the world. The breeding-ground survey tallies eleven species—mallards, northern pintails, gadwalls, shovelers, wigeon, green-winged teal, blue-winged teal, canvasbacks, redheads, and scaup (both lesser and greater). The survey data are the basis for the government analysis used to judge whether populations are

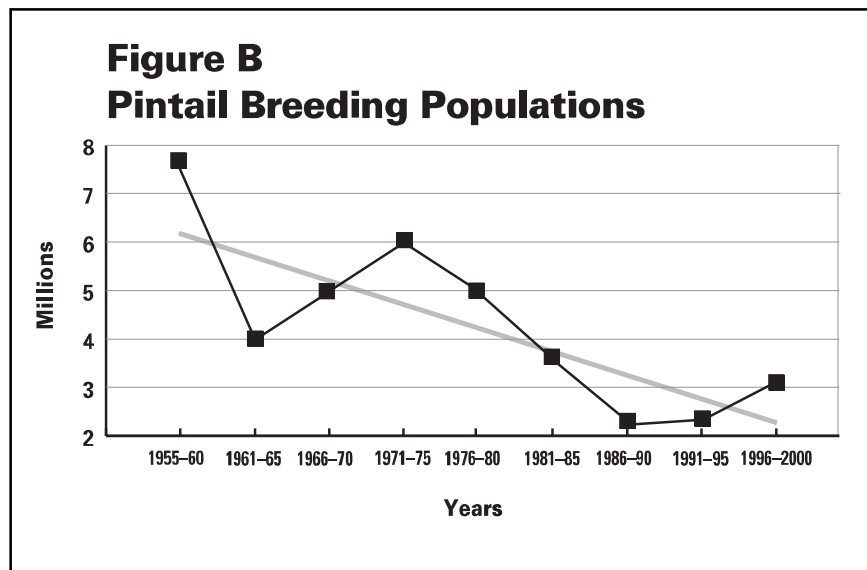


Figure B. The northern pintail, once the second most abundant North American duck, has dropped from an average population of 7.4 million in 1955–1960 to 3.0 million in 1996–2000, a 59 percent decline according to the plotted trend line (Wilkins and Otto 2002).

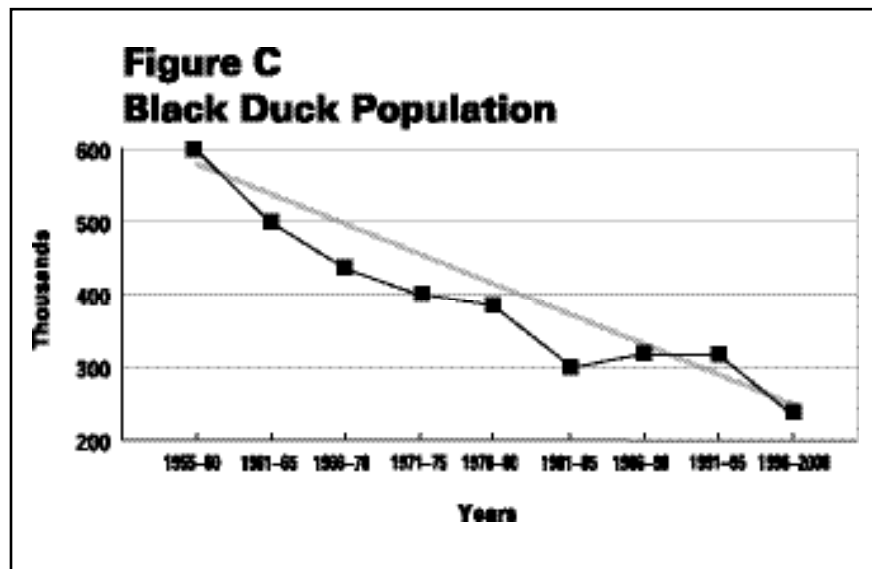


Figure C.

Wintering-ground surveys disclose that the average number of black ducks has fallen from 603,000 in 1955–1960 to 274,000 in 1996–2000, a decline of 56 percent (Fronczak 2002).

breeding-ground survey suggests that, despite weather-related population fluctuations, the overall numbers of ducks have remained essentially stable in the past half-century.

Critics argue that the monolithic “total-duck” argument avoids the central issue of whether wildlife managers have really learned how to manipulate waterfowl populations. They point to declining numbers of those species most prized by hunters—northern pintails, black ducks, scaup, and mallards—as evidence that management is not achieving what it claims. Some indication of the trend line for duck populations from the late 1800s through the early 1900s might have helped support or refute management claims. Unfortunately, no data are available prior to the 1950s.

Two primary causes for the pintail’s losses are given by wildlife managers—the loss of short-grass prairie nesting habitat on the western plains and over-shooting, especially in recent years.

Unlike prairie-nesting species, the black duck has not suffered extensive loss of its eastern-forest nesting habitat. Its decline is attributed largely to

increasing or decreasing.

In 1961 biologists began gathering additional data designed to give them greater insight into the population dynamics of various species. These data include counts of nesting potholes on the northern-prairie breeding grounds; age-ratios of ducks taken by hunters (which index annual reproductive success); numbers of hunters; and the number of each species killed by hunters. In addition, a number of ducks each year are captured and fitted with leg bands. When hunters return these bands, the data are used for statistical estimates of annual mortality from natural causes (disease, predation, etc.) and sport hunting.

These data are designed to allow biologists to create a population model that will allow waterfowl managers to predict and control numbers of ducks. They permit wildfowl managers to make decisions, largely based on chang-

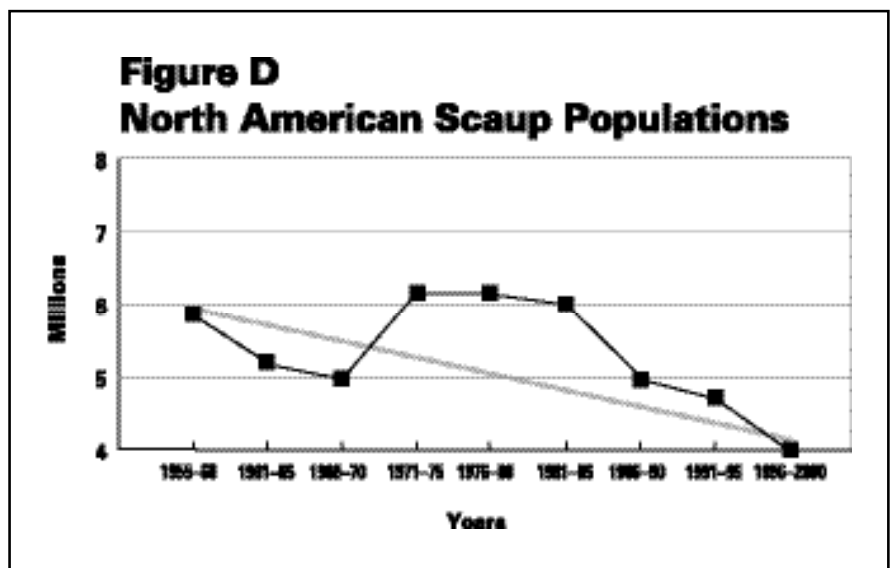
ing hunting regulations, that should lead to an increase in the breeding population of a species in decline or to a reduction in the numbers of an overabundant species.

However, the enormous amounts of data have not yet led to a general agreement on what determines spring breeding success and whether changing hunting regulations have any significant impact (see Grandy 1983).

Those who assert that waterfowl management has succeeded in maintaining an abundance of waterfowl cite as evidence the overall breeding-ground counts. A look at the average numbers of all species counted during the spring

Figure D.

Biologists remain baffled over the decline of scaup, medium-sized diving ducks whose populations have dropped from an average of 6.4 million in the period 1976–1980 to 4 million in the period 1995–2000, a decline of 38 percent (Wilkins and Otto 2002). The primary cause of their decline remains unknown, although some believe over-shooting in the 1970s and early 1980s played a significant role (Allen et al. 1999).



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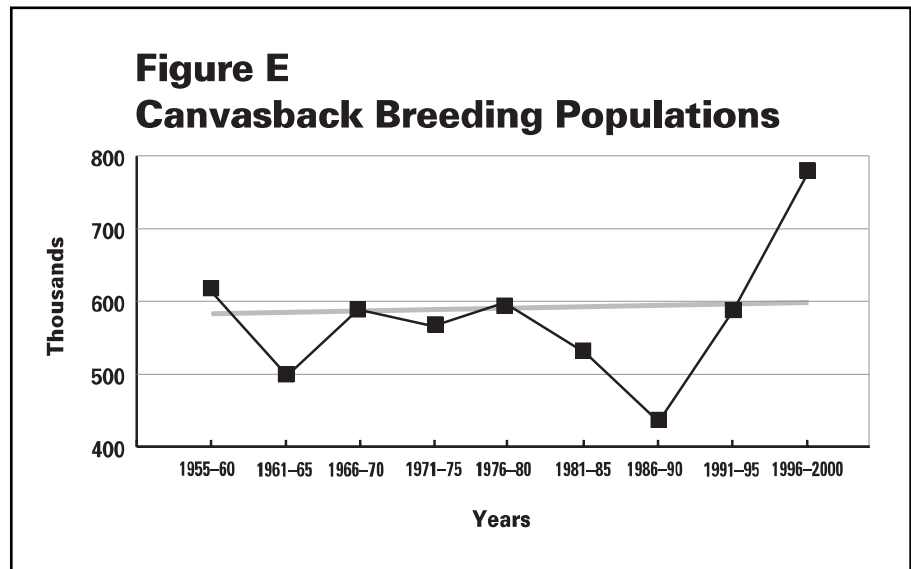
over-shooting, although some argue that mallards have displaced black ducks from portions of their range.

Restrictive hunting regulations have been imposed for nearly a quarter-century, but these restrictions have not allowed the species to rebuild its numbers. In recent years, in spite of the low population levels, hunting regulations have been liberalized, permitting an even greater kill of black ducks by hunters. A detailed analysis and critique are provided in Grandy (1983).

The remaining species—gadwall, shovelers, wigeon, green-winged teal, and blue-winged teal—make up approximately another 12 million wild-fowl but have not been subjected to much analysis.

Half a century of data collection and associated scientific analysis does not appear to have brought the authorities much closer to their goal of understanding the factors affecting duck populations.

The debates continue unabated. Some blame the loss or degradation of northern-prairie breeding habitat. However, no study has shown that all avail-



able nesting habitat for any species is filled to capacity. Indeed, the evidence suggests—and several studies have found—that there is more habitat than ducks to occupy it, especially for mallards and pintails (Bethke and Nudds 1995). However, few studies have attempted to determine the carrying capacity of available nesting habitat in the northern prairies or whether carry-

Figure E.

The beleaguered canvasback, once the most celebrated duck in North America, has so far not responded to a forty-year effort to increase its breeding numbers, although the last ten years have produced an upward trend. This increase may not continue because hunting of this species was closed in the 2002 season when breeding numbers dropped to 487,000 (Wilkins and Otto 2002).

hunters may include those who come to rely on those gadgets to which Leopold (1966) was so opposed (Peyton 2000), which would seem to disqualify them from the ranks of nature hunters.

Evidence of the divisions among general types of hunters also has been manifested in criticisms directed toward hunters by their peers, or by other writers who generally support hunting. For example, Williams (1986) sharply criticizes hunters who shoot the pheasants who are raised in captivity and released by state wildlife agencies to provide a put-and-take (i.e., release and kill) recreational hunting opportunity. Williams questions the ethic—on the part of both the pheasant shooters and the wildlife managers—in promoting this artificial type of hunting experience involving the killing of half-tame non-native

birds, sometimes within forty-eight hours of their release. Other authors have expressed concern over the ethics of some hunting activities, and what the activities mean for the future of what they consider legitimate forms of hunting. Peyton (2000, 777), for example, criticized some hunters' "overzealous attitudes toward wildlife as a crop," such as those individuals who frequent game farms that resemble a "barnyard" more than a hunting opportunity.

Similarly, Peyton states that landowners in Michigan (and elsewhere) who feed free-ranging deer have essentially created game farms without fences. Varmint hunters, who shoot ground squirrels, prairie dogs, and other rodents, often purely for sport, are sometimes viewed by other types of hunters as "wasteful" or otherwise unethical. Teel, Krannich, and

Schmidt (2002) found that, although a majority of Utah hunters approve of cougar and black bear hunting (66 percent and 57 percent approval, respectively), most hunters (64 percent) disapprove of the practice of bear baiting. This study also indicates that a surprising number of hunters in Utah have negative views toward the use of hounds to hunt predators: one-third of Utah hunters disapprove of the use of hounds to hunt cougars and nearly half oppose the use of hounds to hunt black bears.

In a similar vein, some authors assert that hunters often display opinions and behaviors that are not in the best interests of conservation or the environment, despite the prevailing claim to the contrary by modern-day hunters. In particular, Holsman (2000) reviews several studies from the 1990s indicating that hunters at

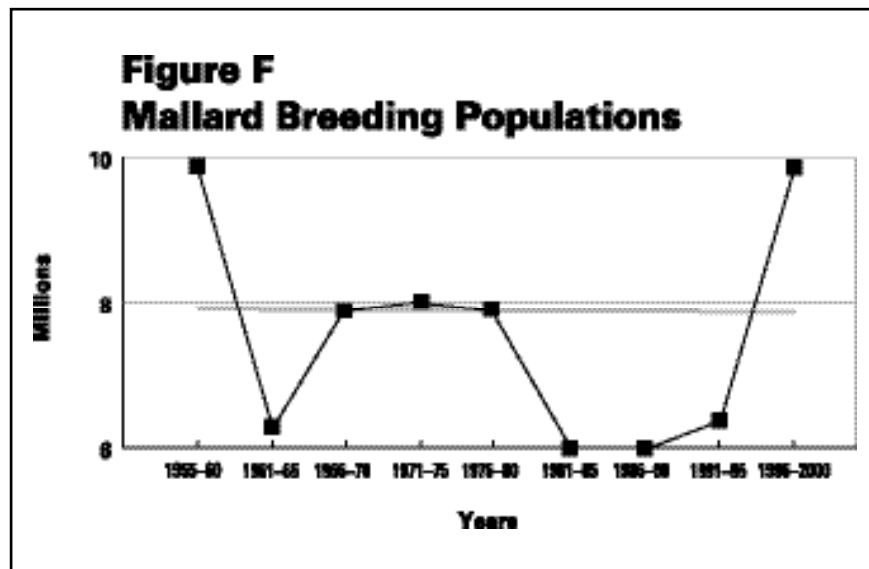


Figure F.

The population of the mallard, North America's most abundant and adaptable duck, has essentially been stable over the last fifty years (Wilkins and Otto 2002). The data indicate that mallards are holding their own in the face of heavy shooting pressures and agricultural degradation of the northern-prairie breeding grounds.

ing capacity in this region has been reached.

Some blame increasing predation on nests and nesting hens for the failure of some species to rebuild their numbers. But losses to natural predators generally affect only duck populations that are declining for other reasons, such as over-hunting or habitat loss (Côté and Sutherland 1997). These losses may be

alleviated by reducing the kill of hens by human hunters but, to date, this has been attempted only for the mallard.

The data represent a continuing challenge for wildlife management and modern-day duck hunting in the United States. Regulators have long since concluded that duck hunters will not go "afield" (i.e., to shoot) if they are unable to shoot enough ducks to make it worth

their while. Therefore, in most areas, hunters can kill a "basic bag" of six ducks. To that they can add up to five mergansers ("fish-eating" ducks) and fifteen coots. However, mergansers and coots are rarely if ever eaten (one of the justifications given for duck shooting).

The data gathered over the past fifty years continue to challenge the assumptions and premises upon which wildfowl management is based. For those who appreciate the beauty of ducks and the joy of watching them undisturbed, modern waterwildfowl management is, to date, more of a failure than a success.

—John W. Grandy

that time were among those *least* likely to support conservation of biodiversity or an emphasis on management of endangered species; according to these studies, hunters also were least likely to engage in environmentally responsible behaviors. Williams (1986) and Holsman (2000) both cite examples of hunters and hunters' associations opposing attempts to restore native wildlife to regions from which they have been extirpated, especially wolves and other predators. More recently the U.S. Sportsmen's Alliance has opposed efforts to end bear baiting and to restrict the release of pen-raised non-native pheasants.

Other outdoor recreation enthusiasts, such as bird watchers, may be more likely to support such goals, either by volunteering their time or through financial contributions

(Theodori, Luloff, and Willits 1998; see also McFarlane and Boxall 1996 for evidence of bird watchers' willingness to contribute to conservation). Wildlife protection advocates also are demonstrating their willingness to protect habitat. For example The Humane Society of the United States Wildlife Land Trust, an affiliate of The HSUS, has grown steadily since its inception in 1993 to encompass sixty thousand acres in twenty one U.S. states and four countries outside of the United States. The Wildlife Land Trust is one of a growing number of organizations that seek to protect wildlife, not only through habitat protection but also by prohibiting hunting and trapping in protected sanctuaries.

Hunting and Shooting in the United Kingdom

"Hunting" versus "Shooting"

In the United Kingdom, the term *hunting* generally refers to the use of dogs—hounds, fast coursing dogs, and sometimes terriers—in a hunt; it does not include the use of retrieving dogs or pointers, which neither pursue nor kill the quarry. Typically hounds chase the fox, deer, hare, or other animal and humans follow on horseback, on foot, or in vehicles. The term *shooting*, on the other hand, is used in the United Kingdom to

describe the use of a rifle or shotgun to kill foxes, deer, or other animals and does not involve the use of dogs for pursuit.

In the case of fox hunting as defined above, despite wide variation, the average pursuit lasts half an hour (Macdonald and Johnson 1996; Masters of Foxhounds Association [MFHA] 2000), and about 75 percent of foxes found during a mounted hunt evade capture (n=149 hunts, data, 1990–1996). On average, 64 percent of fox kills are made by the hounds. In 30 to 40 percent of cases where a fox is killed (by any means) during a mounted hunt, a terrier is used either to kill the fox underground or to locate it or flush it out so it can be killed by hounds or shot. In the United Kingdom, packs of foxhounds, occupying largely non-overlapping territories, are registered with the Masters of Foxhounds Association. In common British usage, each of these is referred to as a *Hunt*. (The proper noun distinguishes these organizations from a *hunt*, the common noun referring to a particular chase. Internationally, this usage can be ambiguous, so here we refer to each “club”—a word that itself would have different connotations in this context in Great Britain—as a “pack of foxhounds.”) However there is enormous variation among packs of foxhounds: some dig out no foxes, while in others up to 86 percent of fox kills are dug out by terriers, having gone underground after being pursued (Macdonald et al. 2000). Digging to reach the fox and/or fighting between fox and terrier underground may last from ten minutes to three hours (Phelps, Allen, and Harrop 1997). This activity is not considered to be part of hunting “proper.” From an anthropological perspective, at “this point hunting has ceased and vermin control takes over” (Marvin 2000, 195). Indeed, MFHA rules stipulate that those out hunting may not participate in digging to reach a fox.

In a deer hunt, the average overall time for a deer to be successfully hunted, brought to bay, and killed is around three hours, though hunts

can go on for up to six hours (Bateson 1997). More than 80 percent of hinds are pregnant during the hind hunting season (Langbein 1997); the extent of abortions among hinds that escape the hounds is not known. More than half of the deer roused and hunted escape without being brought to bay (Masters of Deerhounds Association 2000). Once the deer has been brought to bay or has stopped running and attempting to escape, it normally is killed by a shot at close quarters with a modified shotgun, pistol, or, under some circumstances, a humane killer (a captive bolt pistol used from extremely short range). Stag hounds are trained to surround the deer and bark at the end of the hunt, and should not attack or savage the deer, although Bradshaw and Bateson (2000) report attacks by dogs in one out of four deer kills observed. Hunting deer to hounds is now restricted almost entirely to one small part of England lying within West Somerset and North Devon.

Hares are hunted with dogs either using packs of hounds, or by coursing in competitions or on an ad hoc basis. With packs of hounds, a hunt usually lasts for an hour to an hour and a half, and only an estimated 5 percent of hares sighted are killed (Association of Masters of Harriers and Beagles 2000). During organized competition coursing, dogs are not released until the hare is at least 80 meters away; the hare must be “in a fit condition”; nothing must hinder the hare’s escape; and it must have “sufficient knowledge” of the ground (National Coursing Club 2000). An average greyhound course lasts 35 to 40 seconds, and an average of 13 percent of the hares chased are killed, either by the dogs or by human “pickers-up,” the latter of whom have a duty to ensure that hares are killed quickly and humanely (National Coursing Club 2000). There are no data on the extent or nature of ad hoc coursing, which often is associated with illegal gambling and use of land without the owner’s permission.

Although it has attracted a much lower level of public controversy than

has hunting with dogs in the United Kingdom, and access to guns is regulated heavily, shooting is widespread and is probably the predominant means of wildlife culling (Macdonald et al. 2000). Shooting by stalking with a rifle or large bore shotgun is the most common method used to cull deer in England and Wales, as well as in Scotland and Northern Ireland (British Association for Shooting and Conservation 2000; British Deer Society 2000). Shooting, particularly as part of organized Deer Management Groups (groups of adjoining landholders coordinating their deer management), is the method of deer control recommended by government (MAFF 2000). From its 1996 survey, the British Association for Shooting and Conservation (BASC) estimated that 10,000 of its members were active deer stalkers. Of these, 87.6 percent (8,700) were “recreational” stalkers, and 12.4 percent (1,300) were “professional” deer stalkers who accounted for 40 percent of the total deer cull.

One part of the debate surrounding the hunting of foxes with dogs in the United Kingdom is whether it is more or less humane than shooting. Supporters of hunting argue that shooting leaves wounded foxes to die long, lingering deaths and that shooting would necessarily increase should hunting be banned. An alternative view is that foxes killed by shooting die quickly and painlessly, without the distress of the chase and capture. Foxes are shot mainly either at night with a spotlight and rifle (known as “lamping”) or during the day by groups or individuals, sometimes at the cubbing den (or “earth”). Gun packs and shooting at earths may combine shooting with the use of dogs to find, bolt, or flush out foxes. Research commissioned by the All Party Parliamentary Middle Way Group (Fox et al. 2003) formed the first experimental attempt to address the humaneness of shooting foxes. The research used colored cut-out fox silhouettes as targets to assess the penetration, kill rate, and wounding rate of fifty-one different shooting

Table 3
Responses of Urban Dwellers and Farmers Regarding
the Acceptance and Need for Fox Control

Questions	Urban Respondents (percent in agreement)	Rural Respondents (percent in agreement)
Where do foxes need to be controlled?		
In the country?	47.7	73.9
In towns?	61.9	70.7
Why do foxes need to be controlled?		
To control disease?	56.6	45.7
To protect livestock?	48.7	67.6
To protect game species?	14.4	44.5
Foxes too numerous	21.1	65.1
Do you approve of fox control for these reasons?		
To improve shooting?	6.7	42.0
For pelts?	3.3	16.8
For sport with hounds?	11.8	68.4
Do you approve of active conservation of foxes?	46.0	19.3

Source: Macdonald and Newdick (1978). Results are based on a questionnaire distributed to 14,000 households in Oxford, England, of which 3,468 (26 percent) were returned the following day. The differences between urban and rural respondents were statistically significant overall: $\chi^2_{(1)} > 23$, $P < 0.0001$.

regimes, including different shot sizes and user competencies. Fox wounding rates increased significantly when No. 6 shot was used in shotguns, due to poor penetration, but the use of BB shot minimized wounding rates. Experienced shooters using correctly zeroed rifles achieved a high kill rate. While studies such as this can point to ways of making culling more humane, it remains extremely difficult to compare different types of suffering. Welfare science is advancing rapidly in this respect; for example, McLaren et al. (in press) have recently described a measure of stress based on leucocyte competency that can provide rapid results in the field.

Attitudes toward Hunting/Shooting in the United Kingdom

There have been few studies examining attitudes of either the general public or landowners toward hunting and shooting. Those that do exist have occurred largely in response to public concern over mounted fox-hunting, therefore this section focus-

es largely on culling of foxes, the most abundant mammalian carnivore in the United Kingdom. Although both include a significant element of sport, hunting and shooting in the United Kingdom often are justified in terms of their contribution to pest control (Burns et al. 2000). When questioned, however, neither farmers nor members of the public necessarily consider either method—especially hunting with dogs—to be acceptable or effective for wildlife damage reduction or sport.

For example, in a public opinion poll of 801 adults throughout Great Britain regarding fox hunting, 63 percent of respondents either supported or strongly supported a ban on hunting foxes with dogs. Most people (69 percent) disagreed with the statement that fox hunting is a necessary means of preserving the balance of wildlife in the countryside; more rural (39 percent) than urban (20 percent) respondents considered fox hunting to be necessary (Macdonald et al. 2000). As in the United States, urban residents appear less likely than farmers to find culling of foxes by any

method to be acceptable. In a questionnaire-based study, Macdonald and Newdick (1982) found that urban dwellers were much less likely to state that foxes needed to be controlled and were less likely to state that any of the listed motives for culling was acceptable (Table 3). Urban dwellers were also more likely to approve of the active conservation of foxes. Upbringing appears to play a role in attitudes toward fox hunting and other forms of fox control: respondents raised in the country were significantly more likely to favor fox control in the countryside (53 percent) than were those brought up in the city (46 percent).

Baker and Macdonald (2000) asked farmers in the county of Wiltshire to say which, among a list of non-exclusive options, were their principal motivations for hunting. All respondents opted for “recreation,” while 55 percent said “to control foxes as a pest.” Farmers’ perceptions and practice of hunting and shooting are likely to be colored by the extent to which they consider target species to be a pest, the extent to which they

Table 4
Farmers' Attitudes toward Hunting on Their Land, according to Enterprise, "Pest" Status, whether Gameshooting Took Place, or the Farmer Himself Hunted¹

	Encourage Hunting	Tolerate Hunting	Discourage Hunting	Disallow Hunting	
All Farms (n=97)	30.9	50.5	12.4	6.2	
Dairy (n=63) N.S.	23.8	55.6	14.3	6.4	
Non-Dairy Stock (n=13)	53.9	30.8	7.7	7.7	N.S.
Mixed (n=16)	31.3	50.0	12.5	6.3	
Arable (n=5)	60.0	40.0	0.0	0.0	
"Pest" Farms ² (n=25)	40.0	56.0	4.0	0.0	X ² =4.68
"Non-Pest" Farms (n=52)	26.9	50.0	17.3	5.8	P=0.094
Game-shooting Farms (n=31)	41.9	48.4	9.7	0.0	X ² =3.76
Non-Game-shooting Farms (n=66)	25.8	51.5	13.6	9.1	P=0.052
Hunting Farmer (n=12)	66.7	33.3	0.0	0.0	Fisher's Exact, P=0.036
Non-Hunting Farmer (n=63)	23.8	55.5	15.9	4.8	

Numbers shown are percentages of farmers who encouraged, tolerated, discouraged, or disallowed hunting.

¹Some farms comprised Council Farms on which the farmer surveyed was a tenant and may not have had control over whether or not hunting occurred on his land.

²Pest status indicates whether a given farmer considered the fox to be a pest.

Source: Baker and Macdonald (2000)

themselves hunt or shoot for sport, and the extent to which they believe a method to be humane and effective for pest control (Macdonald and Johnson 2002).

Mounted fox hunting occurs over about two-thirds of England and Wales (Macdonald et al. 2000), but a farmer allowing hunting on his land does not necessarily see it as part of a strategy for fox control. For example, in the English county of Wiltshire, only 31 percent of farmers encouraged the hunt; 6 percent did not allow it and 63 percent "tolerated" or "discouraged" it (Table 4) (Baker and Macdonald 2000). The high proportion of tenant farmers, and the retention of sporting rights (Parkes and Thornley 1994) by the local authority (Wiltshire County Farms Estate), may create this complex situation in Wilt-

shire. In 1995 the sporting rights on 88 (73 percent) of the local authority's 120 farms had been retained by the local authority, and fox hunting was automatically permitted regardless of the farmer's wishes. In a questionnaire survey of gamekeepers, slightly fewer than half (48 percent) of 203 respondents (persons employed on shooting estates) cited hunting with dogs as one of the methods they used to cull foxes (National Gamekeepers' Organisation 2000). Arable farmers (those who raise food crops but not livestock) are less likely than those with game birds or livestock, especially more vulnerable animals such as chickens, to consider the fox a pest on their farm, although most farmers consider the fox to be a pest in the wider sense (Baker and Macdonald 2000; Heydon and

Reynolds 2000a).

Two questionnaire surveys, one covering 859 farmers from ten regions in England in 1981 (Macdonald and Johnson 1996) and the other covering 72 farmers in Wiltshire in 1995 (Baker and Macdonald 2000), have assessed whether farmers believe different methods of fox control are "humane." In both surveys and all regions, shooting was consistently considered the most humane method of fox control (69 percent overall in 1981, 58 percent in 1995; Table 5); in 1995 49 percent considered it effective as well as humane. In 1981 a high proportion of farmers believed both hunting with hounds (55 percent overall), and gassing (49 percent) to be humane; in Wiltshire in 1995, however, only 29 percent believed gassing was humane, although more than half

still thought hunting with hounds humane. Macdonald et al. (2000) investigated whether these farmers' judgments regarding the humaneness of different methods, and the justification of different motives, were influenced by damage they had sustained that they attributed to foxes, and by the field sports in which they participated. In Wiltshire the proportion of farmers who considered each method to be humane did not vary significantly from the proportion who had, and had not, designated the fox a pest on their farms (Baker and Macdonald 2000). However, more farmers reporting actual stock loss to foxes in the previous year said hunting was humane compared with those who did not. This contrasts with findings in 1981 (Macdonald and Johnson 1996), which suggested that farmers were more likely to think shooting, snaring, poisoning, or the use of terriers humane if they had suffered losses to foxes, but that their opinions of hunting and gassing were not affected. The differences between these studies could reflect regional variation,

changes since 1980, or the smaller sample size in the Wiltshire study.

According to 1981 data, farmers who reported that they had sustained damage by foxes were more likely to say that killing foxes to improve pheasant shooting or for fur were acceptable motives (Table 6). Damage had no effect on the likelihood of farmers approving the active conservation of foxes. Hunting farmers were less likely to say that shooting and gassing were humane and more likely to state that digging with terriers was humane. Paradoxically, farmers who considered hunting to be a form of pest control were also more likely to approve of the active conservation of foxes. This may be because hunting farmers are more likely both to cite pest control as a rationale for the sport and to want foxes to persist in the locality of a pack of foxhounds.

In the United Kingdom as a whole, 75 percent of farmers (including those who did not consider foxes a problem on their farms) said they would instruct their member of Parliament (M.P.) to vote for "no

change" in the legislation governing fox hunting (Produce Studies, Ltd. 1995; n = 831); 11 percent said they would instruct their M.P. to vote for a ban on foxhunting; while 14 percent held no strong view. Regionally, those in favor of no change varied between 86 percent (southwest England) and 56 percent (Scotland). Those in favor of a ban varied between 6 percent (southwest England) and 26 percent (Scotland).

Hunting/Shooting and Wildlife Damage Reduction

The motives for culling wildlife in the United Kingdom are not always clear-cut, and different groups of people take contrasting views on the desirability of certain motivations. For example, the only way to prevent local extinction of some populations of water voles, a species native to Britain, is to remove (de facto, to kill) American mink, an introduced species. Conservationists may see this as a regrettable necessity, whereas

Table 5
Percentage of English Farmers Replying "Yes"
When Asked Whether They Believed a Method
Was Effective or Humane in Controlling Foxes

Control Methods	Wiltshire County (1995 study) n=72, except hunting and snaring, n=71		10 Regions in England (1981 study) n=859	
	Effective	Humane	Effective	Humane
Shooting	62.5	58.3	68.8	68.8
Hunting	54.9	52.1	43.7	54.8
Gassing ¹	38.9	29.2	61.0	49.2
Poisoning ¹	22.2	8.3	41.2	8.3
Terriers/digging	19.4	9.7	34.2	23.0
Snaring	7.0	1.4	39.1	13.2

Adapted from Baker and Macdonald (2000); Macdonald and Johnson (2000, 2003).

¹Gassing was made illegal in 1987, poisoning in 1963.

Table 6
The Effect of Fox Damage and Hunting Participation on
the Perceived Humaneness of Different Control Methods

	Fox Damage?		Farmer Hunts?		Farmer Shoots?	
	No	Yes	No	Yes	No	Yes
Motive						
Protect pheasants	35.3	56.5	43.8	39.5	22.9	62.8
For fur	12.8	25.1	18.9	12.2	12.7	22.1
Humaneness						
Shooting	70.7	77.3	80.5	59.1	76.4	77.4
Gassing	48.8	62.0	59.9	38.7	56.6	64.1
Snaring	9.1	24.6	14.3	13.4	11.4	18.3
Hunting	59.0	59.3	41.4	91.2	44.0	44.0
Poisoning	17.4	32.6	24.2	36.5	24.2	28.9
Terriers	21.2	34.8	19.1	36.5	21.3	36.1

Percentage of respondents approving of the motive or stating that the control method is humane

welfarists may not. Another recent example in the United Kingdom is the proposed cull of introduced hedgehogs from Scottish islands where they threaten endangered seabirds. In general, however, the two major reasons people hunt or shoot in the United Kingdom are, first, to control wild mammal populations that are believed to damage livestock, game birds, or crops and, second, for sport (Macdonald et al. 2000). Conflicting management aims therefore arise, particularly for species such as hares and some deer, which are simultaneously considered pests, game species, and quarry, and are of conservation concern.

Although damage reduction is a frequently cited motive and justification for hunting and shooting in the United Kingdom, there are few comparative assessments of the effectiveness of different control methods in the literature for any mammalian species. Assessing effectiveness is complicated by a lack of data pertaining to cull levels (as there is no obligation to report numbers killed) and to population sizes (monitoring is largely absent or rudimentary); by the lack of coherent management goals and strategies over areas larger than

individual estates or farms; and by the fundamental difficulty in assessing the extent of damage attributable to any one species. Nevertheless such studies as there are for foxes have generally found that the population impact of hunting and shooting is small (Phillips et al. 1972; Hewson and Kolb 1973; Storm et al. 1976; Harris 1977; Macdonald 1980; Hewson 1986; Voigt 1987; Wandeler 1988; Baker, Harris, and Webbon 2002), though, in some upland areas of the United Kingdom, hunting may contribute more substantially to fox mortality (Heydon and Reynolds 2000a,b). Macdonald et al. (2000) estimated that registered mounted foxhunts, together with upland foot and gun packs, probably take a cull in the region of 21,500 to 25,000; this represents perhaps 4 percent of annual fox mortality in the United Kingdom. There are no U.K.-wide data regarding numbers of any mammal shot. However in three regions of England, the proportion of the fox cull taken by methods involving shooting was 46 percent, 62 percent, and 68 percent, in mid-Wales, east Midlands, and west Norfolk, respectively, while that taken by methods involving dogs (some of which also

involved shooting) was 73 percent, 18 percent, and 11 percent for the same three regions, respectively (Heydon and Reynolds 2000a,b; Heydon, Reynolds, and Short 2000). Attempts to model the effects of hunting with hounds further suggest that this method, by itself, has little impact on the abundance of foxes at a national or regional level. Shooting is more likely to effectively reduce populations regionally, provided that it takes place over a high proportion of the region (Macdonald et al. 2000). In addition to human-induced mortality, fox populations appear to be regulated by density-dependent effects on reproductive output, likely as a result of food availability and social (stress-mediated) suppression of reproduction (e.g., Macdonald et al. 2000; Heydon and Reynolds 2000b).

Stag hunting kills, on average, 228 red deer per year, roughly 13 to 17 percent of the total cull required to prevent further population increases within the stag hunting area. Shooting with a rifle kills at least 1,000 per year (Macdonald et al. 2000). Shooting is the most common method to control population numbers of all six of the deer species present in Britain, as well as in most other countries

throughout Europe and in North America, though it is not clear the extent to which human-induced mortality may be compensatory with other sources of mortality. The total annual red and roe deer mortalities due to shooting during 1995–1996 in six countries of Western Europe were 110,000 and 1,750,000, respectively (Deutscher Jadgschutz Verband 1997). Macdonald et al. (2000) calculate that, as a percentage of the pre-breeding population (Harris et al. 1995), shooting kills approximately 14 to 20 percent of red deer, 29 to 40 percent of fallow deer, and 16 to 22.5 percent of roe deer. These estimated percentages fall within the range of human-induced mortality thought to be necessary to contain population increase, provided that population sizes are not greatly underestimated. There are no data on the extent to which population control is reflected in damage control.

Macdonald et al. (2000) concluded that, for deer, foxes, mink, and hares, hunting with dogs is generally less effective than alternative methods of population and damage control, with the possible exception of the use of terriers to control foxes in upland areas. The potential for non-lethal methods to mitigate the need for lethal control is at an early stage of exploration (Baker and Macdonald 1999).

Hunting and Shooting as Monitoring Tools

While there is no legal requirement for packs of hounds to record the number of foxes killed, MFHA packs record this information voluntarily and have proven willing to make it available for scientific scrutiny. In the context of monitoring in general in the United Kingdom, the use of voluntary contributions seems likely to continue to form an important component of the total endeavor. While the ecological importance of monitoring is reflected in national and international agreements, govern-

ment core-funding will not be adequate to supplant the need for voluntary involvement for the foreseeable future (Macdonald and Tattersall 2002). Some effort is now being applied to assessing the factors determining the efficiency of volunteers (e.g., Newman, Buesching, and Macdonald 2003).

Macdonald and Johnson (1996) analyzed a time series of approximately thirty years of cull data generated by MFHA packs, quantifying both regional differences and temporal trends; these were thought to reflect real patterns in fox abundance. The recent establishment (in 2000) in the United Kingdom of an Independent Supervisory Authority for Hunting (ISAH) has presented an opportunity to standardize and regulate the collection of these data and to ensure that all potentially useful data are recorded. Packs of hounds are now recording, where possible, the sex and age of culled foxes. Early returns suggest interesting and hitherto unrecognized patterns. For example of the approximately 6,000 foxes culled in the (at the time of writing, incomplete) 2002/2003 season, the sex ratio (male:female) as recorded for adults is approximately 2:1.

The commissioners of the ISAH (who include D.W.M.) have encouraged the MFHA to maximize their utility in monitoring a number of other species. These wildlife reports seem likely to yield some fascinating geographic patterns when subjected to close scrutiny. For example at a national level, we can already see that perceived trends in deer species differ markedly: the majority of respondents record that Roe and Muntjac deer are more abundant than they were ten years ago, while most record no change in fallow deer numbers.

The United Kingdom's Game Conservancy Trust has for some time made similar efforts to use shooting bags and gamekeeper records to study trends in pest and quarry species on large estates. Tapper (1992) gives an account of these data.

Hunting, Shooting and Habitat Preservation

In the United Kingdom, where much of the landscape is dominated by the effects of farming, the existence of hunting and shooting as sports activities may provide an incentive for the preservation and restoration of some habitat types. For example, mounted packs have traditionally managed woodland and copses as cover for foxes and maintained their hedgerows and dry stone walls to provide jumps for followers on horseback (where otherwise lower-maintenance wire fences, which are much less desirable from the biodiversity perspective, might have been substituted). Macdonald and Johnson (2000) used farmer questionnaire data to identify patterns in habitat management across different sporting interest groups in the 1970s and 1980s. They found that there was a tendency for hunting and shooting farmers to report having removed less hedgerow in the decade preceding the survey, particularly in the 1970s (rates of removal were everywhere much lower in the later period). There was also evidence that other non-productive habitats were better treated by these interest groups. Oldfield et al. (2003) have recently reported a similar result. Aerial photography and questionnaires showed that farms where hunting and shooting occurred had more woodland, and had planted more new woodland and hedgerow, than did farms where these activities were absent.

Conclusions

In both the United States and the United Kingdom, attitudes toward hunting—and toward animals in general—have changed in the past several decades. Interestingly, the public's acceptance of hunting, at least in the United States, is dependent largely on hunters' abilities to justify this activity for the sake of providing food, rather

than merely as a sport; simultaneously, Americans' attitudes toward wildlife have become less utilitarian. If the emphasis on the non-utilitarian values of wildlife increases, the public may also increasingly question utilitarian motivations for hunting.

Mirroring the changing perception of hunting in the United States, participation there has declined steadily over the past twenty years. Though potentially constrained by a financial dependence on this dwindling population of hunters, professionals in wildlife management appear to be placing less importance on "producing" wildlife as a "crop." Instead, broader concepts from conservation biology are increasingly prominent in the profession, with management seeking to integrate the needs of non-game wildlife species.

Management of mammalian wildlife in the United Kingdom is minimally regulated in governmental terms and lacking in any cohesive national strategy. Culling, mainly for pest control and sport, occurs largely on private land and out of public view, and public debate regarding the acceptability of hunting and shooting revolves mainly around foxhunting and hunting with dogs in general. This is perhaps unfortunate, as it has deflected attention away from other issues relating to hunting and shooting. One issue, for example, that has received little attention outside the Scottish conservation community is the very large population of red deer in the Scottish Highlands (more than 350,000, up from 150,000 at the end of the nineteenth century). For many owners of large upland estates in Scotland, red deer are a significant financial asset, bringing revenue from stalking and venison. However, the current high deer numbers pose a problem to native woodland regeneration and moorland conservation, and there have been calls for widespread reductions in deer densities across the Scottish Highlands.

The science that should, and one hopes increasingly will, underpin poli-

cies relating to wildlife has been changing rapidly. Perceptions and policies are also changing fast, within a labile cultural framework. Even between such similar nations as the United States and Great Britain, there are substantial differences in this context, and such differences become immense when the discussion is generalized across the globe. However, our short and incomplete review of this enormous topic, notwithstanding its geographical restrictions, does reveal its inescapable inter-disciplinarity and the complex entanglements of fact and perception. Ultimately, society's judgments—and policies—on wildlife issues such as this will be heavily influenced by ethical considerations. However, these judgments, and the ethics that decide them, should be based on the clearest possible understanding of what is known factually, and an equally clear appreciation of what is not known.

Notes

¹Limitations of space preclude a full discussion of the means by which wildlife damage may be reduced through either lethal or non-lethal means. See Henderson and Spaeth (1980), Robel et al. (1981), Baker and MacDonald (1999), and Knowlton, Gese, and Jaeger (1999) for a discussion of this issue.

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Literature Cited

Allen, S.A. 1988. Montana bioeconomics study: Results of the elk hunter preference study. Report prepared for Montana Department of Fish, Wildlife and Parks, Helena, Mont.

Allen, G.T., D.F. Caithamer, and M. Otto. 1999. *A review of the status of greater and lesser scaup in North America*. U.S. Fish and Wildlife

Service, Office of Migratory Bird Management, Washington, D.C.

Applegate, J. 1991. Patterns of early desertion among New Jersey hunters. *Wildlife Society Bulletin* 17: 476–481.

Association of Masters of Harriers and Beagles. 2000. The hunting of the hare with hound, Joint submission to the Burns Inquiry by the Association of Masters of Harriers and Beagles (AMHB) and the Masters of Basset Hounds Association (MBHA). First round evidence submission to the Committee of Inquiry into Hunting with Dogs. On the CD accompanying the Report of the Committee of Inquiry into Hunting with Dogs, CM 4763 (by T. Burns, V. Edwards, J. Marsh, L. Soulsby, and M. Winter). Norwich: The Stationary Office.

Baker, P.J., S. Harris, and C.C. Webbon. 2002. Effect of British hunting ban on fox numbers. *Nature* 419: 34.

Baker, S.E., and D.W. Macdonald. 1999. Non-lethal predator control: Exploring the options. In *Advances in vertebrate pest management*, ed. D.P. Cowan and C.J. Feare, 251–266. Furth: Filander Verlag.

———. 2000. Foxes and foxhunting on farms in Wiltshire: A case study. *Journal of Rural Studies* 16: 185–201.

Bateson, P. 1997. The behavioural and physiological effects of culling red deer. London: Report to the Council of the National Trust.

Bethke, R.W., and T.D. Nudds. 1995. Effects of climate change and land use on duck abundance in Canadian Prairie-Parklands. *Ecological Applications* 5 (3): 588–600.

Bissell, S.J. 1993. Ethical issues in state wildlife policy: A qualitative analysis. Ph.D. diss., University of Colorado.

Bissell, S.J., M.D. Duda, and K.C. Young. 1998. Recent studies on hunting and fishing participation in the United States. *Human Dimensions of Wildlife* 3(1): 75–80.

Bolen, E.G. 2000. Waterfowl manage-

- ment: Yesterday and tomorrow. *Journal of Wildlife Management* 64(2): 323–335.
- Bradshaw, E.L., and P. Bateson. 2000. Welfare implications of culling red deer (*Cervus elaphus*). *Animal Welfare* 9: 3–24.
- British Association for Shooting and Conservation. 2000. First round evidence submission to the Committee of Inquiry into Hunting with Dogs. On the CD accompanying the Report of the Committee of Inquiry into Hunting with Dogs, CM 4763 (by T. Burns, V. Edwards, J. Marsh, L. Soulsby, and M. Winter). Norwich: The Stationary Office.
- British Deer Society. 2000. First round evidence submission to the Committee of Inquiry into Hunting with Dogs. On the CD accompanying the Report of the Committee of Inquiry into Hunting with Dogs, CM 4763 (by T. Burns, V. Edwards, J. Marsh, L. Soulsby, and M. Winter). Norwich: The Stationary Office.
- Brown, T.L., D.J. Decker, K.G. Purdy, and G.F. Mattfield. 1987. The future of hunting in New York. *Transactions of the North American Wildlife and Natural Resources Conference* 52: 553–566.
- Bryan, H. 1979. *Conflict in the great outdoors: Toward understanding and managing for diverse sportmen preferences*, Bureau of Public Administration, Sociological Studies Series 4. Tuscaloosa: University of Alabama.
- Burns, T., V. Edwards, J. Marsh, L. Soulsby, and M. Winter. 2000. Report of the Committee of Inquiry into Hunting with Dogs in England and Wales. London: The Stationary Office, CM 4763.
- Causey, A.S. 1989. On the morality of hunting. *Environmental Ethics* 11: 327–343.
- Conover, M.R., and D.O. Conover. 1987. Wildlife management in colonial Connecticut and New Haven during their first century: 1636–1736. *Transactions of the Northeast Section of The Wildlife Society* 44: 1–7.
- Côté, I.M., and W.J. Sutherland. 1997. The effectiveness of removing predators to protect bird populations. *Conservation Biology* 11(2): 395–405.
- Dasmann, R.F. 1964. *Wildlife biology*. New York: John Wiley and Sons.
- Decker, D.J., R.W. Provencher, and T.L. Brown. 1984. *Antecedents to hunting participation: An exploratory study of the social-psychological determinants of initiation, continuation, and desertion in hunting*. Outdoor Recreation Research Unit Publication 84-6, Department of Natural Resources, New York State College of Agricultural and Life Sciences. Ithaca: Cornell University Press.
- Decker, D.J., T.L. Brown, B.L. Driver, and P.J. Brown. 1987. Theoretical developments in assessing social values of wildlife: Toward a comprehensive understanding of wildlife recreation behavior. In *Valuing Wildlife: Economic and Social Perspectives*, ed. D.J. Decker and G.R. Goff, 76–95. Boulder: Westview Press.
- Decker, D.J., T.L. Brown, N.A. Connelly, J.W. Enck, G.A. Pomerantz, K.G. Purdy, and W.F. Siemer. 1992. Toward a comprehensive paradigm of wildlife management: Integrating the human and biological dimensions. In *American fish and wildlife policy: The human dimension*, ed. W.R. Mangun, 33–54. Carbondale: Southern Illinois University Press.
- Deutscher Jagdschutz Verband. 1997. *DJV Handbuch*. Verlag Deiter Hoffmann, Mainz.
- Ditton, R.B., D.K. Loomis, and S. Choi. 1992. Recreation specialization: Re-conceptualization from a social world's perspective. *Journal of Leisure Research* 24(1): 33–51.
- Duda, M.D. 1993. *Factors related to hunting and fishing participation in the United States. Phase I: Literature review*. Responsive Management.
- Enck, J.W., D.J. Decker, and T.L. Brown. 2000. Status of hunter recruitment and retention in the United States. *Wildlife Society Bulletin* 28(4): 817–824.
- Fox, N., S. Rivers, N. Blay, A.G. Greenwood, and D. Wise. 2003. *Welfare aspects of shooting foxes*. London: All Party Parliamentary Middle Way Group.
- Fronczak, D. 2002. *Waterfowl harvest and population survey data*. Columbia, Mo.: U.S. Fish and Wildlife Service.
- Fulton, D.C., J. Pate, and M.J. Manfred. 1995. *Colorado residents' attitudes toward trapping in Colorado*. (Project Report No. 23). Project Report for the Colorado Division of Wildlife. Fort Collins, Colo.: Colorado State University, Human Dimensions in Natural Resources Unit.
- Gill, R.M.A. 1990. *The Global Environment Monitoring System: Monitoring the status of European and North American cervids*. (Gems Information Series No. 8). Nairobi, Kenya: United Nations Environment Programme.
- Grandy, J.W. 1983. The North American black duck (*Anas rubripes*): A case study of 28 years of failure in American wildlife management. *International Journal for the Study of Animal Problems, Supp.* (4): 1–35.
- Harris, S. 1977. Distribution, habitat utilization and age structure of a suburban fox (*Vulpes vulpes*) population. *Mammal Review* 7: 25–39.
- Harris, S., P. Morris, S. Wray, and D. Yalden. 1995. *A review of British mammals: Population estimates and conservation status of British mammals other than cetaceans*. Peterborough, England: Joint Nature Conservation Committee.
- Heberlein, T.A., and E.J. Thomson. 1991. Socio-economic influences on declining hunter numbers in the United States 1977–1990. In *Transactions of the 20th Congress of the International Union Game Biologists*, ed. S. Csanyi and J. Ernhhaft, 699–705. Godollo, Hungary: University of Agricultural Sciences.

- Henderson, F.R., and C.W. Spaeth. 1980. *Managing predator problems: Practices and procedures for preventing and reducing livestock losses*. Manhattan, Kan.: Cooperative Extension Service, Kansas State University.
- Hewson, R. 1986. Distribution and density of fox (*Vulpes vulpes*) breeding dens and the effects of management. *Journal of Applied Ecology* 23: 531–538.
- Hewson, R., and H.H. Kolb. 1973. Changes in the numbers and distribution of foxes (*Vulpes vulpes*) killed in Scotland from 1948–1970. *Journal of Zoology* 171: 345–365.
- Heydon, M.J., and J.C. Reynolds. 2000a. Fox (*Vulpes vulpes*) management in three contrasting regions of Britain, in relation to agricultural and sporting interests. *Journal of Zoology, London* 251: 237–252.
- . 2000b. Demography of rural foxes (*Vulpes vulpes*) in relation to cull intensity in three contrasting regions of Britain. *Journal of Zoology, London* 251: 265–276.
- Heydon, M.J., J.C. Reynolds, and M.J. Short. 2000. Variation in abundance of foxes (*Vulpes vulpes*) between three regions of rural Britain, in relation to landscape and other variables. *Journal of Zoology, London* 251: 253–264.
- Holsman, R.H. 2000. Goodwill hunting? Exploring the role of hunters as ecosystem stewards. *Wildlife Society Bulletin* 28(4): 808–816.
- Kellert, S.R. 1980. *Activities of the American public relating to animals*. Phase II of U.S. Fish and Wildlife Service Study. Washington, D.C.: Government Printing Office, 024-010-00-624-2.
- . 1988. Human-animal interactions: A review of American attitudes to wild and domestic animals in the twentieth century. In *Animals and People Sharing the World*, ed. A.N. Rowen, 137–175. Hanover, N.H.: Tufts University/University Press of New England.
- . 1996. *The value of life: Biological diversity and human society*. Washington, D.C.: Island Press.
- Knowlton, F.F., E.M. Gese, and M.M. Jaeger. 1999. Coyote depredation control: An interface between biology and management. *Journal of Range Management* 52: 398–412.
- Kohlberg, L. 1984. *The psychology of moral development*. San Francisco: Harper and Row.
- Langbein, J. 1997. *The ranging behaviour, habitat-use, and impact of deer in oak woods and heather moors of Exmoor and the Quantock Hills*. Fordingbridge, England: British Deer Society.
- Leopold, A. 1933. *Game management*. Madison: University of Wisconsin Press.
- . 1966. *A Sand County almanac and sketches here and there: With other essays on conservation from Round River*. New York: Oxford University Press.
- Macdonald, D.W. 1980. Social factors affecting reproduction amongst red foxes (*Vulpes vulpes* L. 1758). *Biogeographica* 18: 123–175.
- . 1987. *Running with the fox*. London: Unwin Hyman.
- Macdonald, D.W., and S.E. Baker. In press. Non-lethal control of fox predation: The potential of generalised aversion. *Animal Welfare*.
- Macdonald, D.W., and P. Johnson. 1996. The impact of sport hunting: A case study. In *The exploitation of mammal populations*, ed. V. Taylor and N. Dunstone, 160–207. London: Chapman and Hall.
- Macdonald, D.W., and P.J. Johnson. 2000. Farmers and the custody of the countryside: Trends in loss and conservation of non-productive habitats, 1981–1998. *Biological Conservation* 94(2): 221–234.
- . 2003. Farmers as conservation custodians: Links between perception and practice. In *Conservation and conflict: Mammals and farming in Britain*, ed. F.H. Tattersall and W.J. Manley. Yorkshire: Linnean Society Occasional Publication, Westbury Publishing.
- Macdonald, D.W., and M.T. Newdick. 1982. The distribution and ecology of foxes, *Vulpes vulpes* (L.), in urban areas. The second European Symposium. In: *Urban Ecology*, ed. R. Bornkamm, J.A. Lee, and M.R.D. Seaward, 123–137. New York: Halstead Press.
- MacDonald, D.W., and F.H. Tattersall. 2002. *The state of Britain's mammals: 2002*. Oxford: WildCRU and Mammals Trust UK.
- Macdonald, D.W., F.H. Tattersall, P.J. Johnson, C. Carbone, J. Reynolds, J. Langbein, S.P. Rushton, and M. Shirley. 2000. *Managing British mammals: Case studies from the hunting debate*. Oxford: WildCRU.
- Manfredo, M.J., and H.C. Zinn. 1996. Population change and its implication for wildlife management in the New West: A case study in Colorado. *Human Dimensions of Wildlife* 1(3): 62–74.
- Manfredo, M.J., D.C. Fulton, F. Ciruli, S. Cassin, J. Lipscomb, L. Skjorowski, and S. Norris. 1993. Summary of project report: Coloradoans' recreational uses of and attitudes toward wildlife. Summary of Project Report No. 6. Project Report for the Colorado Division of Wildlife. Fort Collins, Colo.: Colorado State University, Human Dimensions in Natural Resources Unit.
- Mangun, J.C., D.A. Hall, and J.T. O'Leary. 1996. Desertion in the ranks: Recruitment and retention of sportsmen. *Transactions North American Wildlife and Natural Resources Conference* 61: 161–167.
- Marvin, G. 2000. The problem of foxes: Legitimate and illegitimate killing in the English countryside. In *People and wildlife: Conflicts in anthropological perspective*, ed. J. Knight, London: Routledge.
- Masters of Deerhounds Association. 2000. First round evidence submission to the Committee of Inquiry into Hunting with Dogs. On the CD accompanying the Report of the Committee of Inquiry into Hunting with Dogs, CM 4763 (by T. Burns, V. Edwards, J. Marsh, L. Soulsby, and M. Winter). Norwich: The Stationary Office.
- Masters of Foxhounds Association. 2000. First round evidence submission to the Committee of Inquiry into Hunting with Dogs. On the CD accompanying the Report of the

- Committee of Inquiry into Hunting with Dogs, CM 4763 (by T. Burns, V. Edwards, J. Marsh, L. Soulsby, and M. Winter). Norwich: The Stationary Office.
- Matthews, B.E. 1993. Recruiting a new constituency for sportfishing and hunting in the 21st century. *Northeast Wildlife. Transactions of the Northeast Section of The Wildlife Society* 50: 159–166.
- McFarlane, B.L., and P.C. Boxall. 1996. Participation in wildlife conservation by birdwatchers. *Human Dimensions of Wildlife* 1(3): 1–14.
- McLaren, G.W., D.W. Macdonald, C. Georgiou, F. Mathews, C. Newman, and R. Mian. In press. Leukocyte coping capacity: A novel technique for measuring the stress response in vertebrates. *Journal of Experimental Physiology*.
- Mighetto, L. 1991. *Wild animals and American environmental ethics*. Tucson: The University of Arizona Press.
- Ministry of Agriculture, Fisheries, and Food (MAFF). 2000. First round evidence submission to the Committee of Inquiry into Hunting with Dogs. On the CD accompanying the Report of the Committee of Inquiry into Hunting with Dogs, CM 4763 (by T. Burns, V. Edwards, J. Marsh, L. Soulsby and M. Winter). Norwich: The Stationary Office.
- Minnesota Department of Natural Resources. 1992. *Constituent inventory: What Minnesotans think about hunting, fishing, and native plant management*. St. Paul: Minnesota Department of Natural Resources, Division of Fish and Wildlife.
- Muir, J. 1901. *Our national parks*. New York: Houghton Mifflin.
- Muth, R.M., D.A. Hamilton, J.F. Organ, D.J. Witter, M.E. Mather, and J.J. Daigle. 1998. The future of wildlife and fisheries policy and management: Assessing the attitudes and values of wildlife and fisheries professionals. *Transactions of the North American Wildlife and Natural Resources Conference* 63: 604–627.
- Myrberget, S. 1990. Wildlife management in Europe outside the Soviet Union. *Norsk Institutt for Naturforskning Utredning* 18: 1–47.
- National Coursing Club. 2000. Questions 2–17, First round evidence submission to the Committee of Inquiry into Hunting with Dogs. On the CD accompanying the Report of the Committee of Inquiry into Hunting with Dogs, CM 4763 (by T. Burns, V. Edwards, J. Marsh, L. Soulsby, and M. Winter). Norwich: The Stationary Office.
- National Gamekeepers' Organisation. 2000. First round evidence submission to the Committee of Inquiry into Hunting with Dogs. On the CD accompanying the Report of the Committee of Inquiry into Hunting with Dogs, CM 4763 (by T. Burns, V. Edwards, J. Marsh, and M. Winter). Norwich: The Stationary Office.
- Newman, C., D.D. Buesching, and D.W. Macdonald. 2003. Validating mammal monitoring methods and assessing the performance of volunteers in wildlife conservation: *Sed quis custodiet ipsos custodiet*. *Biological Conservation* 113: 189–197.
- Nichols, J.D., F.A. Johnson, and B.K. Williams. 1995. Managing North American waterfowl in the face of uncertainty. *Annual Review of Ecology and Systematics* 26: 177–199.
- Oldfield, T.E.E., R.J. Smith, S.R. Harrop, and N. Leader-Williams. 2003. Field sports and conservation in the United Kingdom. *Nature* 423: 531–533.
- Organ, J.F., and E.K. Fritzell. 2000. Trends in consumptive recreation and the wildlife profession. *Wildlife Society Bulletin* 28(4): 780–787.
- Paquet, P., and A. Hackman. 1995. *Large carnivore conservation in the Rocky Mountains: A long-term strategy for maintaining free-ranging and self-sustaining populations of carnivores*. Toronto: World Wildlife Fund.
- Parkes, C., and J. Thornley. 1994. *Fair game—The law of country sports and protection of wildlife*. London: Pelham Books.
- Peyton, R.B. 2000. Wildlife management: Cropping to manage or managing to crop? *Wildlife Society Bulletin* 28(4): 774–779.
- Phelps, R.W., W.R. Allen, and S. Harrop. 1997. *Report of a review of hunting with hounds*. London: Countryside Alliance.
- Phillips, R.L., R.D. Andrews, G.L. Storm, and R.A. Bishop. 1972. Dispersal and mortality of red foxes. *Journal of Wildlife Management* 36: 237–248.
- Posewitz, J. 1994. *Beyond fair chase: The ethic and tradition of hunting*. Helena, Mont.: Falcon Publishing, Inc.
- . 1999. *Inherit the hunt: A journey into the heart of American hunting*. Helena, Mont.: Falcon Publishing, Inc.
- Produce Studies Ltd. 1995. *Farmers' attitudes to fox control*. Newbury, Berkshire, England: Produce Studies, Ltd.
- Robel, R.J., A.D. Dayton, F.R. Henderson, R.L. Meduna, and C.W. Spaeth. 1981. Relationships between husbandry methods and sheep losses to canine predators. *Journal of Wildlife Management* 45(4): 894–911.
- Rohlfing, A.H. 1978. Hunter conduct and public attitudes. *Transactions of the North American Wildlife and Natural Resources Conference* 43: 404–411.
- Roosevelt, T. 1900. *The wilderness hunter*. New York: G.P. Putnam's Sons.
- . 1913. Our vanishing wildlife. *Outlook* 103: 161–162.
- Schmidt, R.H. 1996. A modest proposal to assist in the maintenance of a hunting culture. *Wildlife Society Bulletin* 24(2): 373–375.
- Storm, G.L., R.D. Andrews, R.L. Phillips, R.A. Bishop, D.B. Siniff, and J.R. Tester. 1976. Morphology, reproduction, dispersal and mortality of mid-western red fox populations. *Wildlife Monographs* 49: 1–82.
- Stroud, D.A., S. Gibson, J.S. Holmes, and C.M. Harry. 1999. The legislative basis for vertebrate pest management in Europe (with examples from the UK). In *Advances in Vertebrate Pest Management*, ed. D.P. Cowan and C.J. Feare, 85–108.

- Fürth: Filander Verlag.
- Tapper, S.C. 1992. *Game heritage: An ecological review from shooting and gamekeeping records*. Fordingbridge, Hants, England: The Game Conservancy Trust.
- Teel, T.L., R.S. Krannich, and R.H. Schmidt. 2002. Utah stakeholders' attitudes toward selected cougar and black bear management practices. *Wildlife Society Bulletin* 30(1): 2–15.
- Theodori, G.L., A.E. Luloff, and F.K. Willits. 1998. The association of outdoor recreation and environmental concern: Reexamining the Dunlap-Heffernan thesis. *Rural Sociology* 63(1): 94–108.
- U.S. Census Bureau. 1996. *Intercensal estimates of the total resident population of states: 1980 to 1990*. Washington, D.C.: U.S. Department of Commerce, Bureau of the Census.
- . 2001. *Ranking tables for states: 1990 and 2000*. Washington, D.C.: U.S. Department of Commerce, Bureau of the Census.
- U.S. Department of the Interior, Fish and Wildlife Service, and U.S. Department of Commerce, Bureau of the Census. 1997. *1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*. Accessed at <http://federalaid.fws.gov/surveys/surveys.html>* survey_trends.
- U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau. 2002. *2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*. Accessed at <http://federalaid.fws.gov/surveys/surveys.html>* survey_trends.
- U. S. Fish and Wildlife Service. 1981. 1980 hunting and fishing license revenues continue to increase. U.S. Department of the Interior, U.S. Fish and Wildlife Service. News release, June 1.
- . 2001. Number of anglers and hunters remains steady. U.S. Department of the Interior, U.S. Fish and Wildlife Service. News release, August 15.
- . 2002. *Status of ducks*. Washington, D.C.
- Voight, D.R. 1987. Red fox. In *Wild Furbearer Management and Conservation in North America*, ed. M. Novak, J.A. Baker, M.E. Obbard, and B. Mallock, 379–392. Ontario: Ministry of Natural Resources.
- Wandeler, A.I. 1988. Control of wildlife rabies: Europe. In *Rabies*, ed. J.B. Campbell and K.M. Charlton, 365–380. Boston: Kluwer Academic Publishers.
- Wilkins, K.A., and M.C. Otto. 2002. Trends in duck breeding populations, 1955–2002. U.S. Fish and Wildlife Service Administrative Report, Division of Migratory Bird Management, Laurel, Md.
- Williams, T. 1986. Who's managing the wildlife managers? *Orion* 5(4): 16–23.
- Wolf, A. and J.L. Roseberry. 1998. Deer management: Our profession's symbol of success or failure? *Wildlife Society Bulletin* 26(3): 515–521.