fred Crosby coined an apt new term, "ecological imperialism," to describe the process whereby Europeans managed to stage a demographic takeover of indigenous peoples in many parts of the world with the aid of the plants, animals, and diseases they brought with them.[106] Writing a century prior to Crosby, Darwin and Wallace were among the first to understand how and why this process might take place.

Beyond their implications for island biogeography, Darwin's and Wallace's ideas about evolution had a profound impact on his biological colleagues and the broader culture. The evidence they gathered for the reality of evolution—from paleontology, geographical distribution studies, taxonomy, embryology, and morphology—was not only compelling but also synthesized the biological sciences in a way that had previously been impossible. Ironically, though, while the *Origin of Species* relatively quickly convinced scientists about the reality of biological evolution, until the Modern Synthesis of 1930s and 1940s, few of them accepted natural selection as the primary force driving evolution; for a variety of reasons, even Darwin himself began increasingly relying on other mechanisms in subsequent editions of the *Origin*.[107] Still evolutionary explanations of various sorts, which had already begun springing up in the social and the biological sciences, became pervasive after 1859.

The notion that struggle was ubiquitous in the human and the natural world also became increasingly commonplace. For some, like the American naturalists Henry F. Osborn, William T. Hornaday, and Aldo Leopold, the fact the native species had been the product of countless eons of evolutionary change provided a rationale for admiring and protecting them. As Darwin himself expressed it so eloquently in the concluding sentence of the *Origin:* "There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved."[108]

Of course, evolutionary arguments were malleable enough that they could also be deployed into opposition to wildlife preservation initiatives. Rare species, like the California condor or the ivory-billed woodpecker, for example, would sometimes be portrayed as the dying relicts of another age, species that were on their way out before humans came on the scene, and thus beyond saving. In the most extreme cases, opponents of protecting wildlife would sometimes argue that extinction, even mass extinction of whatever cause, was a routine part of the history of life on earth, not something to be particularly concerned about.

The theory of evolution also had more subtle impacts on discussions about human-caused species extinction. Conspicuously absent from the *Origin* was any

extended discussion of how humans might fit into the emerging evolutionary framework. Darwin remained silent on this issue until the final pages of his book, when he hinted that through his evolutionary ideas, "Light will be thrown on the origin of man and his history," a curiously passive but nonetheless suggestive passage.[109] Although in 1859 he was fearful of more directly stating that the same evolutionary process that had created the diversity of the natural world had produced humans, he had long accepted the notion himself and begun considering its many implications. For example, twenty years earlier, in his first *Transmutation Notebook,* he scribbled a powerful passage suggesting a bond between humans and other animals: "If we choose to let conjuncture run wild, then animals, our fellow brethren in pain, diseases, death and suffering and famine—our slaves in the most laborious works, our companions in our amusements—they may partake [of] our origin in one common ancestor—we may all be netted together."[110] A little over a decade after the *Origin,* Darwin did explicitly bring humans into his evolutionary framework beginning with *Descent of Man* (1871). There he demonstrated the structural, physiological, and behavioral continuity between humans and the great apes. If animals were indeed our kin, as Darwin had now made explicit, then we ought to take how we treat them more seriously. Darwin's ideas thus became one of many factors that helped produce the humane movement in Europe and the United States in the second half of the nineteenth century. Although humanitarians were mostly concerned about minimizing the suffering and pain of domesticated animals, as we shall see, they also occasionally engaged with wildlife issues.

BECAUSE OF THEIR relatively small sizes, impoverished biotas, and high rates of endemism, documenting the process of human-caused extinction on islands proved relatively easy. Not surprisingly, then, research on these sites promoted consciousness about the power of humans to destroy species in the middle decades of the nineteenth century. Could the same process of human-driven extinction be at work on continental species, which typically had much wider ranges of distribution, and thus often proved harder to locate, capture, and monitor? Not long after the appearance of Darwin's *Origin of Species,* the rapid decline of two North American species—the bison and the passenger pigeon—would definitively answer that question while giving rise to the first mass movement to protect endangered species.

CHAPTER THREE

SOUNDING THE ALARM ABOUT CONTINENT-WIDE WILDLIFE EXTINCTION

While the progress the century has wrought in respect to the development of the resources of our country is justly receiving so much attention, it may not be unfitting to notice briefly other attendant changes that are far less obvious, though no less real, than the transformation of hundreds of thousands of square miles of wilderness into "fruited fields," dotted with towns and cities, and intersected by a network of railways and telegraph lines. With the removal of a vast area of forest that has rendered possible the existence of millions of people where only a few thousand rude savages lived before, there has taken place a revolution in respect to the native animals and plants of this great region as great as has occurred in respect to the general aspect of the country. Not only has indigenous vegetation given place largely to introduced species, but the larger native animals have been in like manner supplanted by exotic ones. While these changes do not pass unnoticed by the naturalist, they are less apparent to the general observer.

J. A. ALLEN, 1876

CENTENNIAL CONCERNS

In 1876, the United States reached the centennial of its nationhood. It was a time to take stock of where the young nation had been and where it seemed to be heading. Many Americans viewed the occasion as an opportunity to celebrate the profound transformations of the previous century: a loose coalition of states had been forged into a Union, a once vast wilderness had been largely tamed, a reliable rail transportation system was knitting the expanding nation together,

FIGURE 13. Joel Asaph Allen, ca. 1876. A photograph of Allen taken at about the time he began both documenting and decrying the decline of North American birds and mammals. Courtesy of the Archives of the Ernst Mayr Library of the Museum of Comparative Zoology, Harvard University.

and industrialization had taken a firm hold. In a special centennial edition of the nation's history, the American author and editor Benson J. Lossing boasted of how much had been accomplished over the previous hundred years: "We may safely claim for our people and country a progress in all that constitutes a vigorous and prosperous nation during the century just passed, equal, if not superior to that of any other on the globe."[1] An advertisement for *The First Century of the Republic: A Review of American Progress* (1876) concurred, proclaiming that the nation's many achievements ought to "awaken a feeling of just pride in every American citizen."[2] Similar Panglossian sentiments rang out from the nation's pulpits, meeting halls, and legislative chambers.

Joel Asaph Allen, a young, ambitious, and painfully shy curator at Harvard's Museum of Comparative Zoology, offered a counterpoint to this centennial celebration of American progress. In a remarkable series of publications issued in 1876, he lamented the decline of North American wildlife, while suggesting that civilization's advancement also carried negative burdens that had yet to be fully comprehended.[3] Allen chronicled numerous native species that had either been

lost or greatly diminished in number, he spoke briefly of the forces that threatened those that still managed to hang on, and he offered a series of concrete proposals that might stem their decline. While naturalists, sport hunters, and others had previously noted in passing how humans had driven individual species to extinction or near extinction, Allen's publications marked one of the earliest extended discussions of the larger process of human-induced wildlife extinction.

Allen is an important but largely unappreciated figure in late nineteenth- and early twentieth-century American biology.[4] He began collecting natural history specimens as a teenager on his family's farm in Springfield, Massachusetts. After several years at Wilbraham Academy, an education partly financed with the sale of his extensive bird collection, in 1862 he enrolled in Harvard's Lawrence Scientific School to study with the famed Swiss naturalist Louis Agassiz. Like most of Agassiz's early students, he soon became a curatorial assistant at the Museum of Comparative Zoology (MCZ). Only two years after his arrival, he secured a promotion to head of the bird and mammal department at that august institution. By the time he finally left the MCZ to accept a position at the American Museum of Natural History in 1885, Allen had secured a reputation as one of the nation's leading naturalists. Where most of his colleagues seemed content merely to catalog the young nation's flora and fauna, Allen searched for patterns in the geographical distribution and variation of organisms. As he began carefully analyzing multiple specimens of birds and mammals from across their range, he noticed that within a given species, extremities tended to be shorter in colder climates and longer in warmer climates. This ecological generalization is still known as Allen's rule.

In April 1871, Allen and two assistants headed west under the auspices of the MCZ.[5] For the next nine months, they traveled widely across the Great Plains and into the Rocky Mountains. In addition to helping Allen regain his failing health, a special object of the expedition was a series of American bison specimens for the MCZ. Railroads granted the party special rates, while the U.S. Army provided a base of operations. Among the thousands of specimens Allen shipped back to Cambridge were an extensive series of buffalo skins, skeletons, and skulls obtained in the vicinity of Fort Hays, Kansas.

Five years after he first ventured westward, Allen completed an exhaustive monograph, *The American Bisons, Living and Extinct*.[6] While the first part of his study consisted of technical descriptions of two lost and one living bison species, the second section told the troubling story of the sole surviving form of the American bison, *Bison bison*. This large, lumbering beast, which once inhabited almost half the North American continent, had been driven west of the Mississippi River by 1800. By the 1840s, Native Americans engaged in the

fur trade and Euroamerican migrants heading to California placed increasing pressure on the species. The greatest period of decline, however, followed the completion of the first transcontinental railroad in 1869. The railroad's impact on the bison was multiple, Allen argued: it provided hunters with easier access to their quarry, offered a ready means of shipping bulky hides back to eastern markets, and promoted white settlement throughout the West. A year after the first transcontinental railroad began operation, eastern tanners discovered how to make buffalo hides into durable leather, thus increasing demand for the species. Though convinced that the bison remained abundant in the northern plains, Allen worried that at current rate of destruction, "the period of his *extinction* will soon be reached."[7]

Eager not to bury his alarming conclusions in an obscure academic treatise, that same year Allen issued a series of five more accessible articles detailing the decline of the buffalo and other North American vertebrates. The first of this series, "The North American Bison and Its Extermination," which appeared in the *Penn Monthly,* summarized the major findings of his monograph.[8] Like the longer study, it emphasized that the systematic destruction of the bison formed part of a disturbing pattern. "Wherever civilized man has held sway," Allen argued, larger mammals like the bison faced "annihilation." The only unusual thing about this particular case was the speed with which millions of bison had been destroyed, providing "one of the most remarkable instances of extermination recorded, or ever to be recorded, in the annals of zoology." "Another decade or two at its present rate of decrease," Allen predicted grimly, "will be sufficient for its total extermination."[9]

In the process of examining the natural history, travel, and exploration literature that had documented the bison's decline, Allen also noted changes in the status of other North American wildlife. In a second popular article entitled "The Extirpation of the Larger Indigenous Mammals of the United States," he decried the widespread decrease of the moose, gray wolf, panther, lynx, black bear, wolverine, caribou, elk, Virginia deer, and other large mammal populations since the beginning of white settlement.[10] That fact that so much wildlife destruction had been "reckless," "wanton," and wasteful particularly appalled him.[11] Allen questioned the commonly held assumption that humans owed no obligation to threatened species or to future human generations that might be deprived of their use and enjoyment. But, not surprisingly given the larger culture in which he found himself, he refused to condemn outright the continued westward march of civilization, which in his view had granted millions of American citizens the opportunity to flourish in an area that had once supported modest aboriginal populations.

As part of this same series of articles, Allen called attention to the plight of vanishing and lost birds. A brief notice for the *American Naturalist* pointed out that the great auk had once been abundant on Funk Island, until it had been mercilessly hunted down for feathers in the 1830s and 1840s.[12] A much longer article chronicled the decline of numerous avian species in his native Massachusetts, where at least four birds—the great auk, the wild turkey, the sandhill crane, and the whooping crane—seemed to have been exterminated since European contact.[13] Many others, including the raven, pileated woodpecker, passenger pigeon, heath hen, trumpeter swan, most of the wading and swimming birds, and nearly all the raptors also suffered marked population decreases. In a final article, Allen provided a more general account of the decline in bird populations throughout the United States.[14] Much of this paper was an expansion of his earlier article on Massachusetts birds, with the descriptions of former and current ranges suitably enlarged. Allen noted that settlement rapidly produces "a revolution in the haunts of many of the species as well as in their relative abundance."[15] While some smaller birds—like the robin, blue bird, and house wren—seemed to flourish in association with humans, others, especially larger species, frequently suffered population declines. Of the numerous birds Allen highlighted for more extensive discussion, the one most immediately threatened and the one to which he devoted most his attention was the beleaguered passenger pigeon.

Allen not only lamented the increasing rarity of many North American birds and mammals, he also suggested several measures to rescue them. First, he called for stringent state and federal legislation regulating hunting seasons and establishing bag limits. In the case of severely threatened species, Allen advocated outright prohibitions on hunting.[16] Since the emergence of recreational hunting as an elite activity in the 1830s and 1840s, sport hunting clubs, game protective associations, and related organizations had secured a long string of state laws to protect game species.[17] Now Allen hoped that America's sporting community might also be mobilized to lobby for legislation to rescue other forms of native wildlife. But he remained skeptical about sportsmen's enthusiasm for protecting nongame species, which in his words did "not appeal so strongly to their self-interest" as the creatures they sought to hunt.[18]

For some species, like the buffalo, Allen suggested setting aside federal land to serve as protective refuges. He noted that the czar of Russia pursued this approach in 1852, as part of an effort to save the last remaining European aurochs, the Old World cousin of the American bison.[19] No doubt Allen's suggestion was also related to the recent establishment of Yellowstone National Park, the first of its kind in the world. As a scientific member of the Northern Pacific Railroad

Expedition Party, he had visited the new two-million-acre park in 1873, one year after Congress had removed the site from the public domain. While the establishment of Yellowstone might have suggested the feasibility of national wildlife refuges, in actual practice this and other early national parks initially provided only minimal protection for native fauna. They were established primarily to protect the scenic wonders and natural curiosities contained within their boundaries, and during their early years they lacked sufficient staff even to achieve this limited goal.[20]

Beyond sportsmen, Allen hoped that recently established "associations for the 'Prevention of Cruelty to Animals'" might also aid the cause of wildlife protection.[21] While self-interested utilitarian motives informed the conservation activities of sport hunters, humanitarians were moved to action by a distaste for unnecessary animal pain and suffering.[22] The humane movement began in England in the 1820s and 1830s and was brought to the United States by the wealthy New York socialite Henry Bergh. In 1866, Bergh founded the American Society for the Prevention of Cruelty to Animals, the first in a series of a several dozen state and local humane societies organized over the next decade in the Northeast and Midwest. While humanitarians lobbied successfully for state anticruelty laws, as Allen pointed out, they focused primarily on minimizing the suffering of domestic animals. But they occasionally turned their sights on wild animals as well. Just two years earlier, for example, Bergh had received a series of letters decrying the slaughter of the bison that he widely circulated with the hope of securing legislation limiting hunting of the species.[23] At about this same time, Rep. Greenburg L. Fort, a Republican from Illinois, introduced a bill in Congress that would have made it illegal for any non-Indian to kill a female buffalo within the United States. Humanitarian sentiments loomed large in the debates about the proposal, which passed both houses of Congress in 1874, only to face a pocket veto from President Grant. Two years later, Fort's bill gained passage in the House, but, in the aftermath of the Custer's ill-fated campaign in the Black Hills, it failed to make it out of committee in the Senate.[24]

While sportsmen and humanitarians might serve as allies in the struggle to stem the decline of North American wildlife, they were unlikely to lead the fight. What was really needed, Allen believed, were new organizations devoted exclusively to the cause of wildlife protection. Nearly a decade later, he would be among those stepping forward to create such institutions. This chapter explores the circumstances that led to the creation of the Audubon bird protection movement at the end of the nineteenth century and the crucial role that naturalists played in forging that movement. Clearly, Allen was not working in a vacuum.

His centennial concerns about the growing problem of wildlife decline represented the culmination of a series of transformations in North America's physical and cultural landscape over the previous century.

NATURE'S NATION

The first Europeans to land on North American shores encountered a landscape teeming with wildlife. The superabundance of native flora and fauna, especially when compared to the more densely settled and biologically impoverished Old World, astounded early visitors and promoted the emergence of a persistent "myth of inexhaustibility."[25] The British author of *New England's Prospect* (1634), William Wood, for example, marveled at what seemed like a nearly boundless supply of plant and animal life in Massachusetts Bay Colony. During his four years there, he witnessed firsthand the annual spring migration of alewives "in such multitudes as is almost incredible, pressing up such shallow waters as will scarce permit them to swim"; he boasted that the supply of waterfowl was so bountiful that "some have killed a hundred geese in a week, fifty ducks at a shot, forty teals at another"; he noted how plentiful large and valuable trees were; and he spoke of great flocks of passenger pigeons with "neither a beginning nor ending, length or breadth of these millions and millions."[26] It would be easy to dismiss Wood's report if his visions of abundance were not confirmed by countless other explorers and settlers who ventured to the eastern shores of North America in the seventeenth century and further West well into the eighteenth and nineteenth centuries.

To this seemingly boundless landscape, Europeans brought nearly inexhaustible demands. From the beginning, immigrants like Wood felt driven by a divine mandate to transform the vast American wilderness—which they tended to view as chaotic, wasteful, threatening, even evil—into something that was orderly, productive, and good.[27] Felling trees, destroying predators, harvesting wildlife, draining swamps, introducing livestock, planting crops, building roads, and conquering Native Americans were all part of a holy mission to complete God's creation, to bring the shining beacon of civilization to an otherwise dark and foreboding countryside. The tree stump became the quintessential symbol of progress, and improving the land, settlers argued in a characteristically self-serving fashion, granted them the right to seize it from lazy aboriginals who contented themselves with living off the fat of the earth.[28] Where Native Americans tended to think in terms of various usufruct rights to the land vested in the entire community, Europeans asserted strong notions of private property, the right of an individual to own a bounded parcel of land and all that dwelt on it.

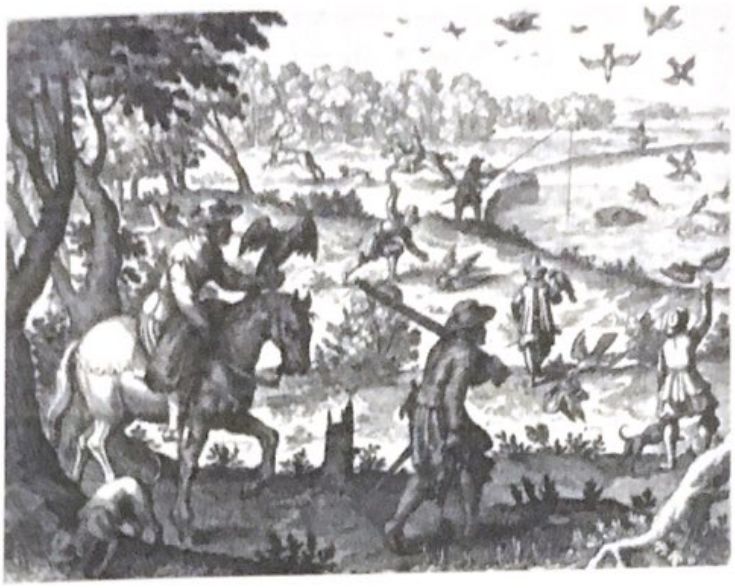

FIGURE 14. The superabundance of New World wildlife, 1618. Although some were undoubtedly exaggerated, early accounts like this seventeenth engraving invariably emphasized that North America was teeming with wildlife. From Theodor de Bry, ed., *America*, part 10 (1618). Courtesy of the Library of Congress, LC-USZ62-49747.

But most important of all, the new arrivals to the New World sought to turn a profit from America's natural resources—to extract valuable plants, animals, and minerals from the landscape—and to incorporate them into a web of commerce that stretched far and wide across the Atlantic and beyond. Native Americans could and did transform the natural world, but for the most part they engaged in only limited trade with neighboring tribes, while their exploitation of plants and animals was restricted by a set of deeply held spiritual beliefs that viewed all of creation as alive, imbued with will, purpose, and meaning. Europeans, in contrast, commodified the landscape, and in doing so, developed insatiable demands for the biota that resided on it.[29]

Given this set of attitudes and practices, newly settled areas of North America soon began experiencing dramatic transformations that proved difficult to ignore.[30] Once diverse habitats gave way to a more limited range of introduced crops, pesky weeds that seemed to sprout up everywhere, and vexing insect pests. Newly introduced domesticated animals roamed across the countryside in feral herds that consumed prodigious quantities of native vegetation, fostered shifts in plant species composition, and compacted the soil. Bounty programs decimated the populations of wolves and other predators. Timber became scarce around villages and towns, forcing their inhabitants to range farther and farther in search

Alexander Wilson's nine-volume *American Ornithology* (1808–14) heralded the beginning of a series of elegant, large format, and heavily illustrated publications that proudly presented the young nation's biological richness to the world. The apogee of this ambitious, overtly nationalistic project came with John James Audubon's *Birds of America* (1827–38), which included exquisite life-sized color engravings of more than 435 North American species.[41] While some naturalists criticized the anthropomorphic, contorted poses of Audubon's birds, the project gained its creator wide acclaim. Cuvier, for example, commended his drawings as "the greatest monument yet erected by Art to Nature."[42] *Viviparous Quadrupeds of North America* (1845–54), which Audubon produced with the help of his two sons and the Charleston naturalist John Bachman, proved less successful artistically, but it still made a strong impact. The images from both publications were widely reproduced.[43]

Where Thoreau, Audubon, and other naturalists had made passing references to troubling changes in the environment, the first detailed indictment of the human power to transform the landscape came from the pen of the Vermont lawyer, businessman, philologist, farmer, congressman, and diplomat George Perkins Marsh.[44] A man of diverse interests, extraordinary ability, and prodigious girth, Marsh was, in the words of his biographer David Lowenthal, "the broadest scholar of his day."[45] Born in 1801, Marsh discovered the joys of nature at the age of eight, when an eye ailment prevented him from reading for four years. As an adult, he grew increasingly concerned about the environmental transformations he witnessed in his beloved Green Mountains. In 1857, after gaining an unpaid appointment as Vermont's Fish Commissioner, he issued a report bemoaning the human-induced changes that had decimated the inland fish stocks of his home state. Marsh worried not only about the loss of the native fish as a source of food and profit but also the recreation that angling provided. In an early version of the call for a strenuous engagement with nature that Theodore Roosevelt and his circle would later expand upon, Marsh charged that his fellow citizens were becoming "more effeminate, and less bold and spirited." "We have notoriously less physical hardihood and endurance" he continued, because "we are suffering . . . from a too close and absorbing attention to pecuniary interests."[46] Marsh advocated an aggressive breeding and restocking campaign that would not only restore Vermont's fish populations but also the prospects for healthful outdoor recreation.

Seven years later, Marsh published a remarkable book, *Man and Nature; or, Physical Geography as Modified by Human Action* (1864), that Lewis Mumford would later praise as "the fountainhead of the conservation movement."[47] Based on voracious reading in a wide variety of scientific and literary works, extensive

travels through Europe and Asia, and changes he had witnessed firsthand in his home state of Vermont, Marsh became convinced that humans were radically transforming the natural world, with potentially devastating consequences. He marshaled a sweeping array of evidence to support his pessimistic thesis: "Man is everywhere a disturbing agent. Whenever he plants his foot, the harmonies of nature are turned to discords. The proportions and accommodations which insured the stability of existing arrangements are overthrown. Indigenous vegetable and animal species are extirpated, and supplanted by others of foreign origin, spontaneous production is forbidden or restricted, and the face of the earth is either laid bare or covered with a new and reluctant growth of vegetable forms, and with alien tribes of animal life."[48]

While the bulk of *Man and Nature* focused on the myriad problems associated with deforestation, Marsh also expressed concern about the widespread destruction of native flora and fauna. He warned, for example, about how modern transportation networks had brought "distant markets within the reach of professional hunters," thus causing wild birds to diminish "with a rapidity which justifies the fear that the last of them will soon follow the dodo and the wingless auk."[49] His basic framework was what we now term "ecological," though that term would not be coined for several more years. "All nature is linked together by invisible bonds," Marsh declared, "every organic creature . . . is necessary to the well being of some other."[50] Humans, he argued, tended to rend those connections asunder, thereby setting into motion a set of cascading effects that often proved irreversible. Marsh's pioneering, impassioned book, which went into three editions, gained widespread praise from scholars and the general public, but it remains unclear to what extent his contemporaries actually heeded his pessimistic message.

A SPORTING CHANCE

Romanticism, nationalism, and the recognition that humans could profoundly change the natural world provided frameworks for eliciting concern about human-caused extinction of wildlife in America. At the same time, the rise of recreational hunting and fishing offered a large, politically vocal constituency that sought to reverse the decline of numerous species, especially those pursued as game. While Southerners had long relished hunting for sport, by the early nineteenth century many Northerners had begun frowning on the activity, which they viewed as a form of wasteful idleness and a vestige of a more savage stage of human development.[51] By the middle of the century, however, recreational hunters managed to refashion their image. Drawing on the dual fonts of elite European sporting traditions and the mythology of frontier heroes like Daniel

Boone and Davy Crockett, American sport hunters began projecting themselves as hardy, self-reliant individuals, defenders of masculine virtue in an increasingly urban, industrial, commercial, and (in their view) effeminate world.[52] At the same time, an emerging sportsmen's code, which also drew heavily from European precedents, called on leisure hunters and fishermen to gain intimate knowledge about the quarry they pursued, to cultivate skill in using the equipment used in that pursuit, and to embrace a sense of fair play. Beginning in the 1830s, numerous books and periodicals codified the practices and values associated with sport hunting and fishing. By the time of the nation's centennial, at least three nationally circulated journals—*American Sportsman* (1871), *Forest and Stream* (1873), and *Field and Stream* (1874)—also helped build a sense of shared identity among wealthy and middle-class hunters and fishers. Two years later, *Forest and Stream* founding editor, Charles Hallock, identified more than 350 local, state, regional, and national organizations devoted to these activities.[53]

Sport hunters proved a potent force in wildlife conservation. While many factors—overhunting, the introduction of exotic species, and habitat destruction, to name a few—contributed to the increasingly obvious decline of many game species, sport hunters tended to pin most of the blame for declining wildlife populations on overzealous subsistence and commercial hunters, or "pot hunters" as they were then termed. Having offered a simplistic diagnosis of the problem, they offered an equally straightforward prescription: governmental regulation of access to game species. By the time of J. A. Allen's centennial warning about wildlife extinction, their persistent lobbying efforts had paid off in a long series of state laws that created game and fish commissions, established hunting seasons and bag limits, and mandated hunting and fishing licenses.[54] Those new state laws provided middle- and upper-class sport hunters with continued access to game species throughout much of the year, albeit for a modest price, while restricting legal hunting opportunities for those who were not wealthy enough to pay the required fees or who pursued game for profit. It is unclear to what extent these laws actually helped boost drooping wildlife populations, however, since they were only sporadically enforced and, as Allen pointed out, they applied only to a narrow range of wildlife: game species.

Anglers pursued a different approach, artificial propagation, as a panacea to restore declining fish stocks.[55] By the mid-nineteenth century, agriculture and industrialization both had exacted a heavy toll on America's fisheries. The damming of rivers for power, the dumping of industrial wastes, and the erosion of soil and disruption of water cycles that followed land clearing devastated the salmon and shad runs in rivers across the eastern and midwestern United States.[56] According to one early chronicler of the "fish culture" movement, "fisheries of

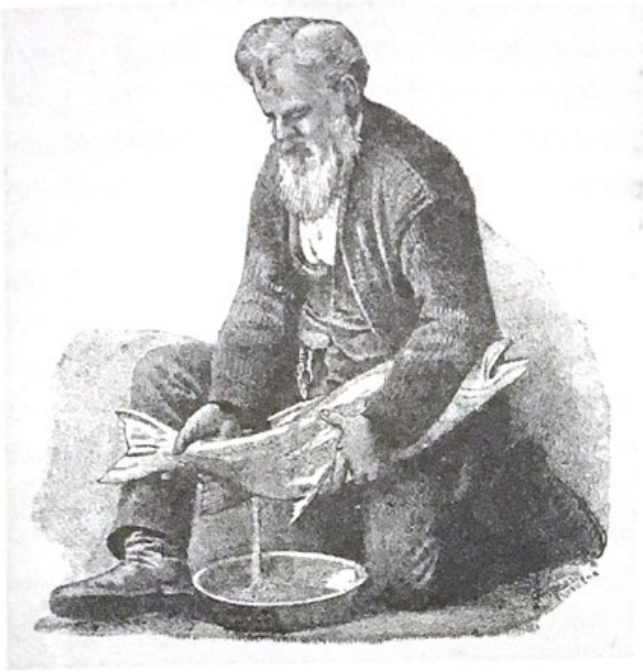

FIGURE 15. Seth Green demonstrating how to remove spawn from salmon trout, 1879. To restore America's depleted fish stocks, mid-nineteenth-century naturalists and fishers began promoting the idea of artificial propagation. Wildlife managers would soon embrace this approach as well. From R. Barnwell Roosevelt and Seth Green, *Fish Hatching and Fish Catching* (1879), 11.

all kinds had deteriorated, until they were on the point of extinction, and in fact, had been destroyed in some instances. . . . The time had arrived when, if our fish supply was to be saved at all, it had to be looked after."[57] A handful of naturalists, anglers, and entrepreneurs responded to this growing sense of crisis by initiating experiments with artificial fish propagation. Guided by reports from France, as early as 1853 two Cleveland physicians managed to fertilize eggs of the brook trout, a particularly popular species with anglers. Over the next decade, fish culture enthusiasts achieved success propagating numerous other aquatic species. They also presented bold claims about the superiority of artificial over natural methods of fish reproduction, claiming a success rate of as high as 80 to 90 percent, compared to only 1 percent in the wild. Widespread adoption of fish culture techniques would not only rescue numerous threatened species, they boasted, but also usher in a new golden age of piscine abundance.[58]

State legislatures responded to these wildly optimistic claims by commissioning a series of studies to investigate the condition of fisheries and the possibilities of fish culture within their boundaries. The most influential publication to emerge from this initial flurry of activity, written by none other than George Perkins Marsh, became an important manifesto for the emerging American fish culture movement.[59] Marsh began his 1857 report with a perceptive analysis of the ecological changes that Vermont's waterways had endured over the last century, when his home state's once abundant fisheries had been carelessly depleted. Overfishing, the "erection of sawmills, factories, and other industrial establish-

ments," and the "general physical changes produced by the clearing and cultivation of the soil" had devastated the state's fish stocks.[60] While Marsh was remarkably prescient in recognizing the signs of ecological degradation, in many crucial ways he was also the product of his time and therefore reluctant to propose potential solutions that might challenge the economic and political status quo: "We cannot destroy our dams . . . ; we cannot wholly prevent the discharge of deleterious substances from our industrial establishments into our running waters; we cannot check the violence of our freshets or restore the flow of our brooks in the dry season; and we cannot repeal or modify the laws by which nature regulates the quantity of food she spontaneously supplies to her humbler creatures." Nor would protective laws "restore the ancient abundance of our public fisheries," Marsh argued, even if they were strictly enforced.[61] The only realistic solution was private initiative in the form of fish culture, which was "not only practicable, but may be made profitable, and . . . our fresh water may thus be made to produce a vast amount of excellent food."[62]

Institutionalization followed in the wake of these initial fish culture experiments. During the two decades following Marsh's report most New England and Mid-Atlantic states created fish commissions, and in 1870, a small but enthusiastic group of advocates established the American Fish Culturists' Association, soon to be known as the American Fisheries Society.[63] One of the new organization's first acts was to petition Congress to authorize "federal action in regard to the stocking of common waters of the United States."[64] In 1871, Congress responded by creating the U.S. Fish Commission and by appointing Spencer F. Baird, a widely respected naturalist who was also the assistant secretary of the Smithsonian Institution, to head the new agency.[65] Baird promoted Marsh's dream for the promise of fish culture through a series of federal hatcheries and a national fish distribution system that turned his fledgling agency into a "biological clearinghouse."[66] With the political support garnered through the broad distribution of hatchery-produced fish, he was also able to pursue less overtly utilitarian projects, like an inventory of North American fish. For well into the twentieth century, however, the main focus of the agency remained fish culture. That limited and strongly interventionist approach to the problem of declining wildlife would soon find support among advocates of captive breeding programs for endangered species.

IMMENSE BEYOND CONCEPTION

Sport hunters and anglers dealt mostly with game species that were facing local decline but were not necessarily in immediate danger of extinction across their entire ranges. It was the highly publicized and nearly simultaneously population

crashes of two once profusely abundant North American species that first ignited widespread apprehension about the specter of extinction. The near loss of the bison and the demise of passenger pigeon presented a wake-up call to Americans, challenging the "myth of inexhaustibility" and placing the issue of wildlife extinction on the public agenda. Euroamerican greed has long been implicated in the annihilation of both species. Until recently, scholars have tended to point the finger of blame squarely on large-scale commercial hunting facilitated by newly constructed railroad networks that knitted together far-flung wildlife habitat and national and international markets. Recent research, however, suggests a more complex picture in which human and natural actors interacted with tragic consequences for both species.

The American bison (more popularly known as the buffalo) once occasionally ranged as far east of the Mississippi as the Atlantic Coast, but it was the Great Plains, especially the shortgrass-dominated western portion, that represented the species' population center and true home.[67] As many as 20 to 30 million bison once resided there, helping to shape the grassland habitat through nomadic browsing.[68] For much of the year, the species remained in relatively small bands, roaming in search of forage and shelter from extreme weather. During the summer rutting season, however, they aggregated into vast herds that routinely awed Euroamerican visitors to the region. In 1806, for example, Lewis and Clark encountered the species at the mouth of the White River in the Dakotas. Lewis wrote of the incident: "We discovered more than we had ever seen before at one time; and if it be not impossible to calculate the moving multitude, which darkened the whole plains, we are convinced that twenty thousand would be no exaggerated number."[69] Nearly thirty years later, the American ornithologist John Kirk Townsend reported on an expedition to the Columbia River in which he sighted the bison: "The whole plain, as far as the eye could discern, was covered by one enormous mass of buffalo."[70] Superlatives loom large in most early encounters with the plains bison during the summer season.

Perhaps the most famous brush with the species occurred in 1832 at Fort Pierre, in present-day South Dakota. Actually, "near encounter" is probably a better term for the incident, because it occurred a few days before the artist-ethnologist George Catlin arrived in the area, a site near the confluence of the Bad and Missouri Rivers that served as a major rendezvous point for the fur trade, so he only learned of the details secondhand.[71] When an "immense herd" of bison appeared on the river shore opposite the fort, several hundred Sioux Indians on horseback descended upon them. A general slaughter ensued, and the Sioux soon emerged with 1,400 fresh buffalo tongues, which they promptly traded for whiskey, leaving the rest of the animal to rot on the prairie. Under the

FIGURE 16. George Catlin, *Buffalo Hunt Surround—no. 9,* 1844. Early witnesses were awed by the teeming masses of bison they observed on the Great Plains. After learning of the massacre of a large herd outside Fort Pierre, South Dakota, in 1832, Catlin issued the first call to establish a national park that would preserve the bison as well as the Native Americans who relied on the species for survival. Courtesy of the Smithsonian American Art Museum, transfer from the National Museum of Natural History, Department of Ethnology, Smithsonian Institution.

combined sway of romanticism and nationalism, Catlin lamented the "profligate waste of the lives of these noble and useful animals" and predicated that their extinction was "near at hand." The species and its native pursuers were both "destined to fall before the deadly axe and desolating hands of cultivating man." Rather than accepting this apparent fate, Catlin called for both to be "preserved in their pristine beauty and wildness, in a *magnificent park,* where the world could see for ages to come, the native Indian in his classic attire, galloping his wild horses, with sinewy bow, and shield and lance, amid the fleeting herds of elks and buffaloes. What a beautiful and thrilling specimen for America to preserve and hold up to the view of her refined citizens and the world, in future ages! A *nation's Park,* containing man and beast, in all the wild and freshness of their nature's beauty."[72] Four more decades would pass before the federal government established the first national park at Yellowstone, and rather than welcoming Native Americans, officials did their best to bar them from their gates.[73]

As this episode suggests, Native American hunting provided one factor leading to an initial decline of the plains bison in the first half of the nineteenth century, although the overall scale of their activity remained modest at first. The

bison was central to the life and culture of the Plains Indians, who had long relied on virtually every part of the species for food, clothing, shelter, tools, implements, weapons, drugs, glue, fuel, and ornaments. One scholar has suggested the large shaggy beast served as a kind of "tribal department store," a "builder's emporium, furniture mart, drugstore, and supermarket rolled into one."[74] When Native Americans began hunting for the fur trade in the 1820s and 1830s, however, they not only increased the quantity of bison they killed, but they also began seeking only its most marketable parts, especially its hide and tongue. In the middle decades of the century, California-bound white immigrants began regularly traveling through the region, a decade-long drought struck, and bovine diseases introduced by European livestock infected the herds, all of which produced additional downward pressures on the bison population.[75]

Beginning in the 1860s, hostilities between whites and natives increased dramatically, leading to ever more vocal calls to pacify Native Americans and confine them on reservations. Generals William T. Sherman and Philip Sheridan, both of whom had embraced strategies of destroying Confederate resources during the Civil War, recognized that as long as the Plains Indians enjoyed continued access to the bison, they could not be conquered. In 1875, for example, Sheridan is supposed to have discouraged the Texas state legislature from protecting the few bison that remained within its jurisdiction. Instead of trying to save the species, Sheridan reportedly argued, the lawmakers should not only thank the hunters but also award them a medal depicting a dead bison on one side and a dejected Indian on the other. The bison hunters had done more in the previous few years to "settle the vexed Indian question, than the entire regular army has done in the last thirty years. They are destroying the Indian's commissary. . . . Send them powder and lead, if you will; for the sake of lasting peace, let them kill, skin and sell until the buffaloes are exterminated."[76] Scholars have yet to uncover a smoking gun proving that the U.S. Army pursued an official policy of systematically destroying the bison as part of its campaign to pacify Native Americans. Historian David Smits has, however, found compelling evidence that numerous government officials knew that they would fail to triumph over the Plains Indians until the bison were gone. And he has shown that these same officials actively encouraged and supported commercial hunting of the species.[77]

The commercial bison trade received a boost in the late 1860s and the early 1870s with the completion of the transcontinental railroad, the manufacture of the first accurate, large-bore rifles, and the development of methods for tanning buffalo hides into leather that was in great demand for industrial belting.[78] After the Civil War, more than a thousand hide hunters descended on the plains hoping to cash in on the newly expanded market for bison leather. Depending on

FIGURE 17. Buffalo hides awaiting shipment, Dodge City, Kansas, 1874. With the spread of western railroads and the development of tanning methods that rendered their hides into pliable leather, demand for the bison soared following the American Civil War. Courtesy of the Kansas State Historical Society.

their skill level, a hunter could expect to bag anywhere from twenty-five to one hundred buffalo per day. The total slaughter ran to as many as 2 million or more bison per year.[79] In addition to overhunting, other bison casualties resulted from the introduction of Texas cattle fever in the southern part of its range, a series of abnormally severe winters, occasional grass fires, periodic drought, and most importantly, competition from introduced cattle. By the end of the 1870s, the southern plains bison had been reduced to a few hundred stragglers; a decade later, the same was true of bison in the northern plains. A species that had once blackened the landscape for as far as the eye could see was barely hanging on by a thread.

At nearly the same time as the bison, the passenger pigeon (*Ectopistes migratorius*) experienced a similar population crash from which it failed to recover.[80] This species, more than any other, has attained iconic status as a symbol of both the natural abundance of North America and the profligate waste of Euroamerican settlers. According to estimates by A. W. Schorger—the chemist, amateur naturalist, and author of a meticulously researched book on the species—as many as 3 to 5 billion passenger pigeons inhabited the eastern and central part of the continent around the time of European contact, a staggering number representing as much as a 25 to 40 percent of the entire avifauna of North America at the time.[81] Ironically, the apparent profusion of passenger pigeons when Europeans first arrived in the New World may have resulted from the crash of Native American populations in eastern North America during this same period.[82] Whatever

the cause of their prodigious populations, we know that the species moved around in vast flocks both to exploit seasonally superabundant crops of mast—especially beechnuts, acorns, and chestnuts—and to overwhelm local predators at sites where they roosted and bred. That evolutionary strategy proved quite successful until Euroamericans, with their insatiable demands and access to far-flung markets, arrived on the scene.

The early descriptions of passenger pigeon flights, roosts, and nesting sites are mind-boggling. One afternoon in the early nineteenth century, the artist and naturalist Alexander Wilson witnessed a massive flock of pigeons flying overhead near the town of Frankfort, Kentucky. "I was suddenly struck with astonishment at a load rushing roar succeeded by instant darkness," he wrote of the encounter. "I took [it] for a tornado, about to overwhelm the house and everything round in destruction."[83] Wilson estimated that the densely packed flock, which was more than a mile wide and took longer than four hours to pass, contained more than 2.2 billion birds. "An almost inconceivable multitude," he admitted, "and yet probably far below the actual amount."[84] According to a later estimate, if each pigeon in Wilson's flight consumed about an eighth of a pint of mast each day, in a year, the entire flock would consume enough to fill "a warehouse 100 feet high, 100 feet wide, and 25 miles long."[85]

Numerous other writers corroborated Wilson's account. In 1813, for example, Audubon was traveling to Louisville, Kentucky, along the banks of the Ohio River, when he encountered a flight of passenger pigeons so large that "the noon-day was obscured as by an eclipse."[86] During this same period Audubon also visited a pigeon roosting site on the banks of the Green River that he estimated to be forty miles long and three miles wide. He was astonished at what he saw there: "The dung lay several inches deep, covering the whole extent of the roosting-place, like a bed of snow. Many trees two feet in diameter, I observed, were broken off at no great distance from the ground; and the branches of many of the largest and tallest had given way, as if the forest had been swept by a tornado. Every thing proved to me that the number of birds resorting to this part of the forest was immense beyond conception." The arrival of the birds in the early evening was also impressive, producing a noise that reminded Audubon of "a hard gale at sea, passing through the rigging of a close-reefed vessel."[87]

While awed by the massive flocks, naturalists learned only the rudiments about the passenger pigeon's life history and behavior before it fell victim to extinction. The species resembled an oversized mourning dove, a bird with which it would later be confused, and bred from April to June in deciduous forests of the northeastern United States and Upper Midwest. Vast nesting colonies stretched to as much as several hundred square miles, with new sites generally selected

each year. Consistent with the evolutionary strategy of predator satiation, the stages of breeding at a particular site—from courtship and nest building to egg laying and hatching—occurred in an extraordinarily synchronous fashion. Generally, only a single egg would be laid in each nest, and only one brood was raised each year. Twelve or thirteen days after the egg was laid, the young would hatch. About two weeks later, the adults abandoned the site en masse, leaving the plump squabs to fend for themselves. Late in the summer, the species migrated to the southern portion of its range. Frequent movement from one site to another earned the species its scientific name, *Ectopistes migratorious*, which roughly translates to "wandering wanderer."

Humans living near temporary pigeon roosts and nesting sites had long utilized the bird for food and feathers. Native Americans and Euroamericans alike celebrated the periodic arrival of "pigeon years," when vast flocks descended upon an area with a sufficiently large mast crop to support the birds.[88] While deforestation pushed the species from the eastern seaboard by the mid-eighteenth century, it remained plentiful in the western part of its range for another century. In the early part of the nineteenth century, for example, Audubon witnessed residents of a community near Russellville, Kentucky, descend on a large pigeon roost in the area. Using pots of burning sulfur, pine-knot torches, long poles, and guns, they killed untold numbers of the birds. Once all the local wagons were groaning with the bodies of hapless pigeons, two farmers turned loose several hundred hogs to devour those that remained. While disturbed at the carnage he witnessed, Audubon believed that the species remained entirely safe from extinction: "Persons unacquainted with these birds might naturally conclude that such dreadful havoc would soon put an end to the species. But I have satisfied myself, by long observation, that nothing but the gradual diminution of our forests can accomplish this decrease."[89] Audubon was wrong, however; he not only greatly overestimated the reproductive potential of the passenger pigeon but also underestimated the impact of large-scale commercial exploitation of the species.

Market hunting of the pigeon, which began in earnest in the 1830s and 1840s, increased dramatically with the development of the railroad. In the second half of the nineteenth century, large urban dealers recruited vast networks of pigeon buyers and trappers, who were alerted to the movements of the species by railroad express agents using telegraphs.[90] When a roosting or nesting area was spotted, hundreds of professional netters descended on the site, where locals hoping to cash in on a visitation from the species would join them. The most efficient way of obtaining the birds was using large nets that could capture as many as several thousands pigeons each time they were sprung. Hunters used salt, grain, and blinded stool pigeons dropped from short platforms to lure the birds

FIGURE 18. Shooting passenger pigeons in northern Louisiana, 1875. Early accounts of the passenger pigeon routinely mention migrating flocks so vast they would blacken the skies for hours. Commercial hunting and habitat destruction quickly decimated the species in the second half of the nineteenth century. Smith Bennett, "Winter Sports in Northern Louisiana: Shooting Wild Pigeons," *Illustrated Sporting and Dramatic News* (July 3, 1875). Courtesy of the Marion duPont Sporting Collection, Special Collections, University of Virginia Library.

into their netting areas.[91] As late as the 1870s, market hunters shipped millions of pigeons from nesting sites in Michigan and Wisconsin. The vast majority were dead birds intended for food, but sportsmen also consumed large quantities of live pigeons to use as trap shooting targets.[92]

During the 1880s, sightings of the species became increasingly sporadic, while the number of pigeons shipped to market declined dramatically. Estimates of individual flock sizes that had once ranged in the hundreds of thousands and even the millions had now been reduced to thousands and hundreds. By the spring of 1888, the bird had become scarce enough that the Massachusetts ornithologist William Brewster ventured to Cadillac, Michigan, to investigate reports of pigeon sightings. While Brewster and his traveling companion located only scattered single pairs of nesting pigeons, they interviewed netters who claimed to have seen passing flocks varying from fifty birds to one that covered "at least eight acres." Based on these reports, Brewster concluded that the species was not

yet teetering on the brink of extinction, as some had feared. But he predicted that without adequate protection "our Passenger Pigeons are preparing to follow the Great Auk and the American Bison."[93]

As early as 1862, the state of New York passed a law that prohibited disturbing pigeons at their nesting sites or discharging a gun within one mile of it perimeter.[94] Over the next several decades, numerous other states would enact similar laws, but because the public initially remained apathetic to the plight of the species, officials rarely enforced them. The Michigan legislature passed the only law giving complete protection to the pigeon in 1897, but by then, it was too late. While a decrease in the overall pigeon population greatly reduced the efficiency of hunters who sought the species, it may have actually increased the effectiveness of natural predators. Survival strategies consistent with predator satiation—for example, exposed nests and single egg clutches—worked quite well as long as the species bred in large flocks that overwhelmed the predators in any particular area. But as the size of flocks diminished, the remaining birds found themselves increasingly vulnerable to attack from other animals. At the same time, they no longer received the critical social cues that large flocks had once provided. Thus, while deforestation and overhunting brought the passenger pigeon to the brink of extinction, biological factors may have been responsible for the final blows. Claims of passenger pigeon sightings continued well into the twentieth century, but the last specimen taken from the wild was probably shot in Ohio in 1900.[95]

THE AUDUBON MOVEMENT TAKES FLIGHT

In early 1886, a decade after Allen first warned about the impending extinction of numerous American birds and mammals, the first inklings of a large-scale bird protection movement swept across the United States.[96] Over the next three decades, thousands of middle-class Americans took up the practice of birdwatching, devoured nature essays, joined Audubon Societies, and lobbied for legislation to protect nongame birds. They were moved to action by a variety of interrelated forces, including a romantic appreciation for nature, a humanitarian concern about the suffering of wild animals, and the aesthetic appeal of birds. Whatever their motivations, for the first time in this nation's history, a significant number of Americans began experiencing wild birds as something more than a resource to be consumed or a commodity to be sold. And as they became more aware of and emotionally connected with the nation's avifauna, they also grew increasingly haunted by threat of extinction. Through publications, lectures, and

institutional connections, naturalists played a crucial role in organizing, leading, and sustaining the Audubon movement.

One early manifestation of that movement was a lengthy warning about the desperate plight of North American birds that first appeared in the journal *Science* in February 1886. This unusual, fifteen-page document was the product of the bird protection committee of the American Ornithologists' Union (AOU), an organization of largely technically oriented ornithologists that J. A. Allen, William Brewster, and Elliott Coues had founded three years earlier. Although first established one year after the creation of the AOU, the bird protection committee remained inactive until late 1885, when Allen, the union's president, convinced the amateur naturalist and oil machinery manufacturer George B. Sennett to take charge.[97] With most of its members residing in the New York metropolitan area, over the next year, the committee held a series of weekly meetings at the American Museum of Natural History. With financial support from G. E. Gordon, the president of the American Humane Association, the committee distributed over one hundred thousand copies of its bird protection manifesto, which introduced many of the arguments that would become standard in the Audubon movement.

The introductory, longest, and most comprehensive essay in the group, "The Present Wholesale Destruction of Bird-Life in the United States," was penned by none other than Allen himself.[98] Echoing arguments he had first made a decade earlier, he castigated humans for severely disrupting "nature's balance." "The history of this country," Allen argued, "is the record of unparalleled destruction of the larger forms of life." Habitat destruction—through deforestation, the drainage of swamps and marshes, the transformation of "wildlands" into farms, and countless other changes accompanying European settlement—had devastated "the haunts and the means of subsistence of numerous forms of animal life" and resulted in "their extermination over vast areas." Market hunting, egg collecting, and indiscriminate shooting by "sportsmen," recent immigrants, and "colored people" each received brief coverage and strong condemnation. The principal target of Allen's wrath, however, was the millinery trade, which remained the nemesis of the bird protection movement for the next three decades. According to Allen, the recent fad for using bird feathers to decorate women's hats represented a threat to North American birds "many times exceeding all others together." Given this and other dangers facing native wildlife, Allen offered a grim prediction: "The fate of extermination, which to the shame of this country, has already practically overtaken the bison, and will sooner or later prove the fate of all of our larger game-mammals and not a few of our game