# *Valuing Shorebirds: Bureaucracy, Natural History, and Expertise in North American Conservation*

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ORIGINAL RESEARCH

# Valuing Shorebirds: Bureaucracy, Natural History, and Expertise in North American Conservation

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## Abstract

This article follows shorebirds—migratory animals that have gone from game to nongame animals over the course of the past century in North America—as a way to track modern field biology, bureaucratic institutions, and the valuation of wildlife. Doing so allows me to make interrelated arguments about the history of wildlife management and science. The first is to note the endurance of observation-based natural history methods in field biology over the long twentieth century and the importance of these methods for the persistent contribution of amateurs. The second major line of argument advances the historical significance of scientific, government bureaucracies as sites of natural knowledge production. Historians of biology and ecology have tended to stress scientists with institutional homes in universities, museums, and at land-grant field stations—particularly as various forms of field biology became professionalized over the twentieth century. In contrast, migratory animals like shorebirds, whether under the auspices of the US Biological Survey or the contemporary Fish and Wildlife Service, were primarily studied and conserved by biologists in bureaucratic agencies. Mid- to low-level bureaucrats, along with avocational birders, have mainly been responsible for developing what we know about shorebird migration, behavior, and life history. And third, shorebirds foreground the importance of bureaucratic context for the valuation of nature, from their economic value to agriculture in the early twentieth century to their value as rare, endangered species in the twentyfirst.

**Keywords** Wildlife · Conservation · Natural history · Bureaucracy · Amateurs

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## Introduction

The winter 1987 issue of *American Scientist* included an article entitled "Conservation Strategies for Migratory Species" (Myers et al. 1987a). Written by a group of scientists with home institutions stretching from Canada to Argentina, the piece focused exclusively on shorebirds as "migratory species" *par excellence*. It highlighted the connection between the Delaware Bay (a major stopover in the northeastern United States) and the natural history of Western Hemisphere shorebirds. Separated by 75 years, in 1912, *Country Life in America* had included an article by US Biological Survey scientist W. L. McAtee (1883–1962) entitled "Why We Should Protect Our Shore Birds" (McAtee 1912). These two articles are remarkably similar. Both pointed out that shorebirds were particularly vulnerable wildlife populations due to their low reproductive rates and the many dangers they faced during their long, hemisphere-wide migrations. Further, the articles pointed to population declines of these animals and raised the fear of their impending extinction.

Despite these similarities, the perceived threats and solutions for extinction had changed dramatically over the intervening years. McAtee's shorebirds faced a threat particular to turn-of-the-century America: excessive hunting, especially during northward, spring migration. By the 1980s, particularly in crowded northeast stopovers like the Delaware Bay, the danger to shorebirds was a much more expansive notion of "competition with man" in the animals' increasingly "small migration and wintering sites" (Myers et al. 1987a, p. 19). The danger of being hunted at important stopovers along shorebirds' migratory routes had largely subsided, to be replaced by the threat of these stopovers disappearing altogether as a result of development. While McAtee and the authors of the *American Scientist* article used similar methods to understand the natural history of shorebirds, they advocated for these species in entirely different legal and bureaucratic contexts. In short, both articles valued shorebirds, but they did so in different socially and politically mediated ways.

What follows is a history of field biology centered on shorebird science and conservation in the "Atlantic Flyway." This case study serves as an exemplar of the difficulties of managing species whose habitat spans landscapes and political jurisdictions across an entire hemisphere and across a century.[1] Migratory wildlife like shorebirds faced their first extinction crisis toward the end of the nineteenth century. The response to this crisis in the United States and Canada—as understood and acted upon by naturalists, nature lovers, hunters, and Survey scientists like McAtee—was political pressure to pass a series of federal-level conservation laws regulating the hunting and transportation of these game animals. This political trend culminated in the 1916 Migratory Bird Treaty, enacted into law in the US as the Migratory Bird Treaty Act (MBTA) of 1918. The US Biological Survey emerged in the early twentieth century as the prime mover in migratory bird conservation

[1] The "flyway" concept itself, developed by the Biological Survey in the 1920s and 1930s, was explicitly framed as an understanding of migratory bird movements that would aid in their conservation. See Wilson (2010, pp. 72–75) and Lincoln (1935).

research, regulation, and enforcement, mirrored by similar bureaucratic institutions in Canada (for example, see Foster 1998).

Over the intervening century, scientific and bureaucratic attention to shorebirds has waxed and waned, highlighting important continuities and changes in the valuation and management of wildlife as well as the practices of field biology. Passage of the MBTA and conservation of shorebirds by the Survey was predicated on "economic ornithology," the notion that migratory birds—shorebirds included—had a role to play in agriculture as insectivorous pest control (Evenden 1995; Kronenberg 2014). When this discipline (and justification) ebbed, so too did attention to shorebirds by professional scientists and wildlife managers, marking a transition from valuing all bug-eating birds to a nearly exclusive focus on hunted waterfowl.[2] By mid-century, sighting and studying shorebirds was mainly the province of groups of enthusiastic and avocational amateurs, who maintained an active knowledge of the life histories and movements of these species. By the end of the twentieth century, when shorebird populations again seemed in decline, the bureaucratic landscape had shifted in the wake of the 1973 Endangered Species Act (ESA), such that threatened species—game and nongame—were considered valuable and worthy of attention by professional scientists, like the authors of the *American Scientist* article cited above.

This article follows shorebirds—migratory animals that have gone from game to nongame animals over the course of the twentieth century in North America—as a way to track modern field biology, bureaucratic institutions, and the valuation of wildlife. Doing so allows me to make interrelated arguments about the history of wildlife management and science. First, I argue that observation-based natural history methods in field biology endured over the long twentieth century, as did the persistent importance of amateurs. Indeed, the two were connected: observational data collection on the movement and behaviors of migratory birds was primarily done by networks of avocational enthusiasts. They possessed a knowledge base and skillset readily coordinated by professionals in wildlife agencies. While scholars have noted the perseverance of collecting practices in the "natural history tradition" and their ongoing importance for "experimentalist" biology (Strasser 2010a, b, 2011), and others have lamented the demise of the "naturalist" in biology (Crist 1999), there exist pockets of biological knowledge production that have continuously employed and explicitly celebrated natural history techniques by both professional and avocational scientists in the field (Noss 1996; Beehler 2010).[3] The study of migratory wildlife like shorebirds is one such pocket.

The second major line of argument advances the historical importance of governmental scientific bureaucracies as sites of natural knowledge production. With

[2] This transition is not only well documented (see the scholars cited previously), but it is also readily apparent in the abundant contemporaneous technical literature of the time. Compare, for example, economic ornithology manuals from the dawn (Palmer 1899) and peak (Weed and Dearborn 1916) of the discipline to later work questioning the efficacy of birds as insect control (Strickland 1928).

[3] More recently, Strasser (2019, pp. 11–21) has pointed out that field biologists' celebration of the natural history tradition and resentment of the ways in which laboratory experimentalism came to overshadow it are as old as this transition in biology itself. It is an odd testament to the longevity and durability of natural history that its practitioners have feared its demise for a century and a half.

a few notable exceptions (e.g., Wellock 2010), historians of biology and ecology have tended to stress scientists whose institutional homes were in universities, museums, and land-grant field stations (Coleman 2010; De Bont 2015; Kingsland 2005; Kohler 2008, 2011; Nyhart 1998, 2009; Vetter 2011a, b, 2016)—particularly as various forms of field biology professionalized over the twentieth century. Shorebirds, whether under the auspices of the US Biological Survey or the contemporary Fish and Wildlife Service, were primarily studied and conserved by biologists in bureaucratic agencies. Mid- to low-level bureaucrats, in concert with avocational birders, have been mainly responsible for developing what we know about shorebird migration, behavior, and life history over the last century. Third, shorebirds foreground the importance of bureaucratic context for the valuation of nature. While the authors of the two papers with which I began were concerned about conserving shorebirds, they went about their work and advocacy with wildly different justifications and resources at their disposal. Understanding how shorebirds have been known and protected, and by whom, tells us a great deal about the history of field biology and wildlife conservation.

## Shorebirds as Insect Control: Economic Ornithology and Conservation

Prior to the mid-twentieth century, many shorebirds were game animals, hunted for sport, subsistence, or for markets. Shorebirds, of course, were also hunted for scientific collections. As concerns grew about severe declines in abundance in the last quarter of the nineteenth century, tensions between these groups erupted—sport hunters in particular blamed market gunners for population declines. Naturalists considered themselves absolved of responsibility (while rushing to collect more specimens before any given species' demise) (Barrow 1998, 2009, p. 90). It was amid this extinction anxiety and clashes between classes of hunters that systematic study of shorebirds began under the US federal government. Within two years of its founding in 1883, the American Ornithologists' Union (AOU) lobbied the US Congress for a Division of Economic Ornithology in the United States Department of Agriculture (USDA). This division later evolved and expanded into the Department's Division of the Biological Survey headed by famed ornithologist and mammologist C. Hart Merriam (1855–1942).[4] These Divisions were tasked with establishing birds' vital role in agriculture. In so doing, the Survey partially dictated the methods by which birds would be studied. It stressed their economic importance as insectivorous pest control alongside other forms of value—recreational, scientific, and market.

[4] Several scholars consider the original Office of Economic Ornithology and Mammalogy *the* Ur-wildlife agency, tracing it from its roots to the US Fish and Wildlife Service (Dunlap 1988, p. 35; Czech and Krausman 2001, p. 16).

The Lacey Act of 1900 is considered the first substantial regulation of wildlife by the federal government.[5] Drafted by the Biological Survey, it gave the USDA control over interstate shipment of birds and other wildlife taken in violation of state laws. The Act passed with the support of sport hunting groups, birding organizations, and the AOU itself (Barrow 2009, p. 105). At the same time, the states continued to enact and modify these game laws. An act approved in New Jersey on April 14, 1903, for example, made hunting shorebirds legal only in the second half of the year, and only with a gun (Reynolds 1903, p. 23). Under pressure from hunters, this Act was amended within a year, changing the beginning of shorebird season from July 15 to May 1 to include the peak spring migration.[6] More robust protection for migratory birds like shorebirds did not come until the 1910s, with the passage of the Weeks-McLean Migratory Bird Act in 1913 and the Migratory Bird Treaty Act in 1918, establishing the power of the federal government to remove species from the game lists and set more restrictive limits on migratory game birds.[7]

In 1910, Wells Woodbridge Cooke, dubbed by the AOU the "father of cooperative study of bird migration in America," published "Distribution and migration of North American shorebirds" in his capacity as an assistant biologist and bird migration expert for the Biological Survey (Palmer 1917). Cooke, who had been working with state agricultural colleges and experiment stations and had been an AOU member, was perfectly placed to continue work on bird migration as a Survey employee in 1901.[8] His 1910 shorebird bulletin, therefore, reflected not only a longstanding personal interest in migration and geographical distribution of species, but also a concern with shorebirds as an imperiled natural resource and the most current governmental and ornithological thinking on the value of these animals.

Cooke's introduction explained that there were several important reasons for preserving shorebirds and that it was "the plain duty of the present generation to pass on to posterity this asset undiminished in value." Several species destroy insects noxious to agriculture, many have "high food value," they are valuable as sport for hunters, and they are aesthetically pleasing to seashore visitors. In Cooke's view, shorebirds do no harm, their "accounts have only a credit side," and "the silencing of their melodious calls would be a loss to every lover of nature" (Cooke 1910, pp. 5–6). Cooke and others shared experiences of birds in terms of aesthetics, care,

[5] Prior to this Act, wildlife was considered the province of state government (Dunlap 1988). As Barrow (1998, chap. 5) notes, relatively ineffectual state-level bird protection measures had been advocated piecemeal by chapters of the Audubon Society and the AOU in the mid- to late-nineteenth century.

[6] State of New Jersey 1904, p. 380.

[7] For concurrent and intertwining national efforts in Canada, see Foster (1998). Philip Pauly tied the final version of the Lacey Act directly to the influence of the USDA, saying "the law was a striking example of the ability of scientific bureaucrats to reshape congressional initiatives" (2000, p. 80). The USDA, and the Biological Survey in particular, were every bit as involved in passing the Migratory Bird Treaty Act. For more details on the passage of these key migratory bird laws, see Bean (1983, p. 74); Dunlap (1988, p. 38); Evenden (1995); Vileisis (1997, pp. 154–56); Dorsey (1998); Barrow (2009, pp. 141–42); and Wilson (2010).

[8] The relatively new land grant colleges were not only important sources of personnel for USDA agencies, but also part of a network of "harmonious relations" maintained by these scientific bureaus like the Biological Survey (Dupree 1957, p. 159).

and duty to future generations. However, in allegiance to rational argument and their institutional homes, they made clear that the "real" value of shorebirds, beyond "sentiment," was as insectivorous pest-control. In addition, as the Secretary of Agriculture put it in his introduction to Cooke's Biological Survey Bulletin: "A knowledge of the summer and winter abodes of the several species and of the routes they take in migration is essential to intelligent legislation on their behalf" (Cooke 1910, p. 2). Shorebirds mattered most as a boon to American agriculture, and the key to their conservation was the ability to locate and track their migration, establish species' life histories, and analyze their stomach contents to confirm that they ate insect pests. Ornithologists, especially those working for the US government in the USDA, were crucial to studying migratory birds and making a case for their protection. This took the form of observation-based natural history techniques like bird-banding, as well as more intrusive studies quantifying stomach contents (Evenden 1995).[9]

The work of the Biological Survey leading up to the Weeks-McLean Act of 1913 is a case in point regarding the value and valuation of shorebirds and the centrality of natural history to migratory bird science and conservation. The 1912 *Country Life in America* article with which I started was based on a 1911 Biological Survey circular, also by W. L. McAtee, entitled "Our Vanishing Shorebirds." In it, McAtee described the threats to shorebirds, their life histories, and population distributions. The majority of the publication, however, described shorebird feeding habits as a justification for their conservation, "for few groups of birds more thoroughly deserve protection from an economic standpoint" (McAtee 1911, p. 2). Their economic contribution included mosquito control as well as feeding on insects known as pests to both livestock and crops. Following page after page of detailed lists of insect pests and the shorebirds that fed upon them, McAtee concluded, "all the shorebirds of the United States are in great need of better protection. They should be protected, first, to save them from the danger of extermination, and, second, because of their economic importance. So great, indeed, is their economic value, that their retention on the game list and their destruction by sportsmen is a serious loss to agriculture" (McAtee 1911, p. 9).

This bulletin, focused on shorebirds, was by no means an isolated example. McAtee, in fact, published an "Index to Papers Relating to the Food of Birds" in which he listed and annotated 131 documents published by the Biological Survey related to birds' feeding habits, involving over 400 species. For over 173 species, these reports included "detailed analyses of stomach contents," representing "the most important statements of the economic value of our birds" (McAtee 1913, p. 7). It was in this milieu of economic ornithology—drawing on a host of life history data—that shorebirds were studied and advocated for by the US government. In both his House and Senate testimony leading up to the Weeks-McLean act, Biological Survey Assistant Chief T. S. Palmer (1868–1955) used the natural history of the Wilson Snipe (a shorebird) as one of his primary examples of the need for federal preservation of

[9] For a concise and thorough history of early, interwar banding, see Benson (2017) and Barrow (1998, pp. 169–71).

migratory birds (US House Committee on Agriculture 1912, p. 72; US Senate Committee on Forest Reservations and the Protection of Game 1912).

Five years later, in 1917, Congress ratified the Migratory Bird Treaty with Great Britain (for Canada) and was considering the 1918 legislation (the Migratory Bird Treaty Act [MBTA]) that would enact and fund it. E. W. Nelson (1855–1934) of the Biological Survey, in testimony leading up to this Act, could state matter-of-factly the bird-as-insectivore justification: "Practically every intelligent person, certainly in the United States, appreciates that birds are among the most beneficial elements in protecting crops from insect pests. As we know, new insect pests are appearing all the time, and millions of birds are always at work on them" (US House Committee on Foreign Affairs 1917, pp. 4–5). Challenged by several states, the 1918 MBTA was eventually upheld by the Supreme Court. In his decision, Justice Oliver Wendell Holmes summed up the value of migratory birds this way:

> Here a national interest of very nearly the first magnitude is involved. It can be protected only by national action in concert with that of another power. The subject matter is only transitorily within the State and has no permanent habitat therein. But for the treaty and statute, there soon might be no birds for any powers to deal with. We see nothing in the Constitution that compels the Government to sit by while a food supply is cut off and the protectors of our forests and our crops are destroyed. It is not sufficient to rely upon the States. The reliance is vain and were it otherwise; the question is whether the United States is forbidden to act. We are of the opinion that the treaty and statute must be upheld. (USDA 1920, p. 4)

Migratory birds, shorebirds included, were a national and international commons to be studied and managed as "protectors of our forests and our crops."

The MBTA was, and is, an important piece of federal conservation legislation in North America. In its wake, however, the division between species considered "game" versus "nongame" became starker, and the Biological Survey focused more exclusively on researching and managing game animals. Or rather, as in the case of many migratory birds, species became de facto nongame animals by being removed from game lists altogether or having very limited open seasons and low "bag limits." USDA regulations based on the MBTA closed the hunting seasons on shorebirds with the exception of a small handful of species (e.g., woodcock and snipe), and even these were only permitted to be hunted in the autumn, well outside their spring migration and breeding seasons (Lawyer 1918; US House of Representatives 1920). In the published hunting literature of the time, contemporary sportsmen seemed to accept these restrictions as an overall good (e.g., Robins 1916; Wilbur 1919). The net effect, over the decades from early- to mid-century to the present, has been to technically consider shorebirds "game" birds, but game with by and large no open seasons and no avid groups of sport hunters in pursuit (Sanderson 1977; Harrington, pers. comm.).

By mid-century, the Survey and its successor, the US Fish and Wildlife Service (FWS), were derided by some as being dominated by concerns over predator control and conservation for hunted waterfowl only. In addition, "economic ornithology" declined as a way of knowing migratory birds, and the creation of synthetic

pesticides simultaneously rendered these animals' services as insectivores irrelevant, and themselves caused the avian deaths documented in *Silent Spring* (Carson 1962; Evenden 1995; Russell 2001).[10] However, though the US government and sportsmen were no longer devoting much attention to shorebirds, new generations of ornithologists—professional, avocational, and amateur—continued to probe their habitats, migration, and behavior, aided in part with financial and administrative support by these now-entrenched wildlife bureaucracies (Barrow 1998).

## Shorebirds as the Province of Amateurs

Shortly after the passage of the MBTA, one of the first, and arguably also one of the last, large-scale scientific descriptions of shorebirds was published. Arthur Cleveland Bent (1866–1954), a businessman and amateur ornithologist, collaborated with the Smithsonian Institution for over three decades to publish the encyclopedic, twenty-three volume *Life Histories of North American Birds*—a source still cited by ornithologists today.[11] Assembling years of work from the Survey, networks of amateur enthusiasts, museum collections, expedition records, bird-banding data, and USDA reports, Bent's (1927) and (1929) volumes were devoted to shorebirds. Again, however, once what seemed to be a brief flurry of activity around shorebirds immediately before and after the 1918 Act had subsided—and once these animals had relatively well-established habits, nomenclature, and geographical distribution—shorebirds largely averted the scientific gaze, government-sponsored or otherwise. A shorebird guide in 1960 asserted that "not since Bent's 'Life Histories' appeared in 1927 and 1929 has a serious study of this spectacular family been attempted" (Hall 1960). Eight years later, a reviewer of the beautifully illustrated *Shorebirds of North America*, with "species accounts" by Robert S. Palmer, even more forcefully lamented that "Particularly notable from Palmer's review is that basic information ... is still lacking for many common and easily accessible North American species.... One could almost argue that American research stopped after the publication of Bent's Life histories. It is embarrassing that Palmer can cite only one reference (Bent 1927) for the Marbled Godwit and American Avocet ... and that the most recent notable contributions for Least Sandpiper, Lesser Yellowlegs, Stilt Sandpiper, and Black Turnstone date from 1927, 1929, 1934, and 1943, respectively" (Jehl 1968). Professional ornithologists themselves bemoaned the dearth of studies on shorebirds.

The exceptions to this lack of interest were avocational bird enthusiasts of various stripes, both amateur and professional. As the conservation issues associated with shorebird hunting faded from view mid-century, and as the "economic"

[10] Evenden (1995), in particular, tied the decline of economic ornithology not only to the passing of the Biological Survey and the rise of synthetic pesticides, but also to internal disputes in a science "riven by debate over its fundamental methods" (p. 177). For the influence and fate of economic ornithology in the British context, see Holmes (2017).

[11] On Bent and the *Life History* series, see Barrow (1998, pp. 174–75).

ornithological work on shorebirds that helped support such efforts disappeared, shorebirds continued to inspire fascination and study in places like the northeast and mid-Atlantic East Coast by dedicated amateurs. Turn-of-the-century organizations like, for example, the Delaware Valley Ornithological Club (DVOC, or the Club) and bird-watching sparked by the Audubon movement and aided by field guides, improved optics, and greater mobility continued to flourish (Barrow 1998, pp. 156–161).[12] These amateurs were as dedicated to natural history and observational methods for acquiring life history information as their professional peers in the Biological Survey. In 1911, the same year that McAtee published his shorebird articles, the new editor of the Club's journal *Cassinia* made a case for increasing these efforts:

> of late, there has been a tendency to belittle the chances of adding to the knowledge of the birds of this region, to believe, because so much has been accomplished in the timing of migratorial movements, the determining of distribution, the plotting of faunal areas, that little is left for the younger generation. I, for one, am confident that this belief is without foundation... the age of the indefatigable observer has arrived. The work of the past has been hardly more than foundational. The superstructure of life-histories has just been begun. (Moore 1911, p. 68)

Avocational ornithology was to be pivotal in assembling observational data on birds.

Concerning shorebirds specifically, by the 1930s, DVOC members were writing that "Until twelve or fifteen years ago the members of the Club with only two or three exceptions knew next to nothing concerning shore-birds ... all of this has been changed, largely perhaps to the advent of the automobile, which makes a day's trip to the shore as easy of accomplishment as a tramp through nearby woodland. The result is that the study of shore-birds and water-fowl has taken the leading place in our ornithological activities" (Street 1935). The author, architect, and avocational ornithologist J. Fletcher Street (1880–1944) then went on to speculate that investigating shorebirds had also become easier, not only because they were more abundant in the wake of hunting restrictions, but also that the halting of this "bombardment" had made the birds more tame and easily approached.

In contrast to economic ornithology, among amateurs, migratory shorebirds were valued aesthetically. Repeatedly in the pages of *Cassinia*, birds were of interest not only as information and avocation, but also as ongoing sources of wonder and pleasure. Historians have noted that the turn of the century Audubon movement, so essential to bird protection, relied heavily on "an emotional and aesthetic bond between humans and birds." The same was true fifty years later for semi-professional enthusiasts watching, counting, and banding birds and publishing their accounts (Barrow 1998, p. 156; Whitney 2013). On the emotional experience of bird-banding, for

[12] Historian Mark Barrow's work on the history of ornithology and bird conservation remains the most influential text in the field. For details on the rise and eventual successes of organizations like the Audubon Society and the AOU, see Barrow (1998, chaps. 5 and 6). The more narrow focus on shorebirds here predisposes my analysis to more regional and local amateur networks and organizations.

example, one Club member waxed: "While holding [a trapped Wood Thrush] in my hand, I thought of his wonderful ability to take care of himself in the many storms that he, no doubt, encountered. I thought of his ability to protect himself against all his many enemies. I thought of his ability to find all the food he required, and most amazing of all, his ability to find the tiny little spot in this big world called Ardmore [Pennsylvania], where he came back again to raise another family. What could be more wonderful than this? This is the compensation a bander receives for his efforts" (Groskin 1946, p. 31). Celebrating in print the seventieth anniversary of the DVOC, one author noted that "we have looked to the birds for recreation and avocation" (Anonymous 1961, p. 13), and felt moved to quote a 1929 Louis Untermeyer poem, "Return to Birds":

> When cities prod me with demands.
> Of many minds and many hands,
> .....
> And men bewilder men with words,
> .....
> Gratefully I return to birds.

It was these sentiments, judged by economic ornithologists as a partial but inadequate basis for shorebird conservation fifty years earlier, that helped to maintain a reserve of local knowledge and enthusiasm in places like the Delaware Bay—a reserve that was ready to be tapped when structural forces and new conservation concerns favored shorebirds with renewed interest from professional and government-sponsored scientists and managers in the 1970s.[13] When interest in shorebirds did not require bureaucratic justification, it resumed some of the flavor of former ways of experiencing nature: the pleasures of exploration, recreation, and emotional attachment to particular landscapes and animals. Shorebirds were briefly part of a national commons, uniting disparate social groups behind conservation in the name of agriculture. Out from under this technocratic purview, these creatures became the common interest of smaller, more localized groups of enthusiasts and, along the way, reacquired value beyond the purely rational or economic.

## Endangered Shorebirds, Bureaucracy, and Conservation

Sweeping changes in North American environmental legislation in the 1970s, as in the 1910s, again focused more governmental and popular attention on shorebirds. This was a slow process, however. A ten-year study begun in 1967 by the International Association of Fish and Wildlife Agencies on "migratory shore and upland game birds" management in the US, for example, attempted to generate information

[13] This phenomenon bears a family resemblance to Chandra Mukerji's "elite reserve labor force" of oceanographers maintained in various ways by the federal government at this time (1989, esp. chap. 1). For marginal and little-funded scientific avocations like bird censuses and banding, I would argue that a tappable labor force still exists, although it constitutes a more subtle and less "elite" reserve.

on game birds overshadowed by large state programs for ducks and geese (Sanderson 1977). The first published edition of this study in 1977 included a chapter on shorebirds, but this was removed from a later 1994 edition, given that the first study acknowledged that "Fifty-two species of shorebirds occur regularly in the United States.... Although the members of this group were originally classified as game birds, hunting seasons on all but common snipe and American woodcock have been closed for many years." Nevertheless, in the wake of legislation like the US Endangered Species Act (ESA), this document acknowledged that "as increased interest and emphasis are given to nongame wildlife species, many states are becoming directly or indirectly involved in research and management programs on nongame species, including shorebirds" (Sanderson 1977, p. 301).

Indeed, it would be difficult to overstate the importance of the ESA and its state-level equivalents in terms of legal mandates and funding for conservation of migratory birds, regardless of their status as game or nongame animals.[14] Historian Roderick Nash has suggested that the ESA represented entirely new legal and ethical standing for non-human nature: "The passage of the Marine Mammal Protection Act (1972) and that of the Endangered Species Act (1973) were remarkable in that they endowed nonhuman species with rights to life, liberty, and the pursuit of happiness (in appropriate terms of course). Significantly, many of the species protected were not considered cute or useful to humans in any way; their value was intrinsic and their membership in the biotic community indisputable" (Nash 2010, p. 375). When shorebirds became de facto nongame animals, they were largely ignored by wildlife biologists and the state. The ESA was a conceptual shift in wildlife governance, in which nearly *any* animal (or plant, for that matter) could be subject to governmental attention.[15] Furthermore, the key to safeguarding these valued species and meeting the nation's international wildlife treaty commitments was to encourage "the States and other interested parties, through Federal financial assistance and a system of incentives, to develop and maintain conservation programs."[16]

It was in this time of changing wildlife management laws and programs that personnel and funds began to revive shorebird study throughout North America. The Canadian Wildlife Service was one of the first government bureaucracies to do so on a national scale, hiring R. I. G. Morrison in 1973 as a research scientist to specialize in shorebirds. Morrison, who had earned his PhD at Cambridge and been involved in red knot (a medium-sized shorebird now considered "threatened" under the ESA) banding studies with the Wash Wader Ringing Group in the United Kingdom, used his position to continue shorebird work in the Canadian Arctic. He started a volunteer shorebird sighting network in the eastern Canadian Maritime Provinces to

[14] On the importance of the ESA, and on endangered species protection throughout North America, see Yaffee (1982); Sale (1993); Barrow (2009); and Alagona (2013).

[15] Dale Goble (2006) marks this shift from "game management" to "wildlife management" in a series of legislative acts during the 1960s that culminated in the 1973 ESA. This is important, not only on its face value, but also because it marks shifting threats to wildlife. As dangers to animals began to stem from habitat loss as opposed to hunting, courtroom battles over endangered species became proxy struggles over scarce resources. For an analysis along these lines, see Corn et al. (2007).

[16] US Fish and Wildlife Service (2003, p. 1).

help establish the location and extent of shorebird migration through these areas (Morrison, pers. comm.; see also Burnett 2003, p. 80). Around the same time, the Manomet Bird Observatory (now the Manomet Center for Conservation Science, a non-governmental organization in Massachusetts) hired Brian Harrington to work on shorebirds throughout the Western Hemisphere, utilizing, in part, US Fish and Wildlife Service funding for various shorebird projects. He started a similar volunteer network in the US, called the International Shorebird Survey, and coordinated with Morrison to establish the location of shorebird migration staging areas throughout the continent (Harrington, pers. comm.).

As it happened, the mid-Atlantic stomping grounds of the DVOC was to become a significant focus of shorebird research and conservation when these changes in wildlife management were ushered in during the 1970s. It was through this network of hundreds of enthusiastic volunteers, like the mid-century DVOC members, that Harrington "discovered" in 1980 a massive migratory shorebird stopover in the Delaware Bay.[17] While these researchers and wildlife managers were beginning to reemphasize and value shorebirds, the particular landscapes and places upon which they depended were also acquiring new scientific and conservation value. In the early 1980s, Morrison and his colleagues at the Canadian Wildlife Service had expanded their shorebird programs to include surveys in Latin America, completing and publishing aerial survey data for "28 000 km of the South American coastline" and counting "more than 2.9 million shorebirds" (Morrison and Ross 1989, p. 3). At roughly the same time, although on a smaller scale, researchers at the Cape May Bird Observatory and New Jersey Audubon, with funding from the US Fish and Wildlife Service, conducted aerial and ground surveys in the Delaware Bay that "revealed a staging area of remarkable proportions, one largely unknown to the scientific community" (Dunne et al. 1982, p. 32). By 1986, the New Jersey Endangered and Nongame Species Program had begun yearly aerial surveys of the Bay to determine spring migratory population levels. Population and distribution data on shorebirds for conservation was gathered much as it had been in the 1910s: through networks of volunteers with bureaucratic support and expertise, although increasingly from the air.

At the same time, the "Western Hemisphere Shorebird Reserve Network" (WHSRN, pronounced "wiss-sern") was being organized as a voluntary shorebird-habitat conservation collaboration between the Canadian Wildlife Service, the International Association of Fish and Wildlife Agencies, the World Wildlife Fund, Manomet, and several other US and international wildlife management organizations and agencies. Proposed and developed by Morrison, Pete Myers at the Philadelphia Academy of Natural Sciences, and Pete McLain at New Jersey Fish and Wildlife, WHSRN was an attempt to identify and create a series of habitat preserves across political boundaries to provide vital wintering, stopover, and nesting habitat along shorebirds' migratory pathways. In the words of a few of WHSRN's founders:

[17] This "discovery" by Harrington and his Manomet colleague Linda Leddy, with the help of their local Reed's Beach, NJ informant, is related in Harrington (1996, p. 179) and Sargent (2002, pp. 73–76). See also Cramer (2015).

"the network forms, in essence, an international reserve defined by the migrants rather than by geography" (Myers et al. 1987a, p. 23; Myers et al. 1987b). The Delaware Bay was named the first location in the network in 1985.

By the late 1980s, therefore, the Delaware Bay had become acknowledged as the heart of the Atlantic-coast shorebird migratory path—the "Atlantic Flyway" (Joyce 1986; Myers 1986; Dunne 1989; Harrington 1996). In the 1980s, building on the earlier work done by Harrington, Morrison, Myers, and others, New Jersey and Delaware state biologists began to intensify and coordinate their shorebird studies.[18] Biologists Kathleen Clark and Lawrence Niles, working for the New Jersey Endangered and Nongame Species Program, in coordination with researchers at Rutgers University, New Jersey Audubon, and their state counterparts in Delaware, began to publish findings from their studies and management activities in the bay, confirming the importance of the region as a migratory staging area and highlighting threats to this habitat. Among these threats in densely-populated New Jersey and Delaware were habitat loss through development and oil spills, human disturbance of shorebird feeding on Delaware Bay beaches, and "horseshoe crab over harvest" (Clark et al. 1993). While all of these issues would remain a concern among scientists and conservationists, the horseshoe crab harvest would come to take center stage, bringing unprecedented public and bureaucratic attention to the plight of shorebirds. To give one prominent example, in 2014, the FWS listed the *rufa* subspecies of red knot—a medium-sized shorebird that migrates through the East Coast Atlantic Flyway—as "threatened" under the ESA. This action was the denouement of decades of study and advocacy related to the red knot, long considered "an 'arch-typical' shorebird, a species where conservation of its key habitats will also bring benefits to many other species of shorebirds" (COSEWIC 2007, p. 38).

While perhaps overshadowed in the past twenty years by intense scientific and bureaucratic interest in the Delaware Bay and migratory shorebirds, much of the banding and sighting work has continued to be accomplished through networks of dedicated amateurs and avocational birders. Teams of shorebird researchers, led by biologists from state agencies and nonprofit organizations but primarily staffed by volunteers, descend on the Delaware Bay every year to gauge the health of the stopover and migratory bird populations. The listing of *rufa* red knots as endangered has added both a sense of urgency and a layer of bureaucracy. That is, shorebird research has become a hybrid endeavor—enrolling professional scientists (mainly working in government bureaucracies) and amateur enthusiasts, underpinned by federal and state mandates (and funding) to conserve endangered species. While the stomach content analysis that was so vital to establishing the value of shorebirds in an economic ornithology paradigm has largely subsided, field techniques for determining

[18] For a synthesis of much of this early work and shorebird conservation issues, see the volumes co-edited by Joanna Burger, a behavioral ecologist at Rutgers University who has herself been involved in shorebird research in the Delaware Bay since the 1980s (Burger and Olla 1984a, b).

shorebird abundance, distribution, movement, and life histories continue into contemporary conservation.[19]

## Discussion: Natural History, Bureaucracy, and the Value(s) of Nature

### Natural History: Hybridization, Persistence, and Bureaucracy

The history of shorebird science offers insights into both changes and persistence in field biology methods over the long twentieth century, as well as significant and dramatic shifts in *who* was employing those methods and *how* those shifts marked changing values for wildlife like shorebirds. While specific techniques have varied (e.g., stomach content analysis under economic ornithology vs. contemporary stable isotope analysis), shorebird science helps to establish and extend the historical continuity between nineteenth-century naturalists' traditions of collecting and life-history studies and those of modern-day "naturalists." Bruno Strasser (2010a, b) has stressed that the natural history tradition, among others, lies at the root of much contemporary biomedical research in the practices of collecting and comparing animal DNA sequences. More broadly, he notes that such classificatory knowledge generation has been at the heart of the "deep transformations of the life sciences in the twentieth century" (Strasser 2019, p. 8). There is another, more straightforward way to write natural history back into twentieth and twenty-first-century biological practice, namely, to claim that it never went away.

Strasser, drawing upon Pickstone (2000) and others, argues that observational "ways of knowing" in the natural history vein comingled freely with experimental biology. Taking an analytic approach to knowledge-production practices, Strasser highlights how collecting and comparing has "interacted, conflicted, and hybridized" with experimentation "*within* different fields of biological inquiry" and across different kinds of scientific institutions (Strasser 2019, p. 16)—institutions that included natural history museums, agricultural field stations, and academic laboratories. By contrast, the work of Lynn Nyhart and Raf de Bont offer a window into equally diverse knowledge production, and producers, within a more narrow range of institutions in a European context. Nyhart (2009) has analyzed what she calls "practical natural history" in mid-nineteenth-century Germany—the observation of living animals in their habitats—as a form of hands-on knowledge created outside of universities and museums by a range of actors, including taxidermists, collectors, writers, and zookeepers. Similarly, but with a slight temporal and institutional shift, her concept of "civic zoology" encompasses the world of popular zoology in zoos and museums (i.e., outside of state or university institutions) in late-nineteenth and

[19] Stomach content analysis has subsided, but not vanished. More interventionist, laboratory-based studies still utilize stomach content analysis for the purposes of understanding and modeling the physiology of long-distance migration. Shorebird feeding habits are also implicit in the use of lab-based stable isotope analysis to establish summer and winter grounds for migratory shorebirds. See, for example, Atkinson et al. (2005).

early-twentieth-century Germany, as a source of early "ecological thinking," arguing that this "deserves to be considered an autonomous scientific-cultural sphere" (Nyhart 1998, pp. 607–608).

The work of Raf de Bont (2015), also surveying the European context and drawing in part upon Nyhart's civic science, looks at biological field stations as institutions that, as in Strasser's and Nyhart's case studies and examples, blur distinctions between analytical dichotomies: the lab and the field, professionals and amateurs, or observing naturalists versus experimenting scientists. These accounts, across multiple institutions, ways of knowing, and scientific personae, provide a compelling narrative of the many ways in which knowing nature hybridized and flourished across various places and times—all during a period when natural history was ostensibly in decline and lab-based biology was ascendant. In the North American context, the work of the Biological Survey and the networks of avocational migratory bird research it helped to coordinate, complement (and perhaps partially correct) this account by reasserting the vital roles of the state and of dedicated amateurs. For wildlife, particularly migratory wildlife like shorebirds, research did not depend on any one location, institution, or practice. Instead, the coordination of the Biological Survey made, in essence, every backyard and wildlife refuge a potential field station. State-sponsored and coordinated surveys and experiments were how backyard amateurs, station professionals, avocational excursions, and museums contributed to conservation science. Moreover, as I show, the amateur and avocational networks and organizations outlasted the Biological Survey as reservoirs of expertise on shorebirds and other nongame animals. Natural history persisted not solely by hybridizing with experimental practices or shifting institutions, but by *continuing* in practices largely unchanged since their inception (e.g., bird banding, population counts, etc.), and in networks of professional and avocational ornithologists coordinated by scientific bureaucrats.

In a plenary address to the Association of Field Ornithologists, Bruce Beehler (2010) declared that "we need to expand greatly the study of natural history and we need to raise up natural history to again stand among the leading pursuits honored by universities and research institutes," further suggesting that only older, less-reductive natural history practices like these new forms of collecting would provide the information necessary to conserve wildlife and the environment. Similar and grander claims for the importance of natural history to "science and society" have recently been advanced by a diverse group of biologists (see Tewksbury et al. 2014). Historians of science are thus in a position to show that the practices of natural history have not been "forgotten," but have continued to be integral to environmental science and ecology both in and outside of the academy.[20]

[20] Jamie Lorimer (2008, pp. 392–398), in his account of the UK corncrake census, makes a similar point about the natural history tradition and its ongoing role as non-reductive motivation for field scientists to do their work as "curious and emotional beings" with an "ethos of engagement" with the birds they study.

### People: Bureaucrats, Amateurs, and Citizen Scientists

The US environmental movement and critical laws like the ESA provided the impetus, expertise, and resources for a ramifying set of collecting practices in wildlife biology and related fields, utilizing amateur collectors in new ways as "citizen scientists." In history of science disciplines (Strasser et al. 2019) and in Science and Technology Studies (Kimura and Kinchy 2016), the history of ornithology has been used as an exemplar of observational science lending itself to amateur involvement—tracing a genealogy of practice from "amateur naturalists" of the nineteenth century to Cornell University's contemporary eBird project and, following Bonney (1996), coining the term "citizen science" along the way (Strasser et al. 2019, pp. 58–60; Kimura and Kinchy 2016, pp. 334–35). Kimura and Kinchy (2016, p. 337) explain the rise of citizen science in the 1980s as, in part, a *scientizing* of politics and policy—when, as in the post-ESA bureaucratic context, science was considered key to mobilizing government conservation of wildlife. Observational data from amateurs was an essential source of information for doing so.[21] As Jeremy Vetter (2011a, b) points out, the bureaucratic roots of these kinds of networks of citizen observers go back at least a century—in his case, to the US Weather Bureau (like the Biological Survey, housed in the Department of Agriculture), as it enlisted local, lay weather observers. Amateurs have always had an important, if tense and fraught, influence on professional ornithology and related disciplines, and they have been instrumental in pushing for species conservation (Barrow 1998, 2002; Kastner 1986). As discussed above, observational forms of science in the natural history tradition lent themselves to participation by extensive networks of avocational ornithologists. Wilson (2010, pp. 72–75) points out, for example, that the Biological Survey created just such banding networks to develop the flyway concept in the service of waterfowl conservation in the 1920s and 1930s.

Tracking shorebirds over time includes tracking the people who cared about and studied them: the networks of what could be anachronistically called "citizen scientists" mobilized by early twentieth-century bureaucracies that persisted over time, utilizing observational, natural history techniques to understand wildlife, even as the organizing bureaucracies in question, and their interest in particular types of wildlife, waxed and waned over the decades. In the case of shorebirds, volunteers along the East Coast helped to maintain an enthusiasm for, and knowledge of, these creatures. As one writer in the pages of *Cassinia* reflected: "The Delaware Valley Ornithological Club has been in existence since 1890; 1960 is its seventieth anniversary. For three score years and ten, or roughly for two generations of men, the Club has met regularly for deliberation, edification, and entertainment. Through the austerity of four wars, under eleven administrations in the White House, and through economic disturbances and sociological changes, we have continued our organized interest in birds" (Anonymous 1961, p. 13). This "organized interest in birds" was available

[21] Historian Bernadette Bensaude-Vincent (2009, p. 363) has gone further to suggest that computer-driven data collection involving citizen science, like the Delaware Bay shorebird projects, reflects a new "epistemic culture" in modern science.

to be tapped by scientists with a renewed conservation mandate and resources after 1970. This led directly, not only to a focus on the Delaware Bay, but also served, and continues to serve, as a labor pool for the extensive shorebird studies and conservation efforts centered there. The standard genealogies of amateur ornithology, as the recent literature on citizen science suggests, need not culminate in Cornell's Lab of Ornithology, but could just as easily (and perhaps more accurately) end at the USGS Patuxent Wildlife Research Center's Bird Banding Laboratory. Just as natural history and observational data gathering were not replaced by experimental biology, so too did bureaucratic and avocational science persist and flourish alongside academic ornithology.

The scientific activities of local and mid-level bureaucrats involved in conservation and organizing citizen science have been relatively ignored by environmental historians and historians of science. Twentieth-century American science, so the historiography goes, is the story of the growth of academic institutions, professionalization, and governmental funding of "big science" (Galison and Hevly 1992; Shapin 2008; Coleman 2010; Aronova et al. 2010). Lost in this story are bureaucrats doing science as a function of their professional responsibilities. They implemented and maintained the regulatory structure of government; monitored populations, wildlife, and the environment; and attempted to solve the environmental problems with which they were tasked.[22] Of course, government science goes far beyond the FWS, the Environmental Protection Agency, and their international counterparts.[23] The people in the shorebird story have, by and large, been bureaucrats working for environmental agencies in the US and Canada, scientists working for environmental NGOs using funding from such agencies, and volunteers doing similar work around the globe, helped immeasurably by a spate of environmental legislation like the ESA. They have constructed and utilized a wide variety of knowledge, including shorebird population monitoring and modeling (through banding), genomic and taxonomic work, stable isotope analysis, ecological interactions and ethology, and migratory energetics, not only putting this knowledge to use for environmental management, but also publishing in peer-reviewed journals alongside academic scientists. The understanding of nature generated and acted upon by environmental agencies, while perhaps considered low-status and low-profile, nevertheless affects natural resource use and land development throughout the US. If we wish to understand changes in the land and knowledge-making in the complicated governmental landscape of the past 40 years, more direct attention will need to be paid to scientific bureaucracy.[24]

[22] Historian Samuel Hays (1981) suggested that state-level bureaucracies are the best place to understand the twentieth-century environmental movement, as they represent a middle ground between grassroots environmental concerns and national-level politics. In agreement with these suggestions, I argue that mid-level bureaucracies are excellent places to look in order to understand both modern environmental politics and environmental science.

[23] Roger Turner (2010), in his history of meteorology, conceptualizes a similar type of technoscientific activity as "infrastructural science."

[24] Perhaps the most formative study of the dynamics of science in federal institutions is A. Hunter Dupree's prewar analysis (1957). The Biological Survey and the Fish and Wildlife Service have certainly not been the only scientific bureaucracies, and historians of science and environmental historians since Dupree have examined science within and across government agencies (and, I would argue, should do

### Bureaucracy, Value, and Conservation

Beyond being a reservoir of practices and people for wildlife conservation, scientific bureaucracy can also reify particular values for nonhuman nature. There is perhaps a "lesson" in the eventual demise of the Biological Survey and "economic ornithology" (Kronenberg 2014). In the early twentieth century, the reasons for caring about shorebirds were overshadowed by one primary justification for conservation: their agricultural value as insectivores. This was entirely rational and understandable, given that economic value was far more calculable than, say, aesthetics, and that a division of the Department of Agriculture had become the center of that calculation (Latour 1987; Benson 2017). While conservation on this basis proved useful—shorebird numbers recovered once they became pest control for farmers rather than sport for hunters—the primary justification for this new level of bureaucratic intervention was ephemeral.

In contrast, acknowledging the reality of past and potential species extinction, the US Congress declared in the 1973 Endangered Species Act that "species of fish, wildlife, and plants are of esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people." Given this expansive definition of value, the ongoing role of agency and citizen scientists in understanding and advocating for shorebirds assumes greater importance, as taxonomy and organismal biology continue to wane in the academy (Wilcove and Eisner 2000; Tewksbury et al. 2014). The persistence of observational practices and avocational enthusiasts coordinated by scientific bureaucrats remain the bedrock of wildlife preservation. Understanding conservation and conservation sciences over the long twentieth century requires attention to moments when values and regulatory mandates (economic or otherwise), mobilized scientific bureaucracy, and natural history methods accessible to citizen scientists aligned and became mutually reinforcing. The extinction scares of the last century and a half have been such vitally important moments.

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Footnote 24 (continued)

so to a greater extent). Perhaps the best comparison to these wildlife agencies, however, is the United States Geological Survey (USGS). This agency was created just prior to the Biological Survey, in 1879, like the Fish and Wildlife Service is presently located in the Department of the Interior, and, after a reorganization in the 1990s, is a scientific bureaucracy that has actively carried out environmental research in geology (Davidson 2017; Markovski and Moon 2011; Powell 2015), hydrology (Carroll 2012; Lave et al. 2010), and pollution (Jackson 2004), among other areas. See also Wellock's (2010) exceptional work on the importance of scientists in the US Forest Service for both biology and environmental policy.

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