

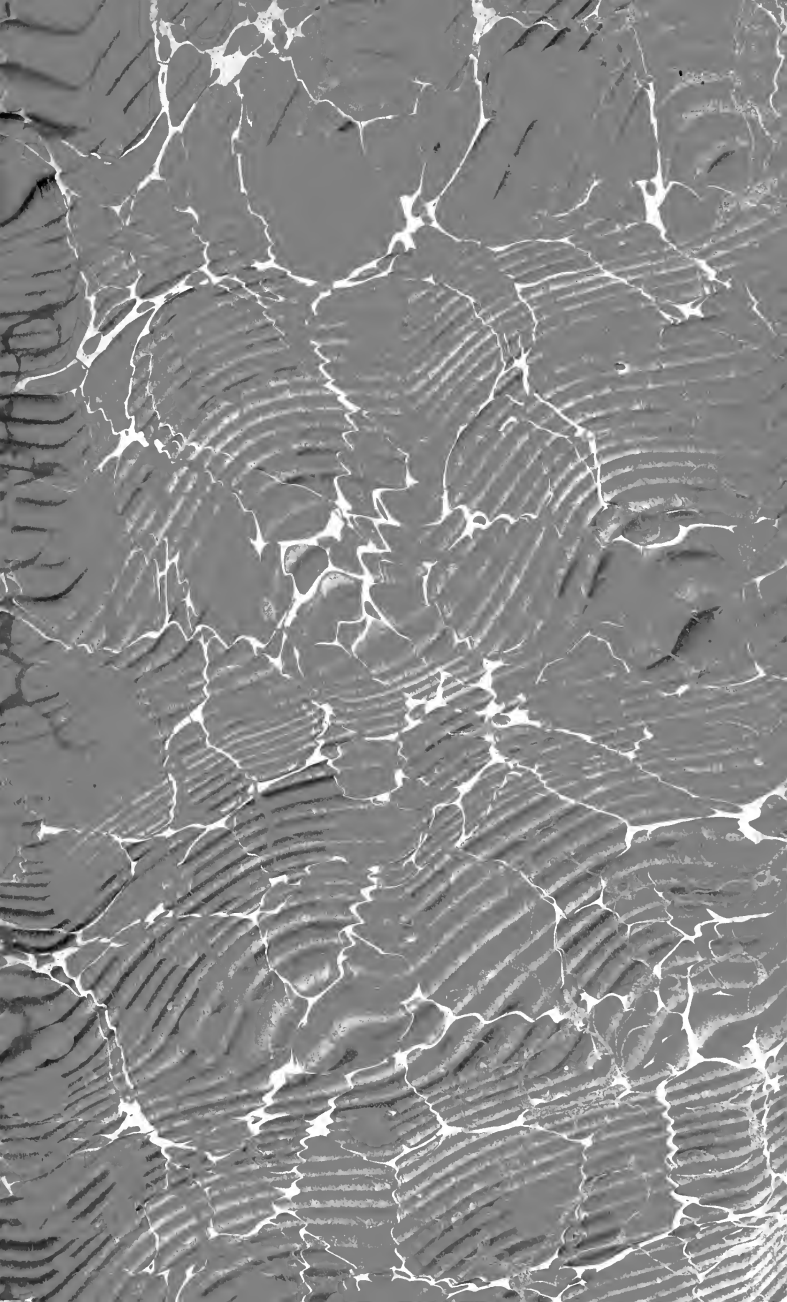
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The Danger of Introducing Noxious Animals and Birds.

BY

T. S. PALMER,

Assistant Chief of Biological Survey.

REPRINT FROM YEARBOOK OF DEPARTMENT OF AGRICULTURE FOR 1893.

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THE DANGER OF INTRODUCING NOXIOUS ANIMALS AND BIRDS.

By T. S. PALMER,

Assistant Chief of Biological Survey.

INTRODUCTION.

Acclimatization of plants and animals has attracted attention in all parts of the world. Useful or curious species have been introduced from one country to another with varying degrees of success; some have failed while others have become acclimated, and occasionally have increased to such an extent as to usurp the places of native species. In comparing the results of the introduction of plants and of animals, the important difference between these two classes of experiments should not be lost sight of. Plants, on the one hand, are introduced almost without exception for purposes of cultivation, and are therefore kept somewhat under control. Occasionally, under favorable conditions, they "escape" and increase so rapidly that they become troublesome weeds. Chicory and wild garlic of the Eastern States and the water hyacinth of Florida are familiar examples of weeds originally introduced as useful or ornamental plants. Animals, on the contrary, unless intended for pets or for exhibition in menageries or zoological gardens, are seldom kept in captivity, but are liberated and allowed to live as nearly as possible under natural conditions. Only the strongest and hardiest species survive, and in adapting themselves to new surroundings necessarily cause some change in the existing fauna. If prolific, they are likely to become abundant in a short time; if they crowd out indigenous species, they are regarded as nuisances. Hence, it is sometimes said that acclimatization of animals has produced far less satisfactory results than that of plants, but the comparison is made between the relatively small number of animals, birds, and insects purposely imported and allowed to run wild and a long list of useful and ornamental plants carefully kept under cultivation.

MEANS OF DISPERSAL.

Animals are transported from one country to another or to distant islands either by accident or by the direct agency of man. Horses, cattle, sheep, goats, pigs, dogs, and cats are now almost cosmopolitan, but they owe their wide distribution entirely to man, who has carried them with him to all parts of the earth. Accidental distribution is

much less common in the case of mammals and birds than among the smaller plants and insects, and species which have gained a foothold in distant lands have almost always been intentionally introduced.

Certain small mammals have, however, accidentally found their way in vessels from one port to another. Two or three species of rats and the house mouse of Europe have thus become widely dispersed over the globe. Fruit vessels plying between ports of the United States and Central or South America occasionally bring snakes, small mammals, and insects in bunches of bananas. In November, 1895, a Central American mouse, of the genus *Oryzomys*, concealed in a bunch of bananas shipped from Puerto Limon, Costa Rica, was captured alive in a commission house in Washington, D. C. A young murine opossum from tropical America was discovered in a bunch of bananas at Ames, Iowa, during the summer of 1882, and was kept alive for some time. If such cases were frequent, it can be readily seen how a species might gain a foothold in new regions, provided the conditions were favorable for its increase.

During the last fifteen or twenty years Bering Island, one of the Commander group in Bering Sea, has been overrun with the common Siberian red-backed mouse (*Erolomys rutilus*). This species was formerly unknown on the islands, but has been introduced since 1870, probably in firewood brought from Kamchatka. Within ten years it spread all over the island from the beaches to the mountains in the interior. It occurs both in the swamps and on the sand dunes, and has become a pest in the huts of the natives. In 1889 it was still confined to Bering Island, but will probably reach Copper Island in time.

DOMESTICATED SPECIES MAY BECOME NOXIOUS.

Domesticated animals, like cultivated plants, may run wild and become so abundant as to be extremely injurious. Wild horses are said to have become so numerous in some parts of Australia that they consume the feed needed for sheep and other animals, and hunters are employed to shoot them. In some of the Western States they have also become a nuisance, and in Nevada a law was passed in 1897 permitting wild horses to be shot. Recent reports from Washington indicate that cayuses are considered of so little value that they are killed and used for bait in poisoning wolves and coyotes.

Pigs have run wild in some of the Southern States and also on certain islands, where, as on the Galapagos, they were originally introduced to furnish food for crews of vessels in need of fresh meat. According to Dr. Finsch,¹ they were introduced into New Zealand by Captain Cook about 1770, and soon becoming wild, increased to a remarkable degree. A century later wild pigs were so abundant in the flax thickets of the province of Taranaki, on the North Island,

¹ Globus, LXIX, 1896, Nr. 2.

that a hunter could shoot fifty in a single day. Dr. Finseh also cites a case mentioned by Hochstetter in which 25,000 wild pigs were said to have been killed by three hunters in less than two years.

Sheep and goats when numerous are likely to cause widespread injury, particularly in forested regions. An instructive example of the damage done by goats is that on St. Helena, described by Wallace.¹ St. Helena is a mountainous island scarcely 50 square miles in extent, and its highest summits reach an elevation of 2,700 feet. At the time of its discovery, about the beginning of the sixteenth century, it is said to have been covered by a dense forest; to-day it is described as a comparatively barren rocky desert. This change has been largely brought about by goats first introduced by the Portuguese in 1513, and which multiplied so fast that in seventy-five years they existed by thousands. Browsing on the young trees and shrubs, they rapidly brought about the destruction of the vegetation which protected the steep slopes. With the disappearance of the undergrowth, began the washing of the soil by tropical rains and the destruction of the forests. In 1709 the governor reported that the timber was rapidly disappearing and that the goats should be destroyed if the forests were to be preserved. This advice was not heeded, and only a century later, in 1810, another governor reported the total destruction of the forests by the goats, and in consequence an expense of \$13,600 (£2,729) in one year for the importation of fuel for Government use.

The Santa Barbara Islands, off the coast of southern California, and the island of Guadalupe, off the Lower California coast, are utilized as ranges for goats. All these islands are dry and more or less covered with brush, but arborescent vegetation is comparatively scarce. The goats practically run wild, and already exist in considerable numbers. On Santa Catalina, one of the Santa Barbara group, wild-goat hunting is one of the diversions afforded tourists, and is considered one of the principal attractions of this popular summer resort. As yet the goats have not been on the islands long enough to cause any serious effects on the vegetation, and they may never bring about the ruin which has been wrought on St. Helena. But it is scarcely possible for the islands to be grazed by goats for an indefinite length of time without suffering serious damage.

House cats are often greater pests than commonly supposed. When numerous about the suburbs of cities and towns, they are apt to forage for a living either from necessity or choice, and their food is by no means confined to rats and mice. They are constantly on the watch for birds, but it is impossible even to estimate how many they destroy. It is certain, however, that in some places the decrease in native birds is largely due to their presence. Where cats have run wild on isolated islands, their work can be more readily appreciated. On Sable Island, off the coast of Nova Scotia, they were

¹ *Island Life*, 1880, pp. 283-286.

introduced about 1880 and rapidly exterminated the rabbits, which had been in possession of the island for half a century. In one of the harbors of Kerguelen Island, southeast of the Cape of Good Hope, cats were allowed to run wild upon a little islet known as Cat Island, which has been used as a wintering place for sealers for many years. Here they live in holes in the ground, preying upon sea birds and their young, and are said to have developed such extraordinary ferocity that it is almost impossible to tame them even when captured young. Dr. W. L. Abbott states that on Aldabra, about 200 miles northwest of Madagascar, cats are common on the main island, and have completely exterminated the flightless rail (*Rougetius aldabranus*), an interesting bird, peculiar to this group of islands. They are also numerous on Glorioso Island, 120 miles to the southeast, and in consequence birds are less common even than on Aldabra.¹

The Chatham Islands, 500 miles east of New Zealand, were colonized about fifty years ago; cats, dogs, and pigs were introduced, and the native birds, represented by fifty-five species, including thirteen not found elsewhere, have since greatly decreased in numbers. Two of the most interesting birds are land rails of the genus *Cabalus*. Dr. Dieffenbach, naturalist of the New Zealand Company, who visited the islands in 1840, states that one of these rails (*Cabalus dieffenbachii*), called by the natives "meriki," was formerly common, but since the introduction of cats and dogs it has become very scarce. It is now probably extinct, and the closely related species *C. modestus* will doubtless soon suffer a similar fate, since the islet of Mangare, to which it is confined, has recently been invaded by cats.²

SOURCES OF DANGER FROM NOXIOUS SPECIES.

The animals and birds which have thus far become most troublesome when introduced into foreign lands are nearly all natives of the Old World. The mammals belong to three orders: (1) Rodents, including rats of two or three species, the house mouse, and rabbit of western Asia or southern Europe; (2) Carnivores, represented by the stoat, weasel, and common house cat of Europe, and the mongoose of India; (3) Cheiroptera, represented by large fruit-eating bats or flying foxes of Australia and the Malay Archipelago. Flying foxes have not yet been actually introduced, but are likely to be carried to different islands in the Pacific, and are dangerous because of their depredations on fruit. The birds comprise the house sparrow and starling of Europe, and the mina of India. Other species, usually regarded as beneficial in their native homes, such as the European skylark, green linnet, black thrush or blackbird, and the great titmouse or kohlmeise, are likely to prove injurious in new surroundings. Most of these species have extended their range from the east

¹ Proc. U. S. Nat. Mus., XVI, 1894, pp. 762, 764.

² Forbes, Ibis, 6th ser., V, 1893, pp. 533, 531-533.

toward the west, although the minas have been carried in the opposite direction to New Zealand and the Hawaiian Islands, and flying foxes are likely to extend northward and eastward. The main danger for the United States lies in species native to central and southern Europe and western Asia, but tropical species, particularly of India, might become acclimated in the Southern States. In order to show how these animals and birds have already spread, and the damage they have done, it will be necessary to refer briefly to the history of each species.

RATS AND MICE.

Rats and mice are among the greatest pests with which man has to contend, and the annoyance and damage which they occasion are beyond computation. They are ubiquitous, abundant alike in the largest cities and on the most distant islands of the sea. They have not been intentionally introduced anywhere, but have found their way by means of vessels to all parts of the earth. Small islands, populated with rats from wrecks, or otherwise, are occasionally overrun by these animals. On the island of Aldabra, already mentioned, rats fairly swarm, and are very destructive to the gigantic native land tortoise, eating the young as soon as they are hatched. Sable Island, off the coast of Nova Scotia, has suffered from several plagues of rats, and it is said that the first superintendent of the light station and his men were at one time threatened with starvation owing to the inroads made on their stores by rats.

The common brown rat.—The common brown rat, known also as the wharf rat and Norway rat (*Mus decumanus*), was originally a native of western China,¹ and until two hundred years ago was unknown in Europe or America. It is very prolific, producing from four to twelve young at a birth several times a year, and has spread so rapidly that at the present time it is nearly cosmopolitan. In the autumn of 1727 large numbers of brown rats entered Europe by swimming across the Volga, and, gaining a foothold in the province of Astrakan in eastern Russia, spread westward over central Europe. Five years later (1732) they reached England by vessels from western India. The brown rat appeared in east Prussia about 1750, and in Denmark and Switzerland in 1809. It reached the eastern coast of the United States about 1775, and in 1825, according to Sir John Richardson, had extended as far west in Canada as Kingston, Ontario. By 1855 it was abundant at several points on the Pacific coast, including San Francisco, Cal.; Astoria, Oreg., and Steilacoom, Wash., and its range on the west coast now extends as far north as Alaska, at Sitka, Kadiak, and even Unalaska.

¹ Blanford (Mammals of India, 1888-1891, p. 409), who gives Chinese Mongolia as its probable original habitat, states that it is not indigenous to India, and is unknown in Persia and Afghanistan, but suggests that it will probably be introduced into the two latter countries as soon as wheeled vehicles take the place of pack animals.

At the present time it is probably abundant in all the larger cities of the United States except in the South, where it is replaced by another species.

The black, or house, rat.—The black rat, or house rat (*Mus rattus*), was in all probability originally a native of Asia. The time of its introduction into Europe is uncertain, but in the middle ages it was the common house rat of central Europe. The date of its introduction into the New World is placed as early as 1544, or more than two hundred years previous to that of the brown rat. It evidently became very generally distributed along the coasts and in the principal seaports, and by the middle of the present century was known as far north as Halifax and Montreal, Canada, and on the Pacific coast at San Diego and Humboldt Bay, California. Since the introduction of the brown rat, the black rat has become comparatively rare in most places where the former is abundant. In the Laccadive Islands, in the Indian Ocean, the black rat seems to have modified its habits and become arboreal. It is said to live in the crowns of the cocoanut trees without descending to the ground, and to do great damage by biting off the nuts, upon which it feeds, before they are ripe.

The roof, or white-bellied, rat.—The roof rat, or white-bellied rat (*Mus alexandrinus*), is a native of Egypt, Nubia, and northern Africa, and evidently found its way to America by way of Italy and Spain at an early date. It probably reached this continent long before the brown rat, but the exact date of its arrival is uncertain. It is common in Brazil, in some parts of Mexico, and in the southern United States, and is known to occur at least as far north as the Dismal Swamp, in southern Virginia.

The house mouse.—The well-known house mouse (*Mus musculus*) is readily distinguished from the native white-bellied mice of North America by its nearly uniform brownish color above and below. It is a native of Europe and central Asia, but now occurs all over the world. In the United States it is found from Florida to Maine, and from San Diego to the Pribilof Islands. It is not restricted to the seaports, as it made its way inland at an early date. Sir John Richardson, in 1829, mentions having seen a dead mouse in the storehouse of the Hudson Bay Company, at York Factory, among packages of goods brought over from England, and states that the house mouse was introduced at Engineer Cantonment, on the Missouri River, near Council Bluffs, Iowa, by Long's Expedition in 1819–20. By 1855 it was found at many points in the interior, such as Prairie Mer Rouge, La.; Fort Riley, Kans.; Fort Pierre, S. Dak.; Fort Redding, Cal., and Parras, Coahuila, Mexico. It has even penetrated to such points as the Huachuca Mountains in Arizona, where it was introduced about 1891 in a wagonload of seed grain. It reached Bering Island, one of the Commander group off Kamchatka, in 1870, in a cargo of flour shipped from San Francisco in the schooner *Justus*. In the southern

hemisphere it occurs at Punta Arenas, Patagonia, and is common in such out-of-the-way places as Gough Island, in the middle of the South Atlantic, and Kerguelen Island, southeast of the Cape of Good Hope. In short, its distribution is apparently limited only by the Arctic and Antarctic circles.

RABBITS.

The common rabbit of Europe (*Lepus cuniculus*) was originally introduced into Australia for purposes of sport, and the results of the experiment are so well known that anything more than a brief reference to them is unnecessary. Suffice it to say that the rabbits were liberated near Melbourne about 1864, and by 1878 had extended westward over Victoria and beyond the Murray River. They were also introduced into Tasmania and New Zealand, and spread over the country like a scourge. So rapidly did they multiply that in 1879 legislative action for their destruction was begun in South Australia, and the example was soon followed by New South Wales, New Zealand, Queensland, and Tasmania. At the present time their range in Australia is probably equal in area to that of our three largest States—Texas, California, and Montana. Millions of dollars have been spent for bounties, poisons, and various other methods of destruction; thousands of miles of rabbit-proof fences have been built, and hundreds of schemes for destroying the animals have been suggested, but nothing has yet been found that will effectually exterminate the pest. Natural enemies, such as cats and other carnivorous animals, have been introduced, and in certain parts of New Zealand at least have become almost as much a pest as the rabbits they were intended to kill. In 1887 no less than 19,182,539 rabbits were destroyed in New South Wales alone, but despite the efforts of the Government and private landowners the rabbits seem to be still increasing. In the meantime, a great industry has grown up in the export of rabbit skins. For the last five years New Zealand has been shipping an average of about 15,000,000 per annum, and since 1873 has exported more than 200,000,000. Recently, canning rabbit meat for export to European markets is assuming larger proportions and gives promise of developing into an important industry.

THE MONGOOSE.

The common mongoose of India (*Herpestes mungo* or *H. griseus*, Pl. VIII) is a well-known destroyer of rats, lizards, and snakes, and has been introduced into Jamaica and other tropical islands for the purpose of ridding cane fields of rats. The annual loss which the island of Jamaica formerly suffered on account of the ravages of the introduced black rats (*Mus rattus*) and brown rats (*M. decumanus*), and the so-called "cane-piece rat," including the expense of destroying these pests, was estimated at £100,000, or \$500,000. Various remedies were

tried, but apparently with little success, until in February, 1872, Mr. W. Bancroft Escent introduced nine individuals of the mongoose, four males and five females, from India. These animals increased with remarkable rapidity, and soon spread to all parts of the island, even to the tops of the highest mountains. A decrease in the number of rats was soon noticeable, and in 1882, ten years after the first introduction, the saving to the sugar planters was said to be £45,000, or \$225,000, per annum.

Still the mongoose increased, and its omnivorous habits became more and more apparent as the rats diminished. It destroyed young pigs, kids, lambs, kittens, puppies, the native "coney," or capromys, poultry, game, birds which nested on or near the ground, eggs, snakes, ground lizards, frogs, turtles' eggs, and land crabs. It was also known to eat ripe bananas, pineapples, young corn, avocado pears, sweet potatoes, cocoanuts, and other fruits. Toward the close of the second decade the mongoose, originally considered very beneficial, came to be regarded as the greatest pest ever introduced into the island. Poultry and domesticated animals suffered from its depredations, and the short-tailed capromys (*Capromys brachyurus*), which was formerly numerous, became almost extinct except in some of the mountainous districts. The ground dove (*Columbigallina passerina*) and the quail dove (*Geotrygon montana*) became rare, and the introduced bobwhite, or quail, was almost exterminated. The peculiar Jamaica petrel (*Æstrelata caribbea*), which nested in the mountains of the island, likewise became almost exterminated. Snakes, represented by at least five species, all harmless, and lizards, including about twenty species, were greatly diminished in numbers. The same thing was true of the land and fresh-water tortoises and the marine turtle (*Chelone viridis*), which formerly laid its eggs in abundance in the loose sand on the north coast. The destruction of insectivorous birds, snakes, and lizards was followed by an increase in several injurious insects, particularly ticks, which became a serious pest, and a Coccid moth, the larvæ of which bore into the pimento trees. In 1890 a commission was appointed by the Government to consider whether measures should be taken to reduce the number of the animals, and the evidence collected showed conclusively that the evil results of the introduction of the mongoose far outweighed the benefits rendered to the sugar and coffee plantations.

Recently there has been a change in the situation, and the mongoose is now reported as decreasing, while certain birds and reptiles, particularly the ground lizard, are increasing. Quail and pigeons are reported as more numerous, and there is less complaint concerning the destruction of poultry. Thus, Jamaica seems to have passed the high-water mark of loss occasioned by rats and by the mongoose, and while its fauna has been modified by the presence of the intruders, both native and introduced species are gradually accommodating



MONGOOSE (*HERPESTES MUNGO*).

The figure consists of four maps of the study area, labeled 1, 2, 3, and 4. Each map shows the coastline of the Mediterranean Sea and the city of Valencia. Map 1 shows the location of station 1, Map 2 shows station 2, Map 3 shows station 3, and Map 4 shows station 4. The maps are arranged in a 2x2 grid.

themselves to the changed conditions, and a new balance of nature is being established.¹

According to Mr. Espeut,² who originally introduced the mongoose into Jamaica, large numbers of the animals have been sent to Cuba, Puerto Rico, Grenada, Barbados, Santa Cruz, and elsewhere, but the fate of these shipments, made at least sixteen years ago, is now unknown. It is now established on Haiti, as shown by the capture of a specimen at Santo Domingo City in the winter of 1895,³ and is generally distributed over the island of Puerto Rico. It is also present on the island of Vieques, east of Puerto Rico, and is abundant on St. Thomas. During a recent visit Mr. A. B. Baker found it along the coast of Puerto Rico at Arecibo, San Juan, Fajardo, Arroyo, Ponce, and Mayaguez, and in the interior at Utuado and Adjuntas. It was introduced at San Juan about 1877-79, and although now becoming a nuisance, is considered beneficial by the sugar planters who claim that the rats, which were formerly very destructive to cane, now do little damage. These rats often live in the tops of the royal and cocoa palms and destroy cocoanuts as well as sugar cane.

The first efforts to introduce the mongoose into the Hawaiian Islands were made about 1881, when a few individuals of a large species were brought from the East Indies and liberated on a sugar plantation in the district of Hamakua on Hawaii. These animals did not breed and soon disappeared. A few months later a few pairs of a smaller species were imported from Calcutta, but nearly all were accidentally drowned while being landed near Hilo. Soon afterwards 75 individuals were imported from Jamaica by the planters of Hilo, and later 215 more were imported for Hamakua. Here the mongoose is aiding in the rapid extermination of some of the native birds, particularly the Hawaiian goose (*Nesochen sandvicensis*), which is found only on those islands above an altitude of 4,000 feet, and the Hawaiian duck (*Anas wyvilliana*), also a peculiar species. According to Mr. H. W. Henshaw this duck was common about Hilo four years ago, but in 1898 none were left anywhere in this region. As in Jamaica, the depredations of rats in the cane fields diminished with the increase of the mongoose, but the latter soon became so abundant that measures became necessary to keep it under control. In 1892 a law was passed forbidding the introduction, breeding, or keeping of the mongoose in the islands, and the sum of \$1,000 was appropriated for the payment of bounties on animals killed on the island of Oahu. These rewards, not to exceed 25 cents per head, were to be paid by the Minister of the Interior, but apparently no applications were made for them, the animals being regarded as a necessary evil in the sugar-cane districts.

¹ See Duerden. Journ. Inst. Jamaica, II, 1896, pp. 273-275.

² Proc. Zool. Soc., London, 1882, p. 714.

³ Elliott, Field Columbian Mus., Zool. Ser., I, 1896, p. 82.

Attempts at introduction in other countries have not succeeded so well. The mongoose was introduced into the Fiji Islands, probably about 1870, but apparently has not increased to the extent to which it has in Hawaii. Early in the eighties several experiments were made in Australia, which resulted in failure. More than a hundred individuals were liberated near the Murray River, and others in New South Wales. An experiment was also made in New Zealand, but apparently without much success.¹ In February, 1892, it was erroneously reported that the Department of Agriculture was about to introduce the mongoose into the United States for the purpose of destroying gophers in the West. Although founded on a mistake, and speedily corrected, the rumor was so well heralded by the press that it attracted widespread attention. Persons who were familiar with the situation in Jamaica and Hawaii protested vigorously against the supposed experiment. Others, ignorant of the animal's past record and anxious to try some new method of exterminating gophers, prepared to obtain specimens from Honolulu. By the most strenuous efforts these importations were prevented, and as yet the mongoose is not known to have gained a foothold on this continent.

FERRETS, STOATS, AND WEASELS.

In the attempt to check the rabbit pest in New Zealand, recourse has been had to the importation of natural enemies, such as ferrets, stoats (*Putorius ermineus*), and weasels (*P. nivalis*). In the Wairarapa district some 600 ferrets, 300 stoats and weasels, and 300 cats had been turned out previous to 1887. Between January, 1887, and June, 1888, contracts were made by the Government for nearly 22,000 ferrets, and several thousand had previously been liberated on Crown and private lands. Large numbers of stoats and weasels have also been liberated during the last fifteen years. This host of predatory animals speedily brought about a decrease in the number of rabbits, but its work was not confined to rabbits, and soon game birds and other species were found to be diminishing. The stoat and the weasel are much more bloodthirsty than the ferret, and the widespread destruction is attributed to them rather than to the latter animal. Now that some of the native birds are threatened with extermination, it has been suggested to set aside an island along the New Zealand coast where the more interesting indigenous species can be kept safe from their enemies and saved from complete extinction.

FLYING FOXES, OR FRUIT BATS.

On August 4, 1893, the steamer *Monowai* from Australia arrived at San Francisco, having on board a fruit-eating bat, or flying fox. The animal had taken refuge on the steamer off the coast of Australia,

¹ Final Rept. Royal Comm. Inquiry Extern. Rabbits Australasia, 1890, p. 9.

and was captured and kept as a pet by one of the passengers. It was promptly killed by the quarantine officer at San Francisco, and four more, which arrived in captivity two months later from China, on the steamer *Rio de Janeiro*, met the same fate. Attention was called to the danger of the new pest, and one of the regulations adopted by the State board of horticulture in the following year prohibited the importation of these animals into California.

Flying foxes belong to the genus *Pteropus* (fig. 1), one of the best-known groups of fruit-eating bats. The genus includes some fifty species which are found in the tropics of the Old World, from Madagascar and the Comoro Islands east to Australia, and the Samoan Islands, and north to India, Malay Archipelago, and southern Japan. Five species occur in Australia, two of them as far south as New South Wales (lat. 35° S.), but none are found in New Zealand or in the Hawaiian Islands. The largest species is the Kalong or Malay fruit bat (*Pteropus edulis*), which measures more than 5 feet across the tips of the wings.

In Australia these bats are described as living in immense communities or "camps" in the most inaccessible parts of the dense scrub of gullies and swamps. Here they may be seen by thousands, frequently crowded so thickly on the trees that large branches are broken by their weight. They fly considerable distances in search of food, sallying forth in flocks about sunset and returning to their camps before dawn.

In New South Wales, and more especially in Queensland, flying foxes are one of the worst pests of the fruit grower, and are described as a plague which threatens the fruit-growing industry in a large part of Australia. They are particularly injurious to figs, bananas, peaches, and other soft fruit, and it is estimated that the damage done to orchards in the coast district of New South Wales amounts to many thousands of pounds annually. Various expedients have been suggested to protect orchards from their depredations. Rags dipped in melted sulphur and hung among the branches, netting placed over the trees, and wires suspended around the trees, and even stretched close together from poles and covering the whole orchard have been tried, but apparently without much success. The most practical method is to destroy the bats in their camps. A few years ago the Minister for Mines and Agriculture for New South Wales supplied

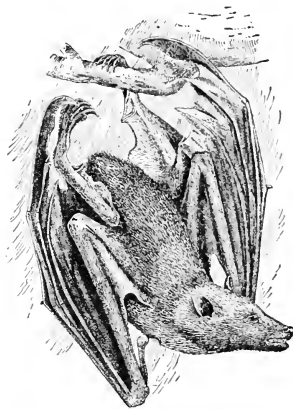


FIG. 1.—Flying fox (*Pteropus* sp.) redrawn from Proceedings Zoological Society, London, 1874.

ammunition for this purpose and, after considerable expenditure of powder and shot, about 100,000 foxes were destroyed at a cost of about 30 cents apiece. Wholesale destruction with dynamite was suggested and experiments with high explosives were made by the department of agriculture. Charges of roborite (1 to 4 pounds) and gun cotton (2½ pounds), connected with wires so that they could be fired by an electric current, were placed in the branches of trees where the bats were accustomed to roost. The bats carefully avoided the trees in which explosives were hung, and when the charges were fired none were killed, even among those roosting in neighboring trees.¹

Since nearly all the species of flying foxes are natives of the Tropics, it is hardly likely that they could gain a foothold in the United States, except in the South, but there is a serious danger of their introduction into the Hawaiian Islands by means of vessels plying between Honolulu and the Orient, the South Sea Islands, and Australia.

THE ENGLISH SPARROW.

The house sparrow, better known in America as the English sparrow (*Passer domesticus*), is a common bird of north central Eurasia. It is said to range as far north as latitude 67° in Europe and to latitude 61° in Asia. The damage which it does in destroying fruit and grain, in disfiguring buildings in cities and towns, and in driving away other birds, makes it one of the worst of feathered pests. The rapidity with which it increases in a new locality is scarcely more remarkable than the persistency and care which have been displayed in introducing it into foreign lands, in spite of the warnings of persons familiar with its habits. It has gained a foothold on all of the continents, and has been transported to some of the most distant islands in the Indian and Pacific oceans. In North America it has not increased very rapidly north of the Transition zone nor in the Lower Austral, but wherever it has become at all abundant efforts to exterminate it have been practically futile.

The English sparrow was first introduced into the United States by a gentleman of Brooklyn, N. Y., who brought over eight pairs from Europe in the fall of 1850 and liberated them in the following spring. These birds did not thrive, and in 1852 a second importation was made. In 1854 and 1858 the sparrow was introduced at Portland, Me., and in the latter year at Peacedale, R. I., and a few birds escaped at Boston, Mass. During the next decade it was imported direct from Europe to eight other cities, and in one case 1,000 birds were sent to Philadelphia in a single lot; birds were also distributed from the colonies already started in this country. By 1870 it had become established as far south as Columbia, S. C., Louisville, Ky., and Galveston, Tex.; as far west as St. Louis, Mo., and Davenport, Iowa, and as far north as Montreal, Canada, thus gaining a

¹Agr. Gazette, New South Wales. I, 1890, p. 105.

foothold in twenty States, the District of Columbia, and two provinces in Canada.

Between 1870 and 1880 it was estimated that its range had been extended by nearly 16,000 square miles, and isolated colonies were established at San Francisco (1871-72) and Salt Lake City, Utah (1873). During the next five years it spread over more than 500,000 square miles, and in 1886 had become established in thirty-five States and five Territories, occupying practically all of the region east of the Mississippi River (except portions of Florida, Alabama, and Mississippi), as well as parts of eight States in the West. Its range was estimated to cover 1,033,000 square miles, including 148,000 square miles in Canada.

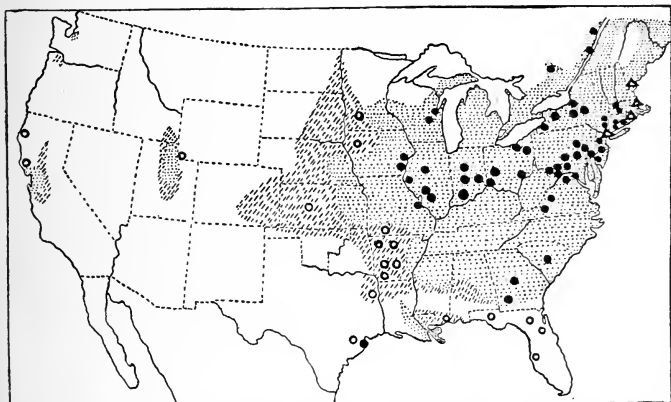


FIG. 2.—Map showing spread of English sparrow in the United States: The entire shaded area represents approximately the present distribution of the sparrow: triangles indicate colonies in 1860: black spots, colonies in 1870: circles, isolated colonies in 1886: dotted area, range in 1886; lined area, extension of range up to end of 1898.

At the present time (1898) only three States (Montana, Nevada, and Wyoming) and three Territories (Alaska, Arizona, and New Mexico) are apparently free from the sparrow. Its range extends westward to the Great Plains and in Colorado to the Rocky Mountains, and also occupies considerable areas in Utah and central California. (See fig 2.)

The true character of the bird is now so well known that it is unnecessary to dwell on its injuries to fruit and grain, the nuisance it has become in large cities, and the extent to which it has replaced native birds. The ill-directed care and energy expended on introducing and fostering it thirty years ago are largely responsible for the marvelous rapidity of its distribution. Now, when too late, efforts at extermination have been begun, and four States (Illinois, Michigan, Ohio, and Utah) have offered bounties for its destruction, the expenditures in Illinois (1891-1895) and Michigan (1887-1895) amounting to about \$117,500.

Besides the United States, New Zealand and Australia have suffered considerably from the English sparrow, and in some of the colonies of Australia it is considered second only to the rabbit as a pest. It seems to have been introduced on the North Island of New Zealand in 1866, by the Wanganui Acclimatization Society.¹ By 1870 it began to be numerous, and twelve years later threatened to spread over the whole island, becoming established in the most inaccessible regions, in spite of its usual partiality for cities and towns. In Victoria the sparrow was introduced about 1865, and probably appeared soon after in Queensland, New South Wales, South Australia, and Tasmania, but data are lacking as to the date of its first appearance in these colonies. It has increased so rapidly that, in order to hold it in check, "Sparrow-destruction" bills have been passed in several of the colonies during the last ten years.

Thus far the sparrow has not gained a foothold in Western Australia, and radical measures have been adopted to prevent its introduction. Its importation was prohibited by the "Destructive birds and animals act," passed in 1893, and when a few birds were discovered in Perth in January, 1898, prompt measures for their extermination were taken by the bureau of agriculture. All that could be found were shot, and attention was called to the necessity of stamping out the pest before it spread beyond control.

The English sparrow has also found its way into many other distant corners of the earth. It is gaining a foothold in Argentina, and has been carried to remote islands. In the Indian Ocean it is present on Mauritius, about 400 miles east of Madagascar, and on the Comoro Islands, off the southeast coast of Africa and 350 miles northwest of Madagascar. It was first reported from Grand Comoro in 1879. In the Pacific Ocean it has been introduced on the Chatham Islands, some 500 miles east of New Zealand,² probably on New Caledonia, and on the Hawaiian Islands. In the latter group it is reasonable to suppose that it was introduced by way of San Francisco in the early seventies, since it was reported to be numerous at Honolulu in 1879. In the Atlantic Ocean it is present on Bermuda, the Bahamas, and Cuba. It was sent to Bermuda from New York about 1874, and two years later was given the same protection accorded to other birds, its destruction being punished by a fine of 5 to 20 shillings. Ten years after its introduction it had increased so enormously that a bounty was offered for its destruction, and between 1884 and 1886 about £530 (\$2,650) were expended, without causing any appreciable decrease in its numbers, notwithstanding the short time the bird had been present and the fact that the islands have an area of less than 20 square miles. It is said to have been imported into Cuba, and in

¹ Rept. New Zealand Dept. Agriculture, 1897, Div. Biology, p. 8.

² *Ibid.*, 1893, p. 543.

1877 was reported to have been introduced on New Providence, Bahamas, "within the last few years." It has not, however, increased rapidly on either island, for in 1891 it was reported as still not abundant, and apparently had not extended its range to any of the neighboring islands.

THE STARLING.

The starling (*Sturnus vulgaris*, fig. 3) of Europe and western Asia is one of the best known birds of the Old World, and during late years has been increasing in numbers in the British Isles. It is sometimes accused of stealing fruit and destroying nests and eggs of other birds, but in its native home it seems to be beneficial rather than otherwise. Comparatively little accurate information concerning its

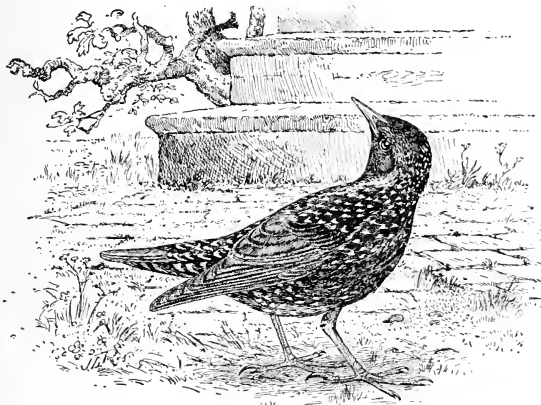


FIG. 3.—Starling (*Sturnus vulgaris*).

food habits is available, except the results of an examination of 175 stomachs recently made in Scotland by Mr. John Gilmour.¹ According to this examination the food consists of 75 per cent insects, 20 per cent grain (mainly waste grain), and 5 per cent miscellaneous substances. Some useful insects were eaten, but the greater proportion were classed as injurious. The charge of destroying eggs of larks, and occasionally young nestlings, was not substantiated, as no eggshells were found in these stomachs. Mr. Gilmour calls attention to the rapid increase of starlings in Fifeshire, thousands now existing where fifty or sixty years ago they were considered rare, and mentions the serious damage sometimes done to shrubs and young plantations when occupied as roosting places, but concludes that on the whole the bird is beneficial and worthy of protection.

¹ Trans. Highland and Agr. Soc., Scotland, 1896.

Several attempts have been made to introduce this species into the United States, but as yet it has hardly obtained a foothold. One of the first importations was made by the Acclimatization Society of Cincinnati, Ohio, in the winter of 1872-73. About 1877 a number of starlings were liberated in Central Park, New York, by the American Acclimatization Society, and several similar experiments have since been made, but only the last seems to have met with success. About 60 birds were released in 1890. Some of them have bred for several years, and, leaving the park, have established themselves in favorable places in the neighborhood. In 1893 and 1894 flocks of as many as 50 individuals were reported to have been seen in the suburbs about the northern end of the city, and late in 1898 a flock of about 30 took up residence at Sing Sing. During the last two or three years a few have been seen on Long Island, about Brooklyn. Thirty-five pairs were liberated at Portland, Oregon, in 1889 and 1892, where they are said to have done remarkably well, and as recently as June, 1898, a few were seen about the suburbs. In the autumn of 1897 it was reported that starlings were to be imported for the city park at Allegheny, Pa., but as yet only a dozen or fifteen seem to have been introduced, and these have been carefully kept in captivity for breeding, with the intention of ultimately stocking the park.

Much has been said concerning the advantages of introducing the starling into this country, but in spite of the many arguments brought forward, the bird's character is not above suspicion, and its usefulness is still open to question. The fact seems to have been overlooked that in other countries the starling has signally failed to fulfill the expectations concerning its usefulness. Certainly the experience of Australia and New Zealand offers little encouragement. It was introduced in New Zealand in 1867, and as early as 1870 was reported as "becoming very numerous." It seems to have increased very rapidly, and in spite of its natural preference for insects, in its new home it has adopted a fruit diet to such an extent as to become a great pest.¹ In South Australia it was reported to be common in certain localities in 1891, and measures for its extermination were considered. In Victoria, on the other hand, steps were taken in 1895 to promote its increase in fruit and grain growing districts, and this fact was used as an argument in its favor by persons who were endeavoring to introduce it into some of the other colonies. Western Australia has taken a firm stand on the question, and Mr. R. Helms, biologist of the bureau of agriculture of that colony, who opposed the proposed importation, gives his reasons as follows:

Had I been asked fifteen or twenty years ago what I had to say, I would probably have recommended their introduction. But not so now. My experience has

¹ It is also interesting to note that nearly twenty years ago an eminent English ornithologist predicted that in foreign countries the starling would undoubtedly aid in destroying native birds. (Newton in Yarrell's *British Birds*, 4th ed., II, 1876-1882.)

taught me better. The birds were introduced more than fifteen years ago into New Zealand, and now, like the thrushes, they have become a pest to fruit growers. They have changed their habit from being principally insectivorous to having become omnivorous.¹

After due deliberation, the Government issued a proclamation on January 22, 1896, declaring the starling a destructive bird and absolutely prohibiting its importation into Western Australia. Still more recently it has been condemned in Tasmania, where it is charged with committing depredations on small fruits, cherries, and wheat.



FIG. 4.—Mina (*Acridotheres tristis*).

Its further distribution has been discouraged, and when the question of introducing several species of birds was under discussion at an agricultural conference at Scottsdale on December 6, 1897, the starling was promptly rejected.²

THE MINA.

The mina, or mynah (*Acridotheres tristis*, fig. 4), is common throughout most of India, except Kashmir and Tenasserim. In its habits it

¹ Producers' Gazette, Western Australia, V, January, 1898, p. 29.

² Agr. Gazette, Tasmania, V, November, 1897, p. 66; January, 1898, p. 103.

is somewhat like our native grackles or crow blackbirds, but seems to resemble the sparrow in its familiarity and partiality for human habitations. It was introduced more than thirty-five years ago into



FIG. 5.—Kohlmeise (*Parus major*).

Mauritius to destroy grasshoppers, and is said to have become perfectly naturalized there.¹ It has also been introduced into the Andaman Islands (some time prior to 1873), the Hawaiian Islands, New Zealand, and possibly Australia.

It is said to have reached the Hawaiian Islands by way of China. Dr. Finsch, an eminent ornitholo-

gist, who visited Honolulu in 1879, found it very abundant, and describes its habits as follows :
The mainas are a great nuisance to the inhabitants, as they drive away the pigeons and fowls, and are said to destroy the nests and eggs of the domestic birds. That they do drive out the pigeons from their houses, I observed many times myself. * * * In Mr. Barning's garden, where the finest trees, chiefly palm, abound, hundreds and thousands come to roost, and their inharmonious concert lasts from 6 in the evening for an hour or more. The same is the case at daybreak, a little after 5 o'clock."

THE KOHLMIESE, OR GREAT TITMOUSE.

"Kohlmeise" is the German name of the great titmouse of Europe (*Parus major*), and this designation is used to some extent in the United States. The kohlmeise (fig. 5) is common over the whole of Europe as far north as the Arctic Circle and also in Siberia. It is a handsome species, about the size of the common eastern chickadee (*Parus atricapillus*, fig. 6), but may be readily distinguished from any American titmouse by the dull yellow on the sides of the body and the broad black stripe



FIG. 6.—Chickadee (*Parus atricapillus*).

¹ Jerdon, Birds of India, II, 1863, p. 326.

² Ibis, 1880, pp. 77, 78.

extending down the center of its breast (see fig. 5). Like other species of the genus, it is mainly insectivorous, but in winter is said to eat nuts and hard seeds. The kohlmeise has recently attracted attention on account of its alleged value as a destroyer of the codling moth (*Carpocapsa pomonella*), particularly in Germany, where it is reported to protect apple trees in large measure from the attacks of this destructive insect. But although several German authors regard it as a most useful species, there seems to be no satisfactory evidence that it is partial to the codling moth, or in fact that it ever feeds on the moth to any great extent. In Great Britain where the kohlmeise is also a resident and generally distributed, its presence has not been sufficient to exterminate the codling moth or even to hold this pest in check. On the other hand, it is said to attack small and weakly birds, splitting open their skulls with its beak to get at the brains, and doing more or less damage to fruit, particularly pears. One English observer reported that all the pears in his garden had to be inclosed in muslin bags to protect them from the birds, which would otherwise eat a considerable part of the fruit before it was ripe. Another reported that the great titmouse spoiled most of a limited crop of apples, and then began on the pears, boring a small hole near the stem, and passing from one pear to another until every one of forty or fifty trees had been damaged. It also attacked figs, scooping them out before they were ripe.

In the autumn of 1897 an article appeared in a paper in Idaho setting forth the great value of the bird to the fruit grower, and strongly advocating its importation into this country. The article attracted the attention of horticulturists throughout the Northwest, and gave rise to considerable discussion concerning the merits of the bird and the desirability of its introduction. While the kohlmeise might not develop its fruit-eating propensities in America, it should not be introduced until more definite information is available concerning its habits and until it has been shown beyond question that it will do no serious harm. Moreover, since there are already several titmice of the same genus in the United States, it seems entirely unnecessary to add another to the list, for it is hardly probable that the European bird would confine itself to the codling moth or be of more value to the horticulturist than the native species. It may be added that recent investigations seem to show that the common eastern chickadee feeds to some extent on the codling moth, as a few larvæ, believed to be those of this insect, have been found in chickadee stomachs collected in New Hampshire during February and March.¹ It may be of interest also to recall the fact that the kohlmeise was actually introduced in 1874 at Cincinnati, Ohio, but the experiment failed, as neither this nor any of the other exotic species imported at the same time became naturalized.

¹Weed, Bul. 54, N. H. Coll. Agr. Expt. Station, 1898, pp. 87, 94.

THE SKYLARK, GREEN LINNET, AND BLACK THRUSH.

The skylark (*Alauda arvensis*), the green linnet (*Ligurinus chloris*), and black thrush, or black bird (*Turdus merula*), are all natives of Europe. They are chiefly of interest in this connection, because in their native home they are almost universally considered beneficial, but in New Zealand they have developed traits which render them far from desirable additions to the fauna of that island. They were introduced into New Zealand in 1867; in 1870 they had begun to breed in a wild state in the province of Auckland on the North Island, and the green linnet was reported as already becoming common.¹ At the present time they are common all over the colony and troublesome in certain districts. The skylark confines its injuries mainly to turnips, eating the seed soon after it is planted, and thus causing no small damage to the future crop. The green linnet is similarly injurious to grain, while the black thrush is accused of taking strawberries, currants, raspberries, and other small fruits. As a fruit destroyer the black thrush is said to be worse than the English sparrow, and the proposal to introduce it into Western Australia elicited a strenuous protest.

The skylark has been introduced several times into the United States, especially in the vicinity of New York, and recently all three birds have been liberated in Oregon, but as yet they have not increased to any extent. Both the skylark and the black thrush are noted singers, but the charms of their song hardly compensate for damage to crops.

NEED OF LEGISLATION.

The examples already cited show the danger of introducing exotic species on large islands, particularly on those far distant from continents, where the fauna is necessarily limited and predatory species practically absent. In such places introduced species are almost sure to increase very rapidly. The experience of New Zealand indicates the necessity of exercising unusual care in introducing birds and mammals into the islands recently acquired by the United States. Much remains to be learned about the fauna of these new possessions. Puerto Rico is less known than any of the larger islands of the West Indies, but it probably has no indigenous mammals except bats. About 150 species of birds have been recorded from the island,² of which 20 are not found elsewhere. The fauna of the Hawaiian Islands is still more limited; indigenous mammals, except one bat (*Lasius*), are entirely wanting, but many of the birds are of great interest. Although no complete list of them has yet been published, about 100 species are known to occur on the islands. The fauna of

¹ The green linnet has found its way to the Kermadec Islands, 600 miles to the northeast, and all three species are said to be now present on the Chatham Islands, nearly 500 miles east of the South Island of New Zealand.

² Gundlach, J. F. O., XXVI, 1878, p. 163.

the Philippines is much richer. The mammals are comparatively unknown, and until recently were supposed to be poorly represented, but at present the list includes some 50 species, of which about half are bats. The birds have received much more attention, and nearly 600 species have been recorded from the archipelago,¹ 286 occurring on Luzon alone.

All of the islands have probably suffered more or less from the introduction of noxious species, especially rats and mice. In Hawaii rats have done so much damage that the sugar planters have imported the mongoose to destroy them, and this animal is now becoming a pest. The mina of India is also present in considerable numbers, and the house finch (*Carpodacus mexicanus frontalis*) has been introduced, notwithstanding the fact that it is usually considered a great pest by fruit growers in California.

During the last fifty years a number of acclimatization societies have been organized for the purpose of introducing animals and plants from foreign countries. Private individuals, too, have devoted both time and money to importing birds or mammals which they consider necessary or desirable additions to the native fauna. Four or five societies exist in New Zealand, and several have been formed in the United States. During the years 1872-1874 the Acclimatization Society of Cincinnati, Ohio, expended about \$9,000 in the purchase and importation of European birds, and introduced some 4,000, belonging to about 20 species, at an average cost of about \$4.50 a pair. These included several birds of doubtful value, such as the starling, skylark, and great titmouse or kohlmeise.² This experiment proved a failure.

In 1888 the Society for the Introduction of European Song Birds was organized at Portland, Oregon, and imported two lots of birds in 1889 and 1892, at a cost of about \$2,000. Among the number were 50 pairs of skylarks, 35 pairs of black thrushes, 35 pairs of starlings, 15 pairs of green linnets, and a number of others, representing in all some 20 species. Recently the introduction of the kohlmeise into the Northwest has been seriously considered, and the spasmodic attempts to acclimatize the skylark and starling have been renewed.

Whatever may be the difference of opinion concerning the desirability of introducing exotic species, it will be generally admitted that some restriction should be placed on the importation of birds and mammals which may become injurious. Since it has been found necessary to restrict immigration and to have laws preventing the introduction of diseases dangerous to man or domesticated animals, is it not also important to prevent the introduction of any species

¹This number includes the species found on Palawan. Worcester and Bourns class Palawan with Borneo on zoological grounds, giving for the Philippines proper 526 species; of these, 323 are confined to the group. (Proc. U. S. Nat. Museum, XX, 1898, pp. 564, 575.)

²Journ. Cincinnati Soc. Nat. Hist., IV, 1881, p. 342.

which may cause incalculable harm? Experience with the English sparrow, the work of rabbits in Australia and of the mongoose in Jamaica, all these have abundantly shown the necessity of preventing the repetition of similar costly blunders in the future.

Twelve years ago Dr. C. Hart Merriam, Chief of the Biological Survey, urged the necessity of restricting the importation of exotic species, as follows:¹

It seems desirable that a law be enacted conferring upon the Commissioner [Secretary] of Agriculture the power of granting or withholding permits for the importation of birds and mammals, except in the case of domesticated species, certain song and cage birds (to be specifically enumerated), and species intended for exhibition in zoological gardens, menageries, and museums, which may be brought in without special permits. The question of the desirability of importing species of known beneficial qualities in other lands is one which sooner or later must force itself upon our notice; and it is highly important that when such experiments are made they should be conducted by or under the control of the Department of Agriculture.

Ten years later Mr. Alexander Crow, quarantine officer of the California State board of horticulture, again called attention to the need of legislation, and in his annual report for 1896 recommended the passage by Congress of a stringent law preventing the introduction of noxious animals.

At present there is no Federal statute on the subject, and apparently California is the only State which has given the matter serious attention or has taken steps to prevent thoughtless or intentional importation of injurious species. In the act creating the State board of horticulture, approved March 13, 1883, and amended March 8, 1889, authority was conferred on the board to make regulations for the purpose of preventing the spread of fruit pests. In accordance with this act, certain quarantine regulations were adopted on August 15, 1894, one of which, Rule XII, provides that "animals known as flying fox, Australian or English wild rabbit, or other animals or birds detrimental to fruit or fruit trees, plants, etc., are prohibited from being brought or landed in this State, and if brought, they shall be destroyed."² This law has resulted in the destruction of several flying foxes and, so far as known, every mongoose thus far brought to the port of San Francisco. It is, perhaps, not too much to say that to this regulation and to the vigilance of the quarantine officer at San Francisco the State owes its present freedom from the mongoose.

The action of Cape Colony and Western Australia on this question stands out in marked contrast to the apathy of other countries. Cape Colony, in 1890, made it unlawful to introduce rabbits, either by land or sea, or to turn them loose within the colony;³ required the rabbits

¹ Annual Report Department of Agriculture for 1886, p. 258.

² Fifth Biennial Report State Board of Horticulture, 1896, p. 8.

³ Under a penalty not exceeding 5 pounds for first offense or 10 pounds for second offense. (See Agr. Journ., Cape Town, III, January 8, 1891, p. 119.)

already in the colony to be confined in hutches or boxes constructed according to certain prescribed regulations, and authorized anyone to destroy rabbits found on his premises, on Crown lands, or along public roads. Western Australia, profiting by the experience of her sister colonies on the eastern side of the continent, has taken measures to secure protection from the evils of indiscriminate and ill-advised acclimatization by the passage of the so-called "Destructive birds and animals act" (57 Vic., No. 22). This law, passed in 1893, prohibits the introduction of all birds or animals which, in the opinion of the governor-in-council, are destructive to vineyards, orchards, fruit trees, or any agricultural produce. The act also prohibits the keeping of such birds or animals on private premises, authorizes the destruction of those already in the colony, prohibits the liberation of any destructive bird or animal, and permits duly authorized officers to enter premises for the purpose of seizing or destroying such birds or animals. The term "destructive" is interpreted to mean any species to which the governor-in-council may from time to time extend the provisions of the act by proclamation, and the selection of species is based mainly upon the recommendations of the bureau of agriculture.¹ The law is therefore elastic and may be easily modified when necessary. Sparrows and rabbits were originally included in 1893, flying foxes were added in December, 1895, and starlings, blackbirds, and thrushes in January, 1896.

SUMMARY.

(1) Acclimatization of plants differs from that of animals since plants are introduced for cultivation and thus kept to a certain extent within control, while animals are liberated and controlled only by natural enemies or unfavorable conditions.

(2) Animals and birds are distributed from one continent to another, and to islands, either by accidental means or by the direct agency of man. Most animals are intentionally introduced into new regions, cases of accidental dispersion being comparatively rare except among rats and mice.

(3) Domesticated animals, like plants, may run wild and become injurious, especially in regions where food is abundant and natural enemies are absent. Goats and cats on isolated islands are well-known examples.

(4) The animals and birds which have thus far proved most injurious are the rabbit, mongoose, stoat, weasel, flying fox, English sparrow, starling, and mina. The skylark, green linnet, black thrush, and great titmouse, or kohlmeise, are of doubtful value and likely to prove injurious. These species are all natives of the Old World, and with the exception of the mongoose, mina, and flying foxes, are inhabitants of the temperate regions of Europe and western Asia.

¹ See Journ. Bureau Agr. Western Australia, II, December 10, 1895, pp. 630-631; III, 1896, p. 676.

(5) Notwithstanding the object lessons afforded by the English sparrow in our own country, the rabbit in Australia, and the mongoose in Jamaica, no steps have been taken to prevent the repetition of similar costly mistakes in the future, and at present no restriction is placed on the indiscriminate importation of exotic species into the United States.

(6) Recent events have given new importance to this subject. The gradual increase of the starling and the efforts to introduce the kohlmise require prompt measures to prevent species of such doubtful value from gaining a foothold in this country. The acquisition of new territory has also brought us face to face with new problems. Not only should the mongoose be prevented from reaching the United States from Hawaii and Puerto Rico, but the native fauna of these islands should be preserved and all our island possessions protected from ill-advised acclimatization, which has caused so much loss in Australia and New Zealand.

(7) The introduction of exotic birds and mammals should be restricted by law and should be under the control of the United States Department of Agriculture. Western Australia has already adopted this course, and under the "Destructive birds and animals act" of 1893, prohibits the importation, liberation, or keeping of animals and birds which the colonial bureau of agriculture considers injurious to vineyards, orchards, or crops.







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