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# A Review of Economic Ornithology in the United States

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# A REVIEW OF ECONOMIC ORNITHOLOGY IN THE UNITED STATES.

By T. S. PALMER,  
*Assistant Chief of Biological Survey.*

## INTRODUCTION.

Economic ornithology has been defined as the study of birds from the standpoint of dollars and cents. It deals with birds in their relation to agriculture, horticulture, trade, and sport; it treats of species important to the farmer, the fruit grower, the game dealer, the milliner, and the sportsman; in short, it is the practical application of the knowledge of birds to the affairs of everyday life. The study of the relations of birds to agriculture is as intricate and difficult as it is broad and comprehensive. Its successful prosecution presupposes not only an accurate knowledge of classification, distribution, migration, and habits, but also an acquaintance with the measures which have been adopted for the preservation of useful or the destruction of noxious species. Theoretically, it should be one of the first branches of ornithology to receive attention; in reality, it has been one of the last.

## DEVELOPMENT OF AMERICAN ORNITHOLOGY.

The history of American ornithology may be traced back to the middle of the sixteenth century, but for one hundred and fifty years the references to birds consisted of little more than fragmentary notes in the writings of early explorers and colonists. In the eighteenth century several important works appeared, the principal one being Mark Catesby's great work on the "Natural history of Carolina, Florida," etc., published in 1731-1743. One hundred and thirteen species of birds were described and figured, and the plates formed the basis of many of the species described by Linnæus a few years later. Important contributions were also made by Edwards, Forster, Latham, Bartram, Hearne, and Barton. Bartram's "Travels through North and South Carolina," 1791, marked the beginning of the distinctively American school of ornithology, and Barton's "Fragments of the natural history of Pennsylvania," 1799, was notable as the first exclusively ornithological book published in this country.

In the nineteenth century three names, Wilson, Audubon, and Baird, stand out with such prominence that they mark epochs in the development of the science. Wilson's "American ornithology," 1808-1814, laid the true foundation of ornithology in the United States;

Audubon's "Birds of America" and "Ornithological biographies," 1827-1839, occupy a field entirely alone, and Baird's "Birds of North America," 1858, published in conjunction with Cassin and Lawrence, made a great advance in all that relates to classification and nomenclature (the technical side of ornithology), and exerted a wider influence perhaps than any previous work. In the meantime the activity of travelers and explorers had added important contributions. The expeditions of Lewis and Clark across the continent in 1804-1806, of Long to the Rocky Mountains in 1819-20, and of Franklin to the Polar Sea; the travels of Douglas, Nuttall, Townsend, Maximilian, Audubon, and others; and, finally, the expeditions of the Pacific Railroad surveys opened up many new fields and brought to light a host of new birds from previously unknown regions in the West and North. The publication of Baird's work was followed almost immediately by a rapid increase in ornithological literature. The number of workers multiplied, and their contributions covered the whole field, from the brief description of a new species to elaborate faunal lists and comprehensive modern manuals, like those of Coues and Ridgway, which include all the birds of the continent from Mexico to the Pole. In 1883 the organization of the American Ornithologists' Union (an outgrowth of the Nuttall Ornithological Club, formed ten years previously) brought the individual workers in touch with one another and gave a new impetus to North American ornithology. The union prepared a code of nomenclature, which found general acceptance among zoologists, harmonized conflicting systems of classification, and published a new check list of birds. It stimulated research in every branch of ornithology, and by means of its quarterly journal, "The Auk" (now in its seventeenth volume), provided a place of publication and brought together in one series a large number of papers which otherwise would have been widely scattered.

Since the beginning of the century the field of North American ornithology has been extended from the Atlantic States to the Pacific, and from the Mexican boundary to Alaska and Greenland. The list of birds has increased 400 per cent, as shown by the number of species recognized by different authors: Wilson, in 1814, described 278 species; Audubon, in 1844, increased the list to 506; Baird, in 1858, recognized 738; Coues, in 1873, 778 species and subspecies; Ridgway, in 1880, 877; the "Check list" of the American Ornithologists' Union, in 1886, 951; and the additions since made have increased the number to about 1,125.

Compared with the activity in systematic work, the record of economic ornithology seems meager. The labors of American ornithologists were naturally directed at first to the discovery and description of new species and the acquisition of facts regarding their general habits and distribution; little attention was given to economic questions. Many notes concerning the food of birds may be found in the writings of

Wilson and Audubon, but there is little of importance outside of the works of these authors before the middle of the present century. The history of economic ornithology may be conveniently considered under three heads: (1) Investigations as to the value of birds; (2) commercial uses of birds; (3) measures for the destruction, preservation, and introduction of important species.

#### INVESTIGATIONS AS TO THE VALUE OF BIRDS.

The practical study of ornithology began to attract attention about 1850, and several papers appeared in the reports of the agricultural societies of Illinois and Ohio, as well as in the reports of the United States Commissioner of Patents. The character of some of these early contributions is indicated by such papers as Le Baron's "Observations on the birds of Illinois most interesting to the agriculturist" (1855), Walford's "Importation and protection of useful birds" (1855), Holmes' "Birds injurious to agriculture" (1857), Kirkpatrick's "Hawks and owls" (1858), and Dodge's "Birds and bird laws" (1865). Between 1860 and 1863 Dr. J. A. Allen prepared a series of twenty-five popular bird biographies entitled "Birds of New England," designed to interest farmers in common birds. In 1864 Elliott published an extended article on "Game birds of the United States," and during the next four years Samuels contributed three papers devoted largely to the birds of New England.

#### COMMENCEMENT OF INVESTIGATIONS ALONG MODERN LINES.

The first investigation along modern lines seems to have been made by Prof. J. W. P. Jenks, who, in 1858, studied the food habits of the robin and examined a considerable number of stomachs, collected at frequent intervals during the year.<sup>1</sup> Between March and September specimens were collected weekly and some of the time daily. Stomachs taken in March and April contained only insect matter, 90 per cent consisting of the larvæ of crane flies (*Bibio albipennis*). From May 1 to June 21 *Bibio* larvæ disappeared, but were replaced by a variety of insects, including caterpillars, elaterid beetles, and spiders. From late June to October the stomachs contained strawberries, cherries, and other fruits, but after October the vegetable diet was discarded and replaced by grasshoppers and orthopterous insects. The few birds which remained during the winter fed mainly on bayberries (*Myrica cerifera*), privet berries (*Ligustrum vulgare*), and juniper berries (*Juniperus communis*).

By a curious coincidence an experimental investigation of the robin was made in the same year (1858) by Prof. D. Treadwell. Two young birds, caught about June 5, were kept in captivity for the purpose of noting the amount of food eaten and the rate of growth from day to

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<sup>1</sup>Trans. Mass. Hort. Soc., 1859.

day. One of the birds died after three days, but the other remained under observation for thirty-two days, when it had attained full size. "The fame of this robin has extended over both hemispheres." Its capacity for worms seemed unlimited. On the fourteenth day the worms eaten numbered 68, and their weight amounted to 41 per cent more than that of the bird, while their length, if laid end to end, would have measured 14 feet. Treadwell estimated that a pair of robins feeding a brood of four young at the rate averaged by this bird would have to collect 250 worms per day—an interesting illustration of the quantity of food consumed during the breeding season.<sup>1</sup>

In 1878 Prof. Samuel Aughey's classical paper, "Notes on the nature of the food of the birds of Nebraska," appeared in the First Annual Report of the United States Entomological Commission. It included observations extending over a period of thirteen years of 90 different species and an examination of more than 630 stomachs. The stomach contents were merely separated into grasshoppers, other insects, seeds, and miscellaneous, and the number of grasshoppers was given in each case. The report was the most extensive contribution to economic ornithology thus far published, and showed that grasshoppers, when abundant, become the principal food of insect-eating birds, and that they are largely eaten even by water birds.

In the meantime two entomologists had published their views on the relative value of birds and predaceous insects as insect destroyers. B. D. Walsh, State entomologist of Illinois, declared in 1867 that unless a bird destroyed at least thirty times as many noxious as beneficial insects it could not be considered a public benefactor.<sup>2</sup> The fallacy of this view was shown by Forbes, in 1880, in his "Interaction of organisms," and later by Weed.<sup>3</sup> In 1873 M. Edouard Perris called attention to the harm that birds might do in destroying parasitic hymenoptera, and stated that the utility of a bird depended on how many injurious insects it destroyed, usually an unknown quantity.<sup>4</sup> Forbes published a translation of this paper<sup>5</sup> seven years later, thus bringing it prominently to the notice of American ornithologists.

#### A PERIOD OF NOTABLE ADVANCE IN INVESTIGATIONS.

A notable advance was made in 1880 by Prof. S. A. Forbes, who first called attention to the relative value of the three methods of investigation now in general use, namely: (1) Field observation; (2) experiments on wild birds recently caught; (3) examination of stomachs in the laboratory. He also divided the food into three categories—injurious, neutral, and beneficial. Forbes's attention was confined

<sup>1</sup>Proc. Boston Soc. Nat. Hist., VI, pp. 396-399, 1859.

<sup>2</sup>Practical Entomologist, I., pp. 44-47, January, 1867.

<sup>3</sup>Proc. Fourteenth Ann. Meeting Soc. Promotion Agr. Sci., pp. 70-74, 1893.

<sup>4</sup>Bull. Mensuel Soc. Acclim. Paris, X, 1873.

<sup>5</sup>American Entomologist, III, pp. 69 and 96, 1880.

mainly to thrushes, wrens, and bluebirds, of which he examined 320 stomachs, representing 9 species. His paper on the "Food of birds," printed in the Bulletin of the Illinois State Laboratory of Natural History in 1880, is a model of thoroughness, and still remains the best report published on the food of the robin. A second paper on "The regulative action of birds upon insect oscillations," published in 1883, was devoted mainly to a discussion of the question whether insectivorous birds neglect their usual food for the sake of other insects which are unusually abundant, and a number of birds were collected during two successive years in an old orchard badly infested with cankerworms. These insects had attracted birds of the most varied character and habits to the orchard. An examination of 146 stomachs, representing 36 species, showed that 35 per cent of the food consisted of cankerworms.

About the same time appeared an elaborate investigation of the "Economic relations of Wisconsin birds," by Prof. F. H. King.<sup>1</sup> This report was chiefly remarkable for the large number of stomachs examined, more than 1,600, representing about 83 species, and the attempt to show graphically the percentage of the various elements of the food. It was the most extensive investigation thus far undertaken, but many species were represented by too small a number of stomachs to furnish satisfactory conclusions, and like Aughey's work in Nebraska, the identifications were rarely carried out in detail.

In Pennsylvania Dr. B. H. Warren has paid much attention to the food of birds, and has published the results of an examination of 2,084 stomachs, chiefly of grackles and birds of prey, in his "Birds of Pennsylvania," 1886. He has given special attention to the economic relations of hawks and owls, and in his reports as State zoologist and his "Enemies of poultry," 1899, has shown the evil results of the Pennsylvania "scalp act" of 1885. To his energy is due much of the credit of exposing the evils of bounty legislation on birds.

The destruction of birds and the causes of the decrease in bird life have been the subject of special study by Hornaday, who published in 1898 an important paper entitled "The destruction of our birds and mammals."<sup>2</sup>

Since 1886 economic investigations have been carried on chiefly with State or federal aid, and comparatively little has been undertaken by private individuals, except along special lines. Reference should here be made to the work of Forbush in connection with the gipsy moth commission of Massachusetts; to the detailed study of the food of the robin by Wilcox, who examined 187 stomachs collected during spring and summer;<sup>3</sup> and also to the studies of Prof. Clarence M. Weed, of the winter food of the chickadee (based on an examination

<sup>1</sup> Wis. Geol. Surv., I, pp. 441-610, 1882.

<sup>2</sup> Second Ann. Rept. N. Y. Zool. Soc., pp. 77-126, 1898.

<sup>3</sup> Bull. 43, Ohio Agr. Expt. Station, pp. 115-129, 1892.

of 41 stomachs) and the habits of the chipping sparrow in feeding its young.<sup>1</sup>

The important researches thus briefly noticed include four investigations on the robin, an examination of 630 Nebraska birds, some 450 Illinois birds, about 1,600 Wisconsin birds, and an investigation of 2,084 birds of prey, grackles, and other species in Pennsylvania, comprising in all more than 5,000 stomachs.

#### WORK OF THE BIOLOGICAL SURVEY.

##### ESTABLISHMENT OF THE DIVISION.

One of the most important results of the organization of the American Ornithologists' Union was the impetus given to the study of economic ornithology. Committees on the English sparrow, bird migration, and geographical distribution were appointed at the first meeting, and elaborate investigations were at once begun. The work, however, had been planned on such a large scale that it soon outgrew the resources of the committees, and at the second annual meeting of the union it was determined to present a memorial to Congress to secure an appropriation for continuing it. The relation of birds to agriculture is so intricate and the thorough study of their food so difficult, on account of the amount of time and material required, that investigations of this kind are ordinarily beyond the means of private individuals, and are entitled to Government support. In recognition of the importance of the work, Congress granted an appropriation of \$5,000, to be expended under the Division of Entomology of the Department of Agriculture, and on July 1, 1885, established a section of economic ornithology. Under the direction of Dr. C. Hart Merriam, investigations were outlined on a broad scale, to include the "food habits, distribution, and migrations of North American birds and mammals in relation to agriculture, horticulture, and forestry." A year later the section became an independent Division, and in 1896 its name was changed by Congress to the broader title of Division of Biological Survey.

##### FIRST PUBLICATIONS OF THE DIVISION.

Upon the organization of the Division of Ornithology and Mammalogy, the data collected by several of the committees of the American Ornithologists' Union were turned over to it and formed the basis of its first two bulletins. The notes on distribution and migration of birds were published in 1888 under the title "Bird migration in the Mississippi Valley," and the report on the "English sparrow in America" appeared in the following year. The latter report contained a full account of the sparrow and its introduction into the United States, its depredations on crops, and recommendations for destroying it, or at least preventing its increase. Special attention was called to the desirability of legislation permitting the destruction of the bird. It

<sup>1</sup>Bulls. 54 and 55, New Hampshire Agr. Expt. Station, 1898.

is interesting to note that at the time the bulletin was issued the English sparrow was practically protected by law in twenty-two States, although Ohio and Michigan had taken steps to exterminate it, while now most of the States have withdrawn protection, and Illinois, Michigan, Ohio, and Utah have vainly attempted to destroy the pest under the bounty system.

#### FUNCTIONS OF THE DIVISION FROM THE STANDPOINT OF ECONOMIC ORNITHOLOGY.

From the standpoint of economic ornithology the Division may be said to have three functions: (1) To determine as accurately as possible the food of birds of economic importance; (2) to act as a court of appeal to investigate complaints concerning depredations of birds on crops; (3) to diffuse the results of its work and educate the public as to the value of birds. In studying birds' food dependence is placed chiefly on examination of stomachs to ascertain what has been actually eaten. Stomachs are collected in different localities at all seasons and in sufficient numbers to show clearly the character of the food. The stomach contents are examined microscopically and identified by comparison with reference collections of seeds and insects. This laboratory examination is supplemented by experiment and field work.

#### INVESTIGATIONS REGARDING SUPPOSED INJURIOUS BIRDS.

Species popularly considered injurious, such as hawks and owls, the crow, blackbirds, woodpeckers, and blue jays, received attention first. A report on hawks and owls was undertaken by Dr. A. K. Fisher, one on the crow by Prof. W. B. Barrows, assisted by Mr. E. A. Schwarz in the identification of the insect material, while the investigations on the crow blackbird, woodpeckers, and blue jay were made by Prof. F. E. L. Beal.

The destruction of birds of prey in Pennsylvania, following the passage of the "scalp act" of 1885, had attracted widespread interest, and showed the necessity for correcting erroneous views concerning the value of hawks and owls. About 2,700 stomachs of these birds were collected, the contents carefully examined, and the results published in 1893 in a bulletin entitled "Hawks and owls of the United States," illustrated by twenty-six colored plates. Of the 75<sup>1</sup> species and subspecies which occur in America north of Mexico, only 6 were found to be injurious, while several were shown to be beneficial. About the time the work was begun bounties on birds of prey were, or had recently been, offered by Colorado, Indiana, New Hampshire, Ohio, Pennsylvania, Virginia, and West Virginia. At present not only have all the important State bounties been withdrawn (the acts

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<sup>1</sup>Ninety species and subspecies are now recognized by the Check List of the American Ornithologists' Union, but if species of accidental occurrence and the less important subspecies are omitted, the number is reduced to about 75. Of these, food examinations of about 45 species have been made by the Division.

still in force are mainly local), but several States have adopted protective measures. New Hampshire and Ohio began with eagles, Rhode Island with fishhawks, and New York and Minnesota with owls. Pennsylvania and Alabama now protect all except the six or seven really injurious species, while during the present year Utah has gone so far as to make it unlawful to kill any hawks or owls. Such changes show the gradual appreciation of the value of these really useful birds.

In the case of the crow, nearly 1,000 stomachs were examined, and the charges of pulling up sprouting corn, of injuring corn in the milk, of destroying fruit, and of destroying eggs of poultry and wild birds were all sustained. But it was found that corn in the milk formed only 3 per cent of the total food, and most of the corn destroyed was waste grain; that the destruction of fruit and eggs was trivial, while, on the other hand, many noxious insects and mice were eaten. The verdict was therefore rendered in favor of the crow, since, on the whole, the bird seemed to do more good than harm.

Similar studies of crow blackbirds (based on about 2,300 stomachs) and woodpeckers (including nearly 700 stomachs), published in 1895, showed that these birds were decidedly beneficial. Only 1 of the 7 species of woodpeckers examined—the yellow-bellied—exhibited any questionable traits, namely, a fondness for the sap and inner bark of trees. Of the 40 or 50 birds, exclusive of hawks and owls, thus far investigated, the English sparrow is the only one which has been condemned.

#### INVESTIGATIONS REGARDING BENEFICIAL BIRDS.

A number of species usually considered beneficial have also received attention. The Baltimore oriole, meadowlark, cuckoos, red-winged blackbird, rose-breasted grosbeak, cedar bird, robin, bluebird, swallows, and several flycatchers have been studied by Professor Beal, and the shrikes, sparrows, catbird, mocking bird, brown thrasher, and house wren by Dr. Sylvester D. Judd. One of the interesting facts brought out in studying the catbird was the discovery that some birds prefer wild to cultivated fruits, so that the latter may be protected by planting certain berry-bearing shrubs and trees, especially in regions where wild fruit is naturally scarce. The kingbird, frequently condemned as a destroyer of honey bees, was shown to eat very few bees, and these mostly drones. On the other hand, it kills many of the destructive robber flies, and a large proportion of its food is made up of injurious insects, so that it must be regarded as decidedly beneficial. Recent investigations show less favorable results in the case of some other flycatchers, and indicate that the prevailing idea that all insectivorous birds are necessarily very beneficial may require decided modification; and that there are birds which habitually feed on beneficial insects to such an extent as to lower their value to the farmer, if not to place them among the enemies of his crops.

## RESULTS OF FOURTEEN YEARS' WORK.

As a result of fourteen years' work the Biological Survey has brought together a collection of about 32,000 bird stomachs, of which some 14,000 have been examined. It has investigated about 100 species (nearly half hawks and owls) and prepared the results for publication in the form of bulletins or special papers. The publications on birds already issued include seven special bulletins,<sup>1</sup> fifteen papers in the Annual Reports for 1886-1893, inclusive, and eight papers in the Yearbooks for 1894-1898. Some of these papers, such as "Seed planting by birds," "Hawks and owls from the standpoint of the farmer," "Birds that injure grain," and "Birds as weed destroyers," deal with general topics of special interest. The investigations on some 30 grain and insect-eating birds were summarized in 1897 for a bulletin entitled "Common birds in their relation to agriculture," and the work of the Division has also formed the basis of two important summaries, one by Miss Florence A. Merriam, entitled, "How birds affect the farm and garden,"<sup>2</sup> the other by Professor Beal, on "Economic relations of birds and their food."<sup>3</sup>

The educational work of the Biological Survey has not been confined to laboratory studies or publications. The Division has prepared exhibits to illustrate the food habits of birds and modern methods of investigation for the expositions at Cincinnati in 1888, Chicago in 1893, Atlanta in 1895, and Nashville in 1897. It indorsed the proposition to establish a "Bird day" in the schools in 1894, and issued a circular on the subject two years later. Ever since its organization it has acted as a bureau of information on all subjects relating to birds or their distribution and habits. In short, it has spared no effort to advance the cause of economic ornithology in every possible way.

## COMMERCIAL USES OF BIRDS.

Birds are utilized in a variety of ways. Some species are valuable for food, a few as egg producers, others for plumage for millinery purposes, and still others for their guano. An immense trade has sprung up in game, feathers, and guano, and our markets draw their supplies from all parts of the world. Aside from its purely commercial aspect, this traffic is important in its relation to agriculture. Most game birds are useful to the farmer, and their preservation is important not only because of this fact and on account of their market value, but also for the purpose of protecting smaller insectivorous species which otherwise are likely to be destroyed to supply the

<sup>1</sup> No. 1, English Sparrow, 1889; No. 2, Bird Migration in the Mississippi Valley, 1888; No. 3, Hawks and Owls, 1893; No. 6, Common Crow, 1895; No. 7, Food of Woodpeckers, 1895; No. 9, Cuckoos and Shrikes, 1898; and Farmers' Bulletin, No. 54, Some Common Birds in Their Relation to Agriculture, 1897.

<sup>2</sup> Forest and Stream, XLVII, pp. 103, 123 and 144, 1896.

<sup>3</sup> Proc. Twenty-fourth Ann. Meeting N. J. Hort. Soc., 1899.

increasing demand for game. The millinery trade has already practically exterminated several native species, and as plume birds become scarce insectivorous birds are utilized in increasing numbers. Finally, to the development of the guano trade, agriculture owes much of the advance which has been made in the modern system of intensive cultivation and the intelligent application of fertilizers.

#### GAME.

Accurate statistics regarding birds and bird products are difficult to obtain, but the increase in this trade has had a marked, and in some cases a disastrous, effect on certain native species. The number of birds annually killed for game in the United States has increased largely with the development of railway systems and the perfection of cold-storage facilities for shipping game to market. Quantities of game are frequently kept in cold storage for months at a time, or even from one season to another, so that our large cities can now receive their supplies not only from neighboring regions but from distant States and even foreign countries; for instance, South American tinamous, shipped from Argentina to London, and then imported into this country, have been sold in the markets of Washington, D. C., having thus been necessarily kept on ice for several months. New York, Baltimore, Boston, Chicago, St. Louis, New Orleans, and San Francisco are all large game centers, and the quantity of birds annually sold in any one of these cities is simply enormous. D. G. Elliot, writing as long ago as 1864, states that one dealer in New York was known to receive 20 tons of prairie chickens in a single consignment, which were estimated to represent 20,000 birds, and that some of the larger poultry dealers sold from 150,000 to 200,000 game birds in the course of six months. "These estimates," he adds, "so far from being exaggerated, are probably far below the true state of affairs, and these, it must be recollected, are but the receipts of a single city. The total number of birds destroyed throughout the country would exceed the credibility of everyone."<sup>1</sup>

The consumption of game to-day is much greater than it was thirty-five years ago, and the effect of such enormous slaughter has become very apparent in the case of several species, as for example, the pinnated grouse, or prairie hen, and the passenger pigeon. The prairie hen (*Tympanuchus americanus*) occurs on the prairies of the Mississippi Valley from Louisiana and Texas, north to latitude 50° in Manitoba, and from northwestern Ohio and southwestern Ontario to central Nebraska and Kansas. In the east its range is rapidly contracting; a few are still found in Kentucky, but the species is rare in Indiana and northwestern Ohio. It usually lays from 11 to 14 eggs in a set, and is considered one of the most prolific of game birds,

<sup>1</sup> Rept. Comm. Agr., 1864, pp. 383 and 384.

ranking next to the bobwhite in this respect. But in spite of this and the fact that the bird is gradually extending its range westward with the settlement of the country, the species can not maintain its normal abundance in the face of the destructive agents against which it has to contend.

Audubon states that when he first moved to Kentucky (about 1808) prairie hens were very abundant, and could be seen frequently in the farmyards with the poultry and even in the streets of the villages. So little were they esteemed as game that hunters scarcely deigned to shoot them, and they could hardly be sold for more than a cent apiece. A quarter of a century later he remarks that the grouse had practically abandoned the State of Kentucky, and each year their limit of abundance was moving farther westward.<sup>1</sup> A few are still found in the State and in many sections of the prairie region of adjoining States, but they are no longer abundant east of the Mississippi River.

A still more striking case of extermination is that of the passenger pigeon (*Ectopistes migratorius*), which has been reduced almost to the point of extinction except in two or three Northern States. This species formerly ranged over the deciduous forest region of Eastern North America, from the Gulf of Mexico to Hudson Bay, and was remarkable for the enormous numbers which often collected together. To-day its breeding range is restricted to the thinly settled wooded region along the northern border of the United States, chiefly in Michigan and Wisconsin. It was one of the first birds to attract the attention of the early colonists, and references to it may be found as far back as 1630.<sup>2</sup> The enormous breeding colonies and roosts and the great flights, such as that seen by Audubon in 1813, afforded an abundant supply of food, and the birds were slaughtered by the million. Audubon speaks of seeing schooners at the wharves in New York in 1805 that were loaded in bulk with pigeons taken on the Hudson River, and states that the birds sold for only a cent apiece. In March, 1830, he found them so abundant in the New York markets that piles of them could be seen in every direction. He purchased 350 live pigeons at 4 cents apiece, most of which were carried to England. Prof. H. B. Roney has described a breeding colony located near Petoskey, Mich., in 1878, which covered about 100,000 acres of land, and from which it was estimated 1,500,000 dead birds and 80,532 live birds were shipped by rail, and probably an equal number by water. He estimates the total destruction of pigeons in Michigan in 1878 at 1,000,000,000, an estimate probably in excess of the number actually killed.<sup>3</sup>

The passenger pigeon has long since ceased to have any commercial importance; the netting and the slaughter to which it was subjected

<sup>1</sup>Ornith. Biog., II, p. 491, 1835.

<sup>2</sup>See Merriam's Birds of Connecticut, pp. 93-94, 1877.

<sup>3</sup>Am. Field, X, pp. 345-347.

at its roosts and breeding grounds have almost exterminated it. According to Brewster, the last important nesting in Michigan took place in 1881, a few miles west of Grand Traverse.<sup>1</sup> In the last twenty years the species has decreased so rapidly that its occurrence in any of the States except Indiana, Michigan, Minnesota, and Wisconsin can hardly be considered more than accidental. During the last ten or twelve years a few flocks of a hundred or more have been reported from the following places:

*Large flocks of passenger pigeons reported between 1889 and 1899.*

Date.	Locality.	Estimated number.	Authority.
1889, September 10.....	Mackinac Island, Mich..	100	White, Auk, X, p. 223.
1894, spring .....	Hickory, Minn .....	500	Gault, <i>ibid.</i> , XII, p. 80.
1836, May 22.....	Constableville, N. Y.....	300	Johnson, <i>ibid.</i> , XIV, p. 88.
1897, August 17.....	Cook, Nebr.....	100	Deane, <i>ibid.</i> , XV, p. 184.
1898, October 3.....	Ann Arbor, Mich.....	200	Covert, Recreation, X, p. 304.
1899, April 10.....	Litchfield, Ohio.....	150	Scudder, <i>ibid.</i> , X, p. 488.
1899, May 15.....	Norway, Wis.....	200	Eagan, <i>ibid.</i> , XI, p. 221.
1899.....	Sparta, Wis.....	500	Dervin, <i>ibid.</i> , XI, p. 221.
1899.....	Montport, Wis.....	300	Collis, <i>ibid.</i> , XI, p. 221.

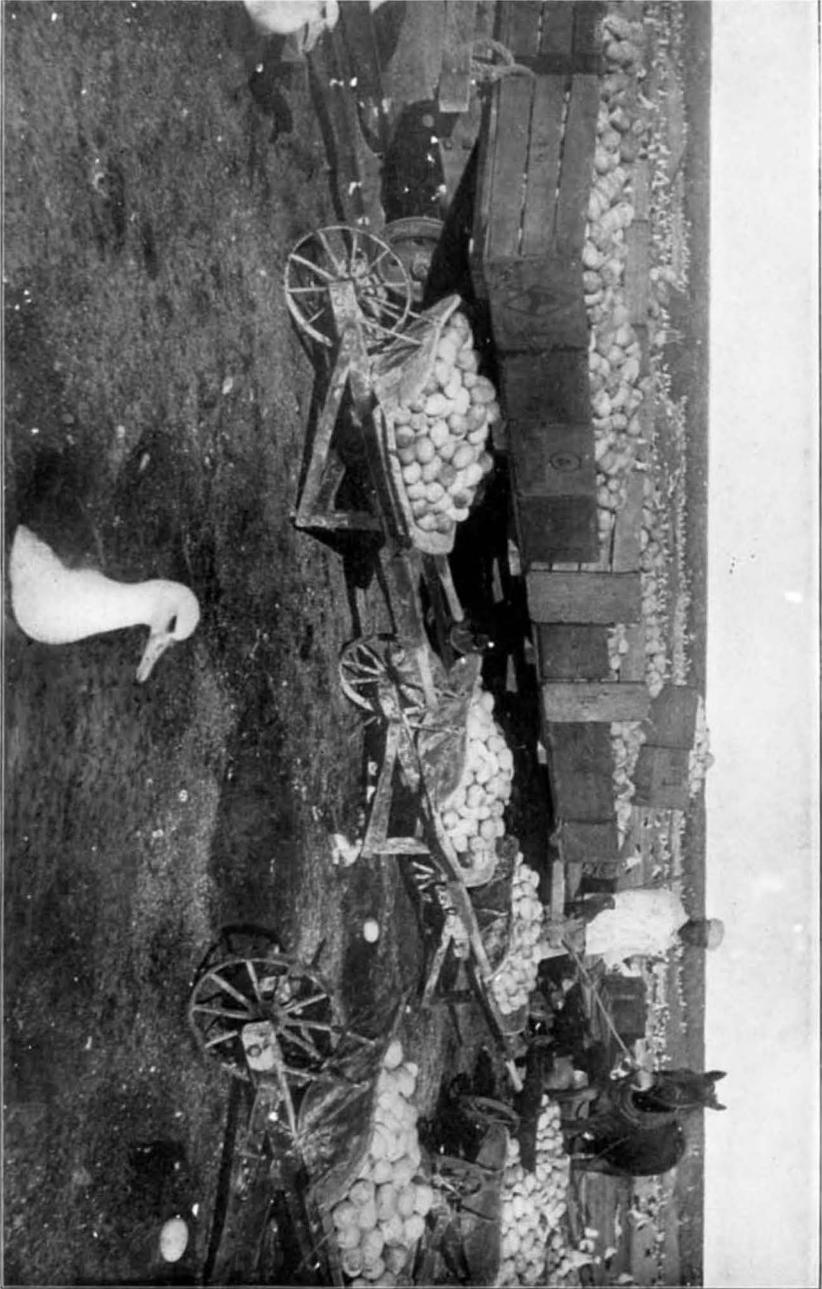
Smaller flocks or single birds have also been reported from Illinois (Chadwick, 1899; Lake Forest, 1895; Marengo, 1894); Indiana (several points, 1894-1896); Kentucky (Cobb Station, 1898); Maryland (several points, 1893); Massachusetts (Norton, 1889); Missouri (Altie, 1896); New Jersey (Englewood, 1896; Morristown, 1893); Pennsylvania (Potter County, 1892). Although the wild pigeon is now protected by law at all seasons in Michigan and Ohio, it is doubtful whether it can be saved from extinction. Like the bison, it has been sacrificed through wasteful and useless slaughter.

EGGS.

Large colonies of water birds, such as murre, pelicans, gulls, terns, and herons, may be found at certain points along our coasts during the breeding season. The value of these birds has never been properly appreciated, although in certain localities eggs of some species are highly esteemed and find a ready market, as on the eastern shore of Virginia, where eggs of the laughing gull (*Larus atricilla*) are considered a great delicacy and are gathered in large numbers for sale to hotels and private individuals. But in the gratification of this taste there is the same tendency toward extermination, which is manifested in the case of feather collecting.

Scott refers to the extermination of gulls and terns near the mouth of Tampa Bay, Florida, brought about in part by the operation of the

<sup>1</sup>Auk, VI, pp. 235-291, 1889.



COLLECTING ALBATROSS EGGS ON LAYSAN ISLAND, H. I.  
[Photograph by J. J. Williams, Honolulu.]



market egg hunters in the early eighties.<sup>1</sup> Sennett, in speaking of the quantities of eggs, chiefly of gulls, terns, and herons, gathered a few years ago along the coast of Texas, says:

There is probably not a port, pass, or bay on the entire coast of Texas whose inhabitants do not regularly devote several days each year to what they term "egging." \* \* \* All eggs from an inch in diameter upward are taken, excepting perhaps those of the pelican, whose eggs are too fishy for any stomach. I have known of boats which came a distance of over 100 miles to gather these eggs, cruising from reef to reef until they secured a good load. For days after the return from these expeditions the shops along the coast expose quantities of birds' eggs for sale, which are disposed of cheaply, according to size. \* \* \* In regard to the profits of the "egging business," I doubt if even the most successful "egger" can make as much money as he could have done had he stuck to his regular and much more praiseworthy occupation.<sup>2</sup>

The eggs of the "arrie" or "Pallas" murre (*Uria lomvia arra*) are collected for food on the Pribilof Islands, in Bering Sea, and H. W. Elliott mentions that on the occasion of his first visit to Walrus Island, in July, 1872, six men in less than three hours loaded a badarrah carrying 4 tons with eggs to the water's edge.

On Laysan, one of the northwestern Hawaiian Islands, the "gooney," or albatross (*Diomedea immutabilis*), fairly swarms. Immense quantities of its eggs are gathered for the use of the employees of the guano company, and possibly some are shipped to Honolulu. Photographs show that the eggs are gathered not only by the wheelbarrow load but by the car load. (See Pl. VI.) Formerly, it is said, the birds were accorded rigid protection by the superintendent of the company, but how long they can survive the recent wholesale removal of eggs is not difficult to surmise.

A still more striking example of wholesale egg collecting, and probably the most important one in the United States from a financial standpoint, is that of the Farallones. These islands, or rather rocks, situated on the coast of California 30 miles west of the Golden Gate, are the breeding grounds of myriads of sea birds, chiefly western gulls (*Larus occidentalis*) and murre, or California guillemots (*Uria troile californica*). For nearly fifty years murre eggs were collected here and shipped to the San Francisco market, where they found a ready sale at from 12 to 20 cents per dozen, a price only a little less than that of hens' eggs. During the season, which lasted about two months, beginning near the middle of May, the eggs were shipped regularly once or twice a week. The main crop was gathered on South Farallone, the principal island, and mainly from the "great rookery" at the west end. The bird lays only one egg, which is deposited on the bare rock. When the season opened, the men went over the ground and broke all the eggs in sight, so as to avoid taking any that were not perfectly fresh. The ground was then gone over every second day, and the eggs were systematically picked up and shipped to market.

<sup>1</sup> Auk, V, p. 377, 1888.

<sup>2</sup> Science, VII, pp. 199-200, February 26, 1886.

The business was in the hands of Italians and Greeks, who were also engaged in fishing, and although only a dozen or fifteen "egggers" were employed on the islands, the number of eggs gathered was simply enormous. It is said that in 1854 more than 500,000 were sold in less than two months, and that between 1850 and 1856 three or four million were taken to San Francisco. Dr. Heermann states that the value of the traffic was between \$100,000 and \$200,000, evidently too large an estimate, even at the high price of eggs prevailing at that time. Since then the value of the eggs has declined, and the number has also fallen off considerably. In 1884 there were gathered 300,000; in 1886 about 108,000; while in 1896 the crop was reduced to a little less than 92,000.

The Farallones being a Government light-house reservation, the "egggers" were allowed on the islands only by sufferance. From 1850 to 1880 the Farallone Egg Company remained in almost undisputed sway, but were dispossessed in 1881 by the light-house authorities. Afterwards the keepers employed men to gather the eggs, but in 1897 the attention of the Light-House Board was called to the decreasing numbers of birds, and instructions were promptly issued prohibiting further gathering of eggs for market, thus practically putting an end to the business for the present. Full accounts of the methods employed in this remarkable traffic may be found in the interesting papers of Bryant and Loomis,<sup>1</sup> from which the above facts have been mainly derived.

#### FEATHERS.

The fashion of wearing feathers and birds on hats has increased to such an extent during recent years as to cause an immense demand for birds and plumes to supply the millinery trade. The saying that a bird which has become fashionable is doomed to almost certain extinction is exemplified by the great decrease in numbers of terns along the Atlantic coast and herons of the Gulf States within the last twenty years. Attention was called to this wholesale destruction by the American Ornithologists' Union in 1886,<sup>2</sup> and the devastation of the Florida heronries and the barbarous methods of the plume hunters were vividly described by Scott in 1887 in a series of papers entitled "The present condition of some of the bird rookeries of the Gulf coast of Florida."<sup>3</sup>

Terns of several species were formerly abundant along the coast from Florida to New England. The common tern (*Sterna hirundo*) and the least tern (*S. antillarum*) bred abundantly on the New Jersey coast, but, according to Stone, both were nearly exterminated about 1883 to supply the millinery trade. As an example of the wholesale destruction of birds, Scott mentions a contract made by two men on Tampa Bay, Florida, for the delivery of 30,000 terns in a single

<sup>1</sup> Proc. Cal. Acad. Sci., 2d ser., I, pp. 31-36, 1888; VI, pp. 356-358, 1896.

<sup>2</sup> Science, VII, pp. 191-205, 1886.

<sup>3</sup> Auk, IV, pp. 135, 213, 273, 1887.

season. Similar contracts have been made on the coast of Virginia; and from Seaford, Long Island, N. Y., more than 3,000 terns were sent to market during the summer of 1883 by one gunner and his associates, while about the same time 40,000 are said to have been killed on Cape Cod, Mass. The results of such slaughter were swift and sure. An examination of the grounds about the mouth of Tampa Bay and the bars off Pass Agrille, on the west coast of Florida, in the summer of 1888 showed that not a tern of any kind was breeding where countless numbers had nested only a few years before.<sup>1</sup> Of the northern coast, Chapman says in 1895 "this little barren, uninhabited sand island [Gull Island, off Long Island]—only a few acres in extent—and Muskeget Island, off the Massachusetts coast, are the only localities from New Jersey to Maine where the once abundant common tern, or sea swallow, can be found in any numbers. [Each of these islands now has a keeper who is paid to protect the terns.] What an illustration of the results of man's greed and woman's thoughtlessness!"<sup>2</sup>

But the destruction of herons has been, if possible, even worse. The only heron feathers of any value are the nuptial plumes, commonly known as aigrettes, and in order to secure these plumes at their best the birds are killed on the breeding grounds soon after the eggs are laid or the young hatched. As the herons nest in colonies, it is often an easy matter to kill a large number by the use of rifles of small caliber. The American egret (*Ardea egretta*) and the snowy egret (*A. candidissima*) furnish the finest aigrettes, and consequently have suffered most severely; to-day the latter species is the rarest heron in the South.

Scott speaks of finding herons abundant in 1880 at a number of large rookeries on the west coast of Florida, but in 1886 the same breeding grounds were almost deserted or marked by piles of dead and decaying birds. The slaughter which had begun at least two years before was then still under way, and a price had been set on every bird of any value to the plume hunters. One man who had visited Florida for four seasons was employing from 40 to 60 gunners, to whom he furnished supplies and paid from 20 cents to \$2.50 apiece for desirable skins, the average price being about 40 cents. Besides the plume birds, such as herons, ibises, and roseate spoonbills, various others—sandpipers, plovers, turnstones, least terns, boat-tailed grackles, gray king birds, and even owls—were killed for the Northern market.<sup>3</sup> "I have heard a 'plume hunter,'" says Chapman, "boast of killing 300 herons in a rookery in one afternoon. Another proudly stated that he and his companions had killed 130,000 birds—herons, egrets, and terns—during one winter. But the destruction of these birds is an unpleasant subject. It is a blot on Florida's history."<sup>4</sup>

<sup>1</sup>Scott, Auk, V, p. 376.

<sup>2</sup>Birds East. N. Am., p. 83.

<sup>3</sup>Auk, IV, pp. 141 and 277.

<sup>4</sup>Birds East. N. Am., pp. 133-134.

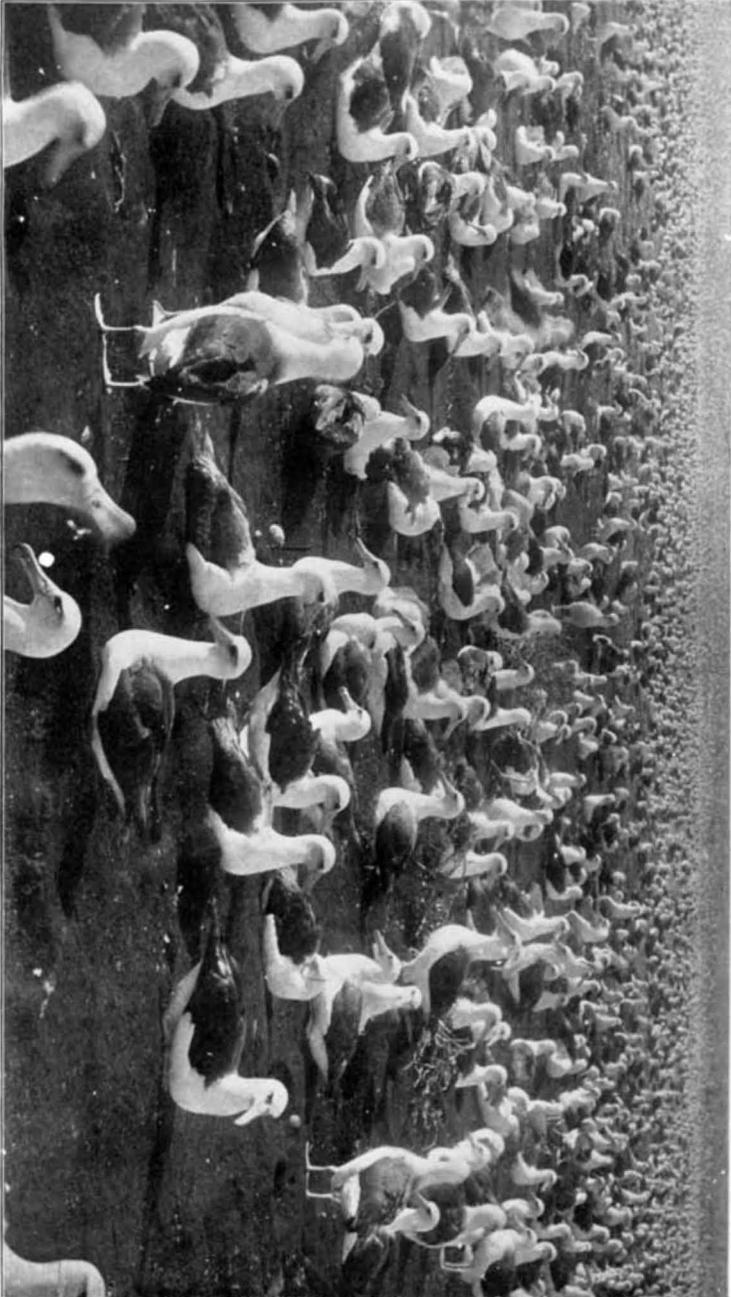
Unfortunately, the demands of the millinery trade are not confined to plume birds and terns or to any particular State, and the slaughter so destructive to the Florida herons is being repeated in less degree in several sections of the country in the case of other birds.

Among the few redeeming features of the feather trade should be mentioned the establishment of a new industry through the introduction of the South African ostrich (*Struthio australis*). The first birds, 22 in number, reached New York in December, 1882, and a few months later were placed on a farm near Anaheim, Cal. In 1899 there were several ostrich farms in southern California, and one each in Arizona, Florida, Texas, and the Hawaiian Islands. Although ostrich farming in the United States has passed through many vicissitudes and is still in its infancy, the important fact has been demonstrated that ostrich feathers can be produced in this country which are equal to the best grades imported from abroad.

#### GUANO.

Alexander von Humboldt, returning from his extended travels in tropical America in 1804, carried to Europe some samples of bird dung, or guano, and first called attention to the value of the extensive deposits of this substance on the Chincha Islands, off the coast of Peru. The announcement excited little interest at the time, but its importance was realized forty years later, when guano revolutionized methods in agriculture and furnished a new source of revenue for corporations, and even nations, chief among the latter being Peru, which for several years depended largely on the income from the Chincha Island deposits to pay the interest on her national debt. In the early fifties guano became the subject of diplomatic correspondence between the United States and Peru and Venezuela; but the negotiations failing to secure the desired reduction in price of Peruvian guano, deposits were sought elsewhere. Finally, Congress was induced to take action, which resulted in the taking possession by private persons under the protection of the United States of a number of small guano islands in the West Indies and in the South Pacific.

Deposits of the excrement of sea birds occur on rocky islands in various parts of the world in nearly all latitudes; but guano of commercial value is limited chiefly to the rainless regions of the Tropics, usually within a few degrees of the equator. Its fertilizing value lies in the presence of nitrogen, phosphates, and a small amount of potash. Under a tropical sun the excrement dries rapidly and undergoes little change, whereas in moist climates fermentation speedily sets in, resulting in a loss of nearly all the organic matter, while the soluble alkalies and phosphates are leached out. Guano may therefore be divided into two main classes: (1) Nitrogenous, represented by Peruvian guano, which has undergone little change; (2) phosphatic,



ALBATROSSES (*DIOMEDEA IMMUTABILIS*) ON LAYSAN ISLAND, H. I.

[Photograph by J. J. Williams, Honolulu.]

developing the deposits on Baker and Jarvis islands, in the South Pacific; and on August 18, 1856, Congress passed an "act to authorize protection to be given to citizens of the United States who may discover guano,"<sup>1</sup> under which any citizen of the United States was authorized to take possession of and occupy any unclaimed island, rock, or key containing guano, upon filing a notice of such claim and a bond to insure compliance with the requirements of the law. The discoverers of such islands were entitled to exclusive rights to the deposits thereon, but the guano could only be removed for the use of citizens of the United States and at a price not exceeding \$8 per ton alongside the vessel, or \$4 per ton on the spot. Imports were subject to the laws governing the coasting-trade of the United States, and the Government was relieved from the necessity of protecting or retaining possession of any island, rock, or key after the guano had been removed. Thus far, claims have been filed to about seventy-five islands in the Caribbean Sea and the South Pacific, as shown by the following list:

*List of guano islands now appertaining to the United States.<sup>2</sup>*

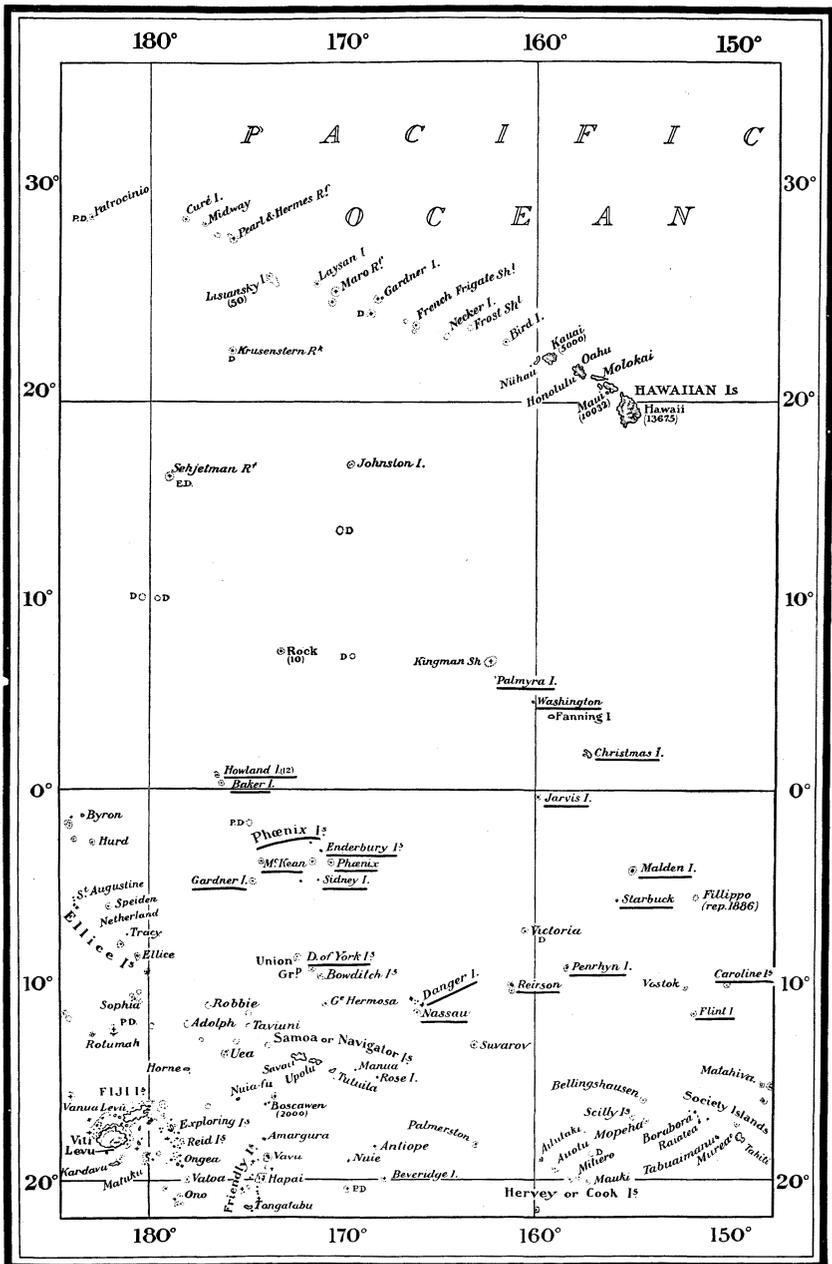
[Bonded under act of August, 1856.]

PACIFIC ISLANDS.

Name.	Latitude.	Longitude.	Name.	Latitude.	Longitude.
America .....	3 40 N.	159 28 W.	Groninque .....	10 00 S.	156 44 W.
Anne .....	9 49 S.	151 15 W.	Howland, or Now- land .....	0 52 N.	176 52 W.
Baker, or New Nantucket.....	15 N.	176 30 W.	Humphrey .....	10 40 S.	160 52 W.
Barber .....	8 54 N.	178 00 W.	Jarvis .....	0 21 S.	159 52 W.
Barren, or Starve ..	5 40 S.	155 55 W.	Johnston .....		
Bauman .....	11 48 S.	154 10 W.	Kenn .....	4 41 S.	173 44 W.
Birnie .....	3 35 S.	171 39 W.	Lideron .....	11 05 S.	161 50 W.
Caroline .....	9 54 S.	150 07 W.	Low .....	9 33 S.	170 38 W.
Christmas .....	1 58 N.	157 10 W.	McKean (Phoenix group).....	3 35 S.	174 17 W.
Clarence .....	9 07 S.	171 40 W.	Mackin .....	3 02 N.	172 46 W.
Dangerous .....	10 00 S.	165 56 W.	Malden .....	4 00 S.	155 00 W.
Dangers Rock .....	6 30 N.	162 23 W.	Mary Letitia .....	4 40 S.	173 20 W.
David .....	40 N.	170 10 W.	Mary .....	2 53 S.	172 00 W.
Duke of York .....	8 30 S.	172 19 W.	Mathew .....	2 03 N.	173 26 W.
Enderbury (Phœ- nix group).....	3 08 S.	171 08 W.	Nassau .....	11 30 S.	165 30 W.
Farmer .....	3 00 S.	170 50 W.	Palmyra .....	5 48 N.	162 20 W.
Favorite .....	2 50 S.	176 40 W.	Penrhyn .....	8 55 S.	158 07 W.
Flint .....	10 32 S.	162 05 W.	Pescado .....	10 38 S.	159 20 W.
Flints .....	11 26 S.	151 48 W.	Phoenix .....	3 40 S.	170 52 W.
Frances .....	9 58 S.	161 40 W.	Prospect .....	4 42 N.	161 38 W.
Frienhaven .....	10 00 S.	156 59 W.	Quiros .....	10 32 S.	170 12 W.
Gallego .....	1 42 N.	104 05 W.	Reirson .....	10 10 S.	160 53 W.
Ganges .....	10 59 S.	160 55 W.	Rogewein .....	11 00 S.	156 07 W.
Gardner (Phoenix group).....	4 40 S.	174 52 W.	Samarang .....	5 10 N.	162 20 W.
			Sarah Anne .....	4 00 N.	154 22 W.

<sup>1</sup> 11 Stat. L., 119.

<sup>2</sup> From data on file in the Treasury Department.



PRINCIPAL GUANO ISLANDS IN THE PACIFIC OCEAN (BONDED UNDER ACT OF 1856).  
 [From Chart 923 of the United States Hydrographic Office. Names of bonded islands underlined.]



*List of guano islands now appertaining to the United States—Continued.*

## PACIFIC ISLANDS—Continued.

Name.	Latitude.	Longitude.	Name.	Latitude.	Longitude.
Sidney (Phoenix group).....	4 20 S.	171 00 W.	Walker.....	3 58 N.	149 10 W.
Starbuck, or Hero.....	5 25 S.	155 56 W.	Washington, or Uahuga.....	4 40 N.	160 07 W.
Staver.....	10 05 S.	152 16 W.			

## WEST INDIES.

	Latitude.	Longitude.		Latitude.	Longitude.
Anchor Key.....	14 18 N.	80 08 W.	North Rocks.....	14 20 N.	80 26 W.
Aves.....	15 40 N.	63 37 W.	Pedro Keys.....	17 00 N.	77 52 W.
Booby Key.....	14 14 N.	80 30 W.	Petrel.....	15 52 N.	78 33 W.
Great and Little Swan.....	17 23 N.	83 50 W.	Quito Sereno.....	14 30 N.	81 07 W.
Morant Keys (Northeast, Sand, Savanna, Seal).....	17 26 N.	77 55 W.	Roncador.....	13 33 N.	80 03 W.
Navassa.....	18 10 N.	75 00 W.	Serrana Key.....	14 15 N.	80 24 W.
North Keys.....	14 25 N.	80 20 W.	Serranilla Keys (East, Middle, Beacon).....	15 20 N.	79 40 W.
			Triangle Keys.....	14 20 N.	80 05 W.

Fifty-four of these islands are in the Pacific Ocean (see map, Pl. VIII), the remainder in the Caribbean Sea or the Gulf of Mexico. Of the Pacific islands, Baker and Jarvis were bonded in 1856, Howland in 1858, Barren, Christmas, Enderbury, Johnston, McKean, Malden, and Phoenix in 1859, and the others in 1860. The Pacific islands<sup>1</sup> are situated between longitude 150° and 178° W., the most northern being the Johnston Islands, latitude 16° 53' N.; the most southern, Bauman, latitude 11° 48' S. Most of them are between the Society and Hawaiian islands, and are chiefly small coral reefs, a mile or two in length, almost entirely destitute of vegetation. One of the most northern guano deposits, which has been successfully developed, is that on Laysan, a small island 3 miles long by 2½ broad, in latitude 26°, which has recently been acquired through the annexation of Hawaii.

As would naturally be supposed, the extent and value of some of the deposits were at first greatly exaggerated, while others proved to have little value, and, as in the case of the Alacran Rocks, in the Caribbean Sea, were afterward abandoned. In an interesting article on the Pacific guano islands, Hague, who had visited a number of them, states that the first cargoes of guano brought from the Johnston Islands proved to be sand; that samples of guano from Christmas Island were chiefly coral sand, and that the deposits on Starbuck, or Hero, consisted of hydrated sulphate of lime. Some of the islands are covered with vegetation, and hence unsuited for the deposition of guano, while others, such as David, Farmer, Favorite, Flint, Samarang, Sarah Anne, and Walker, Hague considered as probably nonexistent, at least in the

<sup>1</sup> Except Gallego, which is in the eastern Pacific in longitude 104° 05' and north-west of the Galapagos Islands.

positions usually assigned them on charts.<sup>1</sup> Still, during the thirty years from 1869 to 1898, 283,871 tons of guano, valued at \$3,229,832, were brought from the islands appertaining to the United States. The production was very irregular, varying from a minimum in 1890 of 1,176 tons, worth \$9,577, to a maximum in 1878 of 17,930 tons, valued at \$211,239. The returns for each year are shown in the following table:

*Guano brought from islands appertaining to the United States for the years ending June 30, from 1869 to 1898, inclusive.*<sup>1</sup>

Year.	Tons.	Value.	Year.	Tons.	Value.	Year.	Tons.	Value.
1869.....	15,622	\$253,545	1880.....	12,795	\$147,051	1891.....	15,857	\$101,918
1870.....	17,068	392,172	1881.....	16,883	179,882	1892.....	4,288	26,032
1871.....	14,154	240,235	1882.....	15,249	160,016	1893.....	4,376	26,256
1872.....	4,209	60,865	1883.....	7,873	92,130	1894.....	5,137	31,190
1873.....	11,014	161,690	1884.....	9,333	106,431	1895.....	8,082	48,164
1874.....	6,877	100,345	1885.....	12,100	86,166	1896.....	6,929	37,374
1875.....	7,269	122,012	1886.....	5,770	38,839	1897.....	5,310	31,860
1876.....	14,785	192,972	1887.....	8,226	55,671	1898.....	4,562	27,372
1877.....	6,060	79,822	1888.....	5,765	41,226	Total ..	283,871	3,229,832
1878.....	17,930	211,239	1889.....	10,439	72,643			
1879.....	8,733	95,137	1890.....	1,176	9,577			

<sup>1</sup>Data furnished by the Bureau of Statistics, Treasury Department. The returns for 1889 to 1898 are published in "Commerce and Navigation of the United States," p. 690, 1899.

Besides the guano deposits belonging to the United States, there are others in various parts of the world, among which may be mentioned those along the coast of Lower California, on the Galapagos, and, the most important of all, the Chincha Islands in latitude 13° 38' S., Guanape, Lobos, and others belonging to Peru. Valuable deposits have been found along the coasts of Venezuela, Colombia, Ecuador, and Bolivia. Guano has also been obtained from Shark Bay and Swan Island, Australia; Algoa Bay and Saldanha Bay, Cape Colony; Ascension and Ichaboe islands, off the west coast of Africa, and Kuria Muria, on the Arabian coast. Some of the best deposits have now been exhausted; those which remain are expensive compared with the better artificial fertilizers now in use; but a small amount of guano is still brought from some of the islands and imported from abroad, a reminder of the important trade of forty or fifty years ago.

#### MEASURES FOR THE DESTRUCTION, PRESERVATION, AND INTRODUCTION OF BIRDS.

A review of the progress of economic ornithology would scarcely be complete without some reference to the attempts which have been made to destroy injurious birds or to increase beneficial species. Naturally, attention was first directed to the damage done by birds to crops, and bounties were paid for the destruction of the marauders. Later, as the

<sup>1</sup>Am. Journ. Sci., XXXIV, pp. 224-243, 1862.

country became settled and the value of birds better appreciated, attempts were made to protect useful species, and also to introduce other species that were thought desirable. The subject may therefore be considered under three heads: (1) Measures for the destruction of birds—bounty laws; (2) measures for the protection of birds—game laws; and, (3) introduction of foreign birds.

#### MEASURES FOR THE DESTRUCTION OF BIRDS—BOUNTY LAWS.

Efforts have been made since colonial days to exterminate certain birds considered injurious to agriculture. The early settlers, seeing their crops attacked by crows, blackbirds, and ricebirds, undertook measures for bird destruction long before they thought of bird protection. Among the various relief measures were the curious scalp-tax acts, which were intermittently in force in Virginia for more than seventy years subsequent to 1734, and which required a certain number of bird scalps each year in lieu of taxes. In most localities, however, the apparently simple expedient of drawing on the county or State treasury for the payment of rewards was more popular and more generally adopted. Sixteen or more States (all but two east of the Missouri River and north of latitude 36°) have waged a desultory warfare against crows, blackbirds, hawks, owls, certain fish-eating birds, and English sparrows. Crow bounties have been offered in eight States, mainly along the Atlantic seaboard; hawk bounties in ten, chiefly in the Middle States and in those along the Great Lakes; premiums on blackbirds in Minnesota and New Jersey; on fish-eating birds in Utah, and on sparrows in Illinois, Michigan, Ohio, and Utah.

Until recently depredations on grain crops were the main cause of hostility to birds; and the crow was the principal object of attack down to the latter part of the present century. In 1805 a crow-scalp tax was in force in Virginia, under which taxpayers in five counties were required to deliver three crow scalps annually or pay a penalty of 4½ cents for each missing scalp. In 1826 a premium of 8 cents on crows was paid by some of the counties of Virginia, and two years later by the whole State. Meantime, Delaware had authorized the creation of a crow-bounty fund in Newcastle County as early as 1810, and New Hampshire had established a premium of 12½ cents on crows in 1817–1819. Some years later New Hampshire reestablished the rewards, and subsequently offered premiums of 10 cents in 1829, 1832–1835, and 1849–1851. Maine followed next with an 8-cent bounty, which was in force from 1830 to 1834. The only recent crow bounties of consequence are those of New Hampshire (1881–1883) and Maine (1889–1891)—10 cents in each case.

From the earliest colonial times down to 1875 crows, blackbirds, and bobolinks, or ricebirds, had been the main, if not the only, subjects of adverse legislation, but in that year Delaware established the precedent of paying premiums on hawks and owls by offering 50 cents for all species except "fishhawks and mouse owls." These hawk

bounties, which were very popular during the succeeding fifteen years, have probably done more harm than any others. In 1877 Delaware's example was followed by Colorado with an act offering a 25-cent bounty on hawks (in force until 1885) and by New Hampshire with one offering a 20-cent bounty (in force until 1881). West Virginia followed in 1881, Indiana in 1883, and Virginia in 1884. Finally, in 1885, Pennsylvania passed its famous scalp act, which resulted in such large expenditures and such glaring frauds that it attracted widespread attention, and was repealed eighteen months later. Since then hawk and owl bounties have been far less popular, and the acts which still remain on the statute books of three or four States are practically dead letters, being enforced in only a few localities.

In 1887 attention was turned to the English sparrow as a legitimate subject for bounty legislation. Michigan began by paying 1 cent apiece for sparrows, and two years later increased the amount to 3 cents. Utah offered one-fourth of a cent apiece and Ohio 10 cents per dozen in 1888, and both States doubled their rewards in 1890. Illinois has paid 2 cents since 1891 on all English sparrows killed in December, January, and February. In 1896 Utah increased its bounty, allowing 1 to 3 cents, and established a rate of 5 cents per dozen on eggs. Sparrow bounties are still maintained in these four States, and have resulted in large expenditures; but they have not exterminated the English sparrow or even caused a perceptible diminution in its numbers except in a few localities. On the other hand, these bounties have caused the destruction of a large number of native sparrows, which have been killed for the sake of the rewards.

A dangerous precedent has recently been set by Utah in placing premiums on fish-eating birds, such as fishhawks, herons, mergansers, pelicans, and loons, in the interest of owners of fish ponds and hatcheries. The act has not been in force long enough to have much effect, but experience in Europe has shown the abuses to which such laws are subject and the evils in which they are likely to result.

The following table contains a list of the principal bounty laws on birds which have been in force during the century; local acts, such as the township bounties in Michigan, and the special county bounties in Maryland, Virginia, and one or two other States, are omitted:

*Principal bounty laws on birds in force from 1800 to 1899.*

State.	In force.	Species.	Remarks.
Colorado.....	1877-1885	Hawks.....	25 cents.
Delaware.....	1810	Crows.....	Newcastle County.
	1847-1852	do.....	4 cents, March to September.
	1852-1873	do.....	4 cents.
	1873-1877	Hawks and owls..	50 cents (fishhawks and "mouse owls" excepted).
Illinois.....	1891-1899	English sparrows..	2 cents, December to February.

*Principal bounty laws on birds in force from 1800 to 1899—Continued.*

State.	In force.	Species.	Remarks.
Indiana .....	1883-1899	Hawks and owls...	Not exceeding \$2 (sparrow hawks and screech owls excepted).
Kansas .....	1889	Crows.....	Crawford County.
Maine .....	1830-1834	.....do .....	8 cents.
	1889-1891	.....do .....	10 cents, April to October.
Maryland .....		Crows and hawks..	
Michigan .....	1869	.....	Township bounties authorized.
	1887-1899	English sparrows..	1 cent; 1889, 3 cents; 1895, 2 cents; November to March since 1893.
Minnesota .....	1885	Blackbirds.....	
	1887	.....do .....	10 cents per dozen, April to June; 5 cents, July to October.
New Hampshire..	1817-1819	Crows .....	12½ cents.
	1829	.....do .....	10 cents, April to June.
	1832-1835	.....do .....	10 cents, March 20 to July 20.
	1849-1851	.....do .....	10 cents, April 15 to June 15.
	1877-1881	Hawks .....	20 cents.
	1893-1897	.....do .....	25 cents.
New Jersey .....		Blackbirds, crows.	
Ohio.....	1881-1882	Hawks .....	50 cents.
	1882-1883	Hawks and horned owls.	50 cents ("hen, chicken, or bird hawks" only).
	1888-1899	English sparrows..	10 cents per dozen; since 1890, 20 cents per dozen.
Pennsylvania.....	1885-1887	Hawks and owls...	50 cents.
Utah .....	1888-1899	English sparrows..	¼ cent; 1890, ½ cent; 1896, 1 to 3 cents, eggs, 5 cents per dozen.
	1896-1899	Fishhawks, herons, fishducks, loons.	10 to 25 cents; since 1897, 25 cents.
Virginia .....	1826-18—	Crows.....	8 cents; 5 counties in 1826; general in 1828.
	1849-18—	Blackbirds, crows.	
	1884-1899	Chicken hawks and owls.	50 cents (screech owls excepted).
West Virginia ....	1881-18—	Hawks and owls...	

It has been deemed expedient to review this legislation in detail in order to correct the misapprehension that bounty laws are few in number or unimportant. More than forty such laws on birds have been in force during the century, but, besides the Pennsylvania scalp act and a few others, very little information is accessible concerning them. There is still a general demand for bounties on certain birds, as taxpayers ordinarily know little about the cost or the results of such legislation.

Though the average bounty law seldom remains in force more than two or four years, it may prove a costly experiment and do much harm. Maine spent more than \$12,000 in her two attempts at crow extermination in 1830-1834 and 1889-1891, Illinois more than \$55,000 for English sparrows in 1891-1896, Michigan about \$61,800 for English sparrows in 1887-1895, and Pennsylvania about \$90,000 for hawks

and owls in 1885-1887. Altogether it is safe to say that the systematic destruction of birds in this country during the century has cost more than \$250,000, and most of this money has been spent by half a dozen States during the last fifteen years. Since the exposure of the evils of the Pennsylvania scalp act there has been a tendency to repeal bounties on useful birds of prey, and so far as possible, to provide against fraud. Premiums on crows and blackbirds have been practically abandoned, and almost the only important ones still in force are those on the English sparrow.

#### MEASURES FOR THE PROTECTION OF BIRDS—GAME LAWS.

It was said some years ago that the United States had done less for the protection of its birds than any other civilized country. If this is still true, it certainly is not because of lack of legislation, for nearly all the States have enacted game laws, and frequently changed them as their defects have become apparent. Statutory law is notoriously erratic and unstable, and with forty-eight States and Territories, each attempting to protect its game in its own way, confusion has naturally arisen. Protective measures have rarely, if ever, fulfilled expectations, and consequently game and insectivorous birds have continued to decrease. Federal legislation has been advocated as the only remedy, but its feasibility is questionable, since the jurisdiction of Congress in ordinary cases extends only to the Territories and Government reservations.

The need of protective measures has long been recognized, and although the uniformity attained by other countries has not been secured in the United States, definite progress has been made, as will be seen from the following brief review: In the present century Massachusetts, as early as 1818, enacted a law for the preservation of game birds; Virginia in 1832 prohibited the killing of wild fowl at night on the water and forbade the use of swivel guns; in 1850 Connecticut and New Jersey protected insectivorous birds; and in 1857 Ohio passed a comprehensive law protecting both game and insectivorous birds and eggs of all species, and prohibiting the sale of game birds during close seasons. By 1864 similar laws were in force in all the States south to Maryland and west to Minnesota, excepting West Virginia and Indiana, and also in California. Several of these acts related solely to game birds, and those of Illinois and Maryland were enforced only in certain counties.<sup>1</sup> At the present day practically all the States and Territories endeavor to protect game, and most of them extend protection to insectivorous birds.

#### CRITICISM OF GAME LEGISLATION.

Game laws have suffered in popular estimation because they have not been systematically enforced; because, as sometimes alleged, they

<sup>1</sup> Dodge, Rept. Comm. Agr., pp. 442-446, 1864.

are enacted for selfish ends, and because they lack stability and uniformity. The enactment of a game law is only a beginning, and unless some one is charged with seeing that its provisions are carried out, it is almost certain to be a failure; nor can it be entirely successful unless supported by public sentiment. The appointment of salaried game wardens has overcome the first difficulty to some extent.

Credit for much that has been accomplished in protective legislation is due to sportsmen and game associations, but their efforts have not always been appreciated, and have even been misconstrued from the belief that other interests have been overlooked. The relation of the sportsman to the farmer was aptly stated in the State senate report on the Ohio game bill of 1861, as follows:

The genuine and honorable sportsman is the friend and ally of the agriculturist. He will be found always ready to protect birds which are useful, destroy the rapacious and hurtful, to prevent trespasses, and enforce the laws.<sup>1</sup> \* \* \* The pursuit of game can not be prevented, and it is useless to attempt it. It should be regulated, and for this purpose the highest skill and knowledge of the habits of birds and wild animals should be employed, the most reasonable and perfect rules established by statute, and all should unite in their rigid enforcement. Any other system will result in disappointment and failure.

The principles on which such statutes should be based were defined as (1) protection of useful birds, other than game, at all seasons; (2) protection of game birds in such manner as to promote their reasonable increase; (3) withdrawal of protection from species of doubtful value; (4) use of well-known names in the statutes to avoid confusion.<sup>2</sup> Another common criticism is that game laws are subject to frequent change. This is, unfortunately, true, but there have been notable exceptions, such as the act recently repealed in the District of Columbia, which remained in force twenty-one years, and the Indiana and Louisiana statutes of 1881 and 1877, respectively, which are still in force. However, permanency without effectiveness is of little value.

#### EFFORTS AT UNIFORMITY IN GAME LAWS.

Repeated efforts have been made to bring about greater uniformity in the various State laws, including those protecting insectivorous birds. The International Association for the Protection of Fish and Game, organized in May, 1875, and comprising representatives from thirty-eight States and Territories and Canada, prepared in 1877 a simplified code of cooperative laws for presentation to State legislatures, but then allowed the matter to drop. Between 1890 and 1896 half a dozen conferences of State commissions were held, but they

<sup>1</sup> This relation is exemplified by the Connecticut Association of Farmers and Sportsmen for the Protection of Fish and Game, which has for its objects not only the preservation of game and the enforcement of game laws, but also the protection of farmers against trespassers and marauders who tear down fences or injure stock. This association has been in existence ten years.

<sup>2</sup> Collins, Fifteenth Ann. Rept. Ohio Board Agr. for 1860, pp. 383, 390, 1861.

\* \* \* The snipe, too, like the pigeon, will take care of itself, and its yearly numbers can not be materially lessened by the gun. The wild goose does not, perhaps, need general protection; though if any linger here till near breeding time they should be spared.<sup>1</sup>

The chief causes of the decrease in game birds are spring shooting, cold-storage traffic, and sale (during the close season) of birds imported from other States. Of late years attention has been directed toward the markets as the chief factor in game destruction, and in order to prevent undue slaughter, the traffic in game has been restricted more closely. Since the constitutionality of nonexport laws was established by the Supreme Court in 1896,<sup>2</sup> nonexport clauses have been quite generally incorporated in game laws, and the shipment of game from one State to another is now restricted or prohibited in more than half the States. Subjecting cold-storage rooms to inspection has been advocated, and laws limiting the quantity of game that may be killed in a day or a season were enacted by Iowa, Minnesota, and Pennsylvania in 1897, and Colorado in 1899. Killing game for sale was prohibited by law in Tennessee in 1889, and in Iowa and Pennsylvania in 1897. It has even been suggested that the sale of game should be prohibited at all seasons. This suggestion, advocated in 1894,<sup>3</sup> seems to have met with some favor, for it was incorporated in the laws of Kansas and Vermont two or three years ago, and has been taken up by the League of American Sportsmen.

The necessity for restricting the list of game birds is still very urgent in certain States. In the markets of New Orleans everything that has feathers seems to be regarded as legitimate game. In some States robins, flickers, meadowlarks, and reedbirds are important items of game, and in California, where true reedbirds do not exist, no less than a dozen species of native sparrows and finches, masquerading under the name of reedbirds, have been identified in the markets of San Francisco. This difficulty is met by the "Act for the protection of birds," proposed early in 1886 by a committee of the American Ornithologists' Union, which limits game birds to the Anatidæ—swans, geese, and ducks; Rallidæ—rails, coots, and gallinules; Limicolæ—plovers, snipe, woodcock, sandpipers, and curlew; and Gallinæ—turkeys, grouse, pheasants, and quail. Species not included in these four groups are protected at all seasons, but provision is made for collecting specimens for scientific purposes. This act was practically adopted by New York in 1886, by Indiana in 1891, and by Illinois in 1899. With its exact definition of game birds and its protection of all other species, it does away with the difficulties attendant upon the enforcement of laws protecting "song" or "insectivorous" birds and obviates the necessity for special acts protecting species that do not properly come within either of these groups. Florida and

<sup>1</sup> Collins, Fifteenth Ann. Rept. Ohio Board Agr. for 1860, p. 387, 1861.

<sup>2</sup> Geer v. State of Connecticut, 161 U. S. 519.

<sup>3</sup> Forest and Stream, XLII, p. 89.

Texas have special acts prohibiting the killing of "birds of plume," such as herons, egrets, and ibises; Maine, one prohibiting the killing of terns; Maryland, Michigan, Oregon, Utah, and Virginia protect gulls; several States, notably Alabama, Illinois, Pennsylvania, and Utah, have begun to protect birds of prey, and a majority of States now protect "insectivorous" birds. The uniform adoption of the proposed act would greatly simplify legislation.

#### PROSPECT FOR ENFORCEMENT OF GAME LAWS.

With the present widespread interest in birds, there is every reason to hope that in future laws will not be allowed to become dead letters. Fish and game commissions, sportsmen's associations, Audubon societies, farmers, and the general public are all interested in the cause of bird protection.<sup>1</sup> In January, 1898, the League of American Sportsmen was organized for the special purpose of enforcing game laws and protecting song and insectivorous birds. This association, which is composed of representative sportsmen in all parts of the United States, advocates the propagation of game and the enactment of laws licensing guns, limiting the killing of game, and prohibiting the sale of game at all seasons.<sup>2</sup>

#### INTRODUCTION OF FOREIGN BIRDS.

Much interest has been manifested in importing song birds and game birds from other lands to supplement the list of native species or replace those which are rapidly decreasing. Neither expense nor failure prevents the frequent repetition of such experiments, although scarcely half a dozen of the thirty or forty introduced species have really become acclimated in the United States. Besides the English sparrow and the European tree sparrow, a score or more kinds of song birds and ten or twelve of game birds have been imported at various times.

The introduction of the English sparrow (*Passer domesticus*) is one of the most familiar examples of acclimatization. Brought over to the United States in 1850, the bird developed such a marvelous ability to adapt itself to new surroundings and increased so rapidly that by 1870 it had gained a foothold in twenty States and the District of Columbia, as well as in two provinces of Canada. At the present time it is found in every State and Territory except Alaska, Arizona, Montana, Nevada, and New Mexico. It is known everywhere as a great pest, and Illinois, Michigan, Ohio, and Utah are now offering bounties for its destruction.<sup>3</sup> The closely related European tree

<sup>1</sup> For list of State officials and associations concerned with the protection of birds and game, see Appendix.

<sup>2</sup> Recreation, VIII, p. 233, 1898.

<sup>3</sup> A full account of the habits and distribution of the English sparrow may be found in Bulletin No. 1, Division of Ornithology and Mammalogy, 1889; see also the Yearbook of the Department of Agriculture for 1898, pp. 98-101.

sparrow (*Passer montanus*) has been introduced at St. Louis, Mo., but has never spread to any extent. Twenty birds were imported in 1870, and the species is well established in the country immediately about the city. It is much less objectionable than the English sparrow, and is said to lack the fighting qualities which have made the latter bird so unpopular.

Importation of song birds from Europe began about the middle of the century. Thomas Woodcock, president of the Natural History Society of Brooklyn, is said to have brought over a number in 1846, and the following season goldfinches, linnets, bullfinches, and skylarks were seen at Greenwood and in the suburbs of Brooklyn. The last species survived two winters.<sup>1</sup> Early in 1853 John Gorgas liberated 42 skylarks at Wilmington, Del., and a number were set free at Washington, D. C.<sup>2</sup> Allen states that in 1853 a considerable number of skylarks, wood larks, English blackbirds and other thrushes, robin redbreasts, and goldfinches were set at liberty in Greenwood Cemetery, New York.<sup>3</sup>

Between 1872 and 1874 the Acclimatization Society of Cincinnati, Ohio, spent about \$9,000 in importing some 4,000 European birds, belonging to about 20 species, but the experiment resulted in failure. At nearly the same time the Society for the Acclimatization of Foreign Birds liberated at Cambridge, Mass., a considerable number of European goldfinches (*Carduelis carduelis*) and other species. About 1877 a number of starlings (*Sturnus vulgaris*) were set free in Central Park, New York, by the American Acclimatization Society. This was followed by several similar experiments, only the last of which, in 1890, when 60 birds were released, seems to have been successful. Goldfinches set at liberty at Hoboken, N. J., in 1878, appeared in Central Park, New York, in the following year, and were found breeding in 1886.<sup>4</sup> In 1889 and 1892 the Society for the Introduction of European Song Birds, of Portland, Oregon, imported two lots of birds at a cost of about \$2,000. Some 20 species were represented, including 50 pairs of skylarks, 30 pairs of black thrushes, 35 pairs of starlings, and 15 pairs of green linnets. As a result of these numerous importations, the European tree sparrow has become established in the vicinity of St. Louis, Mo.; the European goldfinch has been found at various times in several places in eastern Massachusetts and in Central Park, New York; the skylark has become acclimated on Long Island, N. Y., and in the vicinity of Portland, Oregon; the starling is slowly spreading up the lower Hudson Valley and has also gained a foothold at Portland; a few other species are reported to be doing well in Oregon, but all the rest have failed to survive.

<sup>1</sup> Forest and Stream, XI, p. 406, 1878.

<sup>2</sup> Rept. Comm. Patents for 1853 (Agr.), pp. 70-71.

<sup>3</sup> Bull. Nuttall Orn. Club, V, p. 120, 1880.

<sup>4</sup> Adney, Auk, III, pp. 409-410, 1886.

The introduction of game birds has been far more successful than that of song birds. The species include the English pheasant (*Phasianus colchicus*), the ringneck or Mongolian pheasant (*P. torquatus*), the green pheasant (*P. versicolor*), the golden pheasant (*Chrysolophus pictus*), the silver pheasant (*Euplocomus nycthemerus*), the capercaillie (*Tetrao urogallus*), the black grouse or black game (*Lyrurus tetrix*), the migratory quail (*Coturnix coturnix*), the partridge (*Perdix cinerea*), the Indian black partridge, and the sand grouse. Of these, the most important are the English and Mongolian pheasants.

The Mongolian and other Asiatic pheasants were sent to Oregon from China by Judge O. N. Denny, formerly consul-general at Shanghai, and the first importation was apparently made in 1881. Most of the birds died on the way and only 15 (12 males and 3 females) reached Portland alive. These were liberated at the mouth of the Willamette River, about 12 miles below the city. The second lot, received in 1882 (?), comprised 35 or 36 ringnecks, which were set at liberty 12 miles east of Albany, in the Willamette Valley. Nineteen ringnecks were also liberated in 1882 at Victoria.<sup>1</sup> Golden and silver pheasants were imported two or three years later and, with some ringnecks, were placed on Protection Island, near Port Townsend, Wash.<sup>2</sup> These four colonies all flourished, and from them birds were carried to other parts of the Pacific coast. The Mongolian did far better than the others, and increased so rapidly that in 1891, when complete protection was removed, they had spread over a considerable part of western Oregon. English pheasants have been imported mainly in the Eastern States; some were liberated near Tarrytown, N. Y., about thirty-five years ago; 78 were turned out on Jekyl Island, near Brunswick, Ga., in 1887, and these increased to 850 during the following year;<sup>3</sup> others were introduced into New Jersey. Since 1890 there has been widespread interest in these experiments, and pheasants (mainly Mongolian) have now been introduced into at least twenty-five States and have increased rapidly through protection laws and the establishment of pheasantries for their propagation. Of the other species, little need be said. About 1881, 3 sand grouse were liberated near Portland, Oregon, and 9 farther west on the Clatsop Plains, but all promptly disappeared. An importation of Indian black partridges was made in 1891, but only 3 lived to reach their destination, at Macomb, Ill.<sup>4</sup> The black grouse has been liberated in Newfoundland and in Vermont and elsewhere in the Eastern United States. Recently the capercaillie has been introduced in the Adirondaeks: European quail have been introduced several times,

<sup>1</sup> Forest and Stream, XXXV, p. 28, 1890.

<sup>2</sup> Ann. Rept. Dept. Agr. for 1888, pp. 484-488.

<sup>3</sup> Forest and Stream, XXXI, p. 221, 1888.

<sup>4</sup> Ibid., XXXVII, p. 123, 1891.

and in 1879 nearly 3,000 were distributed in various places in New England and the Middle States,<sup>1</sup> but all disappeared after a year or two.

In Hawaii foreign birds have been introduced from both Asia and America. They include the Indian mina (*Acridotheres tristis*), the Java sparrow (*Munia oryzivora*), old world pheasants, the eastern turtle dove (*Turtur chinensis*) and two species of herons from China, the house finch (*Carpodacus mexicanus frontalis*) and California quail (*Lophortyx californicus*) from California, the rice bird, and the English sparrow.<sup>2</sup> Of these, the mina and the English sparrow are the most abundant, and display the same well-known traits which have given them an unenviable reputation elsewhere. The native birds comprise about a hundred species, and among those peculiar to the islands are some of very great interest, but which, unfortunately, are rare. Since the advent of the mongoose and of the introduced birds, some of the native species have been still further reduced in numbers, and apparently are in danger of extermination in the near future.

In the eagerness to acquire new birds, the risk of importing undesirable species has been overlooked, and even the lesson of the English sparrow has not been enough to impress on the general public the dangers of ill-advised acclimatization. But the acquisition of Hawaii and Puerto Rico, both suffering from the introduction of the mongoose, has given new importance to the subject of acclimatization, and has shown the necessity, not only of preventing the pests already on these islands from being brought into the United States, but also of protecting our new possessions against future experiments in the introduction of dangerous species. If we are to escape the losses which have been suffered in the Australian colonies, and especially in New Zealand, some restriction must be placed on the introduction of exotic species, as is now done in Western Australia. Attention has been called to this question, and it is to be hoped that the suggestion that such experiments be placed under the control of the Department of Agriculture will receive the approval of Congress at an early date.<sup>3</sup>

#### SUMMARY.

The history of American ornithology may be traced back to the middle of the sixteenth century, but the chief progress in the science has been made during the last hundred years. So assiduously have our birds been studied that the avifauna of few regions is better known than that of the Eastern United States. With the growth of ornithology, the economic relations of birds, and especially their relations to agriculture, have attracted more and more attention. During the last half century "economic ornithology" has become

<sup>1</sup> Forest and Stream, XII, p. 371, 1879.

<sup>2</sup> Ray, Osprey, IV, p. 1, September, 1899.

<sup>3</sup> Ann. Rept. Dept. Agr. for 1886, p. 258; Yearbook Dept. Agr. for 1898, p. 108.

recognized as a special branch of the science and has undergone rapid development. The relation of birds to agriculture depends mainly on the character of their food, and this is determined in several ways: (1) By field observation; (2) by experiments on birds recently captured, and, (3) by examination of stomach contents in the laboratory—the latter the most complete and satisfactory method. Thus far, about 20,000 birds' stomachs have been examined, and data are now available for determining the extent to which a hundred or more important species are useful or injurious. The English sparrow and several hawks and owls have been condemned, but only six or eight species in all have thus far been found injurious, while several birds commonly considered injurious have been shown to be beneficial.

The harvesting and commercial utilization of bird products has been marked by great waste and a reckless disregard for the future. The game markets, the egg trade, and the millinery trade have all made heavy drafts on our native birds, and have decimated some useful or conspicuous species and forced others to the verge of extinction. This is particularly noticeable in the case of the passenger pigeon, the egrets of the South, and the terns of the Atlantic coast. Attempts are now being made to place the killing and sale of game under proper restrictions; the trade in sea birds' eggs has been curtailed, and wide publicity has been given to the enormous slaughter of birds exacted by the demands of fashion. The guano trade, which resulted in the acquisition of a number of islands whose product was valued at more than \$3,000,000, is now largely a thing of the past, owing chiefly to the depletion of the deposits, although the fact that better artificial fertilizers can now be had at lower rates than natural guano is also partly responsible for this result.

Legislative measures early in the century took the form of bounty acts directed toward the destruction of birds, but most of these have now been withdrawn, except in the case of the English sparrow. Protective measures, commonly known as "game laws," have multiplied, and protection is now extended not only to game birds but also to insectivorous species and in some States to birds of prey. That these efforts have not accomplished more, is mainly because the laws have lacked uniformity and have not been properly enforced, but the last decade has certainly witnessed some progress along these lines. Efforts have also been made to supplement State laws by federal legislation restricting interstate traffic in game killed in violation of State regulations, but although several bills embodying this principle have been considered by Congress none have as yet become laws.

Experiments in the introduction of foreign species have not met with unqualified success. English and Mongolian pheasants have been added to the list of game birds, and the European skylark, starling, and tree sparrow have gained a slight foothold in a few localities,

but we have also acquired the English sparrow, one of the worst of feathered pests.

With the present knowledge of the economic relations of birds based on thorough scientific investigation, and with the recent experience of the effects of indiscriminate slaughter and unrestricted acclimatization, there is every reason to hope that practical questions in economic ornithology will hereafter receive more careful and intelligent consideration.