NATURALISED BIRDS OF THE WORLD

CHRISTOPHER LEVER

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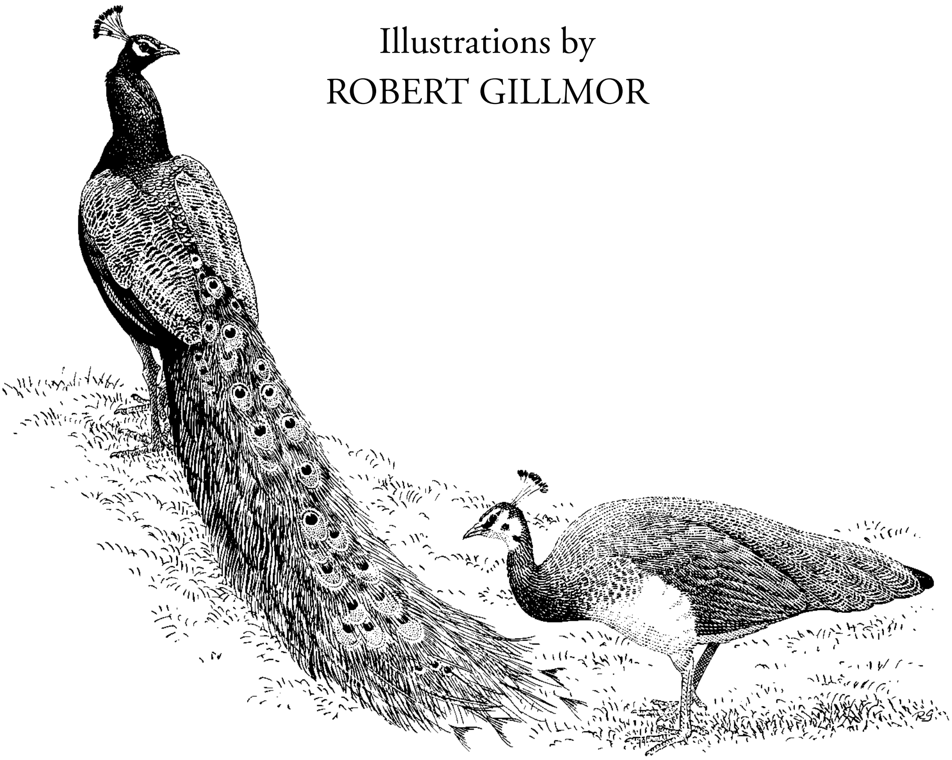
Illustrations by
ROBERT GILLMOR



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Contents

Tables

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As with my previous books, the material resulting from my research for this work has been deposited in the library of the Natural History Museum in London.

Christopher Lever
Winkfield, Berkshire, 2005

Preface

This book, which updates Lever (1987), describes when, where, why, how and by whom the various alien birds now established throughout the world were introduced, how they subsequently became naturalised, and what, if any, ecological and economic impact they have had. The criteria for the inclusion of a species are that it should have been imported to a new country either deliberately or accidentally by human agency, and that it should currently be established in the wild in self-maintaining and self-perpetuating populations independent of man. These criteria provide a good definition of the term 'naturalised'. The term 'feral' properly describes a species that has reverted to the wild from domestication, such as the Feral Pigeon *Columba livia*. Thus 'feral' is not, as it is all too commonly used, a synonym for 'naturalised'.

Each species account is a monograph on an individual bird. (More detailed accounts and further references will be found in Lever 1987). Natural immigrants have only been included when an established exotic has self-colonised a new country, as in the case of the House Sparrow *Passer domesticus* in Africa and Central and South America. The translocation of a species from one part of a country where it occurs to another part of the same country where it does not occur, such as the House Finch *Carpodacus mexicanus* which has been transplanted from the western to the eastern United States, and the natural colonisation by an alien of offlying islands, have in general been ignored: exceptions to the former include birds imported to the Hawaiian Islands from the United States mainland, and to the latter birds that have self-colonised some of New Zealand's subantarctic islands.

In 1974–75 the names and boundaries of several counties in England, Wales, and Scotland were altered. As most of the events described here antedate these changes, the old names and boundaries have been adhered to. Outside Britain, however, the new names of countries and oceanic islands have generally been used.

Since Lever (1987), many new species (e.g. the Purple Swamphen *Porphyrio porphyrio* in the United States) have become naturalised, and these are all included in the text. The status of one species, the Azure-winged Magpie *Cyanopica cyanus*, in Spain and Portugal has recently been reassessed from naturalised exotic to endemic native (see Fok *et al.* 2002, Anon 2002). Some species (e.g. the Yellow-crowned Night Heron *Nyctanassa violacea* in Bermuda, the Eurasian Griffon *Gyps fulvus* in France, and the Northern Goshawk *Accipter gentilis*, White-tailed Eagle *Haliaetus albicilla* and Western Capercaillie *Tetrao urogallus* in England and Scotland) included in Lever (1987) have been excluded here as they are erstwhile native reintroductions rather than alien introductions.

Classification, taxonomy, sequence, scientific and vernacular names, and details of natural range all follow Dickinson (2003).

Introduction

Birds have always held a peculiar fascination for humans. They have been admired for the beauty of their plumage, marvelled at for the variety and delicacy of their songs and, perhaps most of all, envied for their power of flight. What, then, more natural that, in his colonisation of the world, man should have endeavoured to enrich the birdlife of those regions in which he has settled?

Ecosystems exist in a constant state of flux: some species die out, adventives and invasives arrive, and new species slowly evolve through natural selection. These alternatives occur especially when environmental conditions are themselves changing, in particular as a result of human activities. New and artificial habitats, created by urbanisation, land reclamation for agricultural purposes or commercial forestry, or disturbed successional biotic associations, are formed, thus providing opportunities for colonisation by a host of new species. Introductions by man are not inherently different from natural invasions, such as that of the Collared Dove *Streptopelia decaocto* in Europe; the process of establishment and the ecological and/or economic impact that follows may be the same for species arriving by both means. No two species, even if they are close congeners, will necessarily have the same colonising ability; thus the Mandarin Duck *Aix galericulata* has become widely established in Britain, while the Wood Duck *A. sponsa* – the only other member of the genus – has been a relative failure, although given the same opportunities (Lever 1990, 1993).

Motives

Birds (and other animals) have been deliberately introduced by man outside their natural range, possibly since their early domestication some 5,000 years ago (Lever 1996b), for a variety of motives; for sporting purposes; for sentimental or nostalgic reasons; as an aesthetic amenity; as a potential source of food; as a form of biological control of a pest species; as scavengers; and, in pre-Columbian Central America, for their plumage, which was used for ritualistic and decorative purposes; and for conservation reasons. Some birds have been introduced outside their natural range simply out of curiosity as to the outcome. Many have escaped from captivity or domesticity, and several have used man as an unwitting means of transportation as ship-borne stowaways.

Birds (as well as mammals and fish – see Lever 1985, 1996a) have been released for sporting purposes to augment the already existing local game species; such releases have been made principally in North America and the Antipodes, and have been primarily of species from the Odontophoridae, Phasianidae and Anatidae.

Introductions for sentimental or nostalgic reasons have largely involved song birds imported to North America and the Antipodes by homesick settlers (mainly Turdidae, Fringillidae and Emberizidae), and were made under the auspices of local acclimatisation societies (see Lever 1992).

Birds introduced as an aesthetic amenity have mostly been wildfowl (Anatidae) and the so-called 'ornamental' pheasants (Phasianidae).

Introductions of birds as a potential source of food have usually been domesticated species such as the Red Jungle Fowl *Gallus gallus* (the ancestor of the domestic chicken) and the Rock Dove/Feral Pigeon *Columba livia*. In the nineteenth century, Wekas *Gallirallus australis* were imported from Stewart Island, New Zealand, to subantarctic Macquarie Island as a source of food for visiting whalers and sealers. The provision of an additional food resource is, of course, a concomitant feature of the introduction of new gamebird species.

Many birds have been introduced as a form of biological control of (usually insect) pest species. The House Sparrow *Passer domesticus*, was introduced to the United States in an attempt to control the larvae of the Snow-white Linden moth *Eunomos subsignarius* that were defoliating trees; to Argentina to destroy a psychid moth *Oiketicus kirbyi*; and to Brazil to kill mosquitoes that were causing a human health hazard and caterpillars that were damaging ornamental shrubs. Many of these 'biological controls' eventually themselves became pests, and although exotic species are still sometimes used as controlling agents, this has become generally accepted as a potentially dangerous practice.

Two birds, the Chimango Caracara *Milvago chimango* on Easter Island and the Turkey Vulture *Cathartes aura* on Puerto Rico and Hispaniola, were released to act as scavengers. The former also preys on colonially nesting seabirds and causes injuries to cattle when probing their backs for ticks.

If Haemig (1978, 1979) is correct, several birds, notably the Tufted Jay *Cyanocorax dickeyi*, were imported to pre-Columbian Central America to satisfy the demands of the flourishing trade in ornamental feathers.

At least one species, the Greater Bird of Paradise *Paradisaea apoda*, has been introduced (from the Aru Islands) to Little Tobago Island in the West Indies as a means of conservation to protect it from plumage-collectors for the millinery trade (Ingram 1911), though it has not been seen there since 1981 (ffrench 1991).

Numerous species have become established outside their natural range as a result of escaping (or being released) from captivity or domesticity. Among the families most commonly represented in the former category are the Psittacidae, Estrildidae and Ploceidae, while species in the latter include the Red Jungle Fowl, Rock Dove/Feral Pigeon and Muscovy Duck *Cairina moschata*, ancestor of the domestic farmyard variety.

Several birds have used humans as an unknowing means of transportation by stowing away on ships; most prominent of these marine hitch-hikers is, perhaps, the House Crow *Corvus splendens*, which has been carried in this way to the Arabian Gulf, South Africa, Australia and elsewhere.

Consequences

A number of far-reaching and often unpredictable consequences may attend the naturalisation of an exotic species in a new environment: these include the transmission of parasites, pathogens and diseases; damage to human food resources and buildings; disturbance of the native ecosystems; interspecific competition with indigenous species; predation of (and by) autochthons; and morphological, physiological and/or genetic changes in native populations through hybridisation with exotics, and in exotics themselves through their adaptation to a new environment. Temple (1992) estimated that in the United States 56% of introduced birds are primarily injurious, 5% are mainly beneficial, and 39% may be both injurious and beneficial. In Britain, Williamson & Fitter (1996) cite the so-called 'Tens Rule', which holds that approximately one in ten of imported species gain access to the wild, one in ten of those succeed in becoming established, and one in ten of those become pests.

Most diseases are likely to have more serious effects on hosts that have not been previously exposed to them than on their original pre-adapted hosts. Although in time natural selection tends to result in an accommodation between a pathogen and its host, a new host may become endangered or even exterminated before that occurs. When an alien and a native compete for the same ecological niche, the introductory host may partly or entirely displace the indigenous species.

Epizootic diseases most seriously affecting humans and transmitted by birds include psittacosis (or ornithosis), cryptococcal meningitis, histoplasmosis, toxoplasmosis, encephalitis and encephalomyelitis. Among disorders that primarily affect other birds are Newcastle disease, blackhead, bird pox, avian influenza and avian malaria. Pathogens carried by introduced birds may have contributed to the decline or extinction of endemic Hawaiian honeycreepers of the genus *Hemignathus*; another honeycreeper the Akepa *Loxops coccineus*; the Hawaiian Goose *Branta sandvicensis* (Berger 1981); the endemic New Zealand Quail *Coturnix pectoralis novaezelandiae* (Oliver 1930, 1955); and the Auckland Island Teal *Anas aucklandica*, Weka, and Red-fronted Parakeet *Cyanoramphus novaezelandiae* (Falla *et al.* 1979). Ectoparasites carried by birds include ticks (which can transmit typhus and relapsing fever to humans), chicken mites and stickfast fleas: among avian endoparasites are cestodes, nematodes and leucocytozoans.

Examples of naturalised birds affecting human food resources are legion, and are fully discussed in the species accounts that follow. Birds that cause damage to buildings (by the deposition of excrement, by pecking at mortar and by blocking gutters and downpipes with nesting material) include House Sparrows, European Starling *Sturnus vulgaris*, and Rock Doves/Feral Pigeons.

Introduced birds frequently compete – mainly for food and nesting sites – with (usually closely related) native species. Here we are confronted with the concept of the 'vacant ecological niche'. In nature, every species occupies a position (or niche) to which it is better adapted than any other species. Thus in any given ecosystem, provided the diffusion of species has been complete, every available niche will already be occupied. An alien animal introduced into such an environment will survive only if it can out-compete autochthonous ones, or if, as in the case of the Little Owl *Athene noctua* in Britain (see Fitter 1959), it can find a previously unoccupied or empty niche. Of these two options the former is the most common.

Where an alien species has food, habitat and breeding requirements that are very similar to those of native species, the Principle of Competitive Exclusion applies: this states that two species with identical ecological requirements cannot co-exist together unless there is a superabundance of their various needs. One will always prove more effective in utilising the available resources and will displace the other.

Introduced species can be responsible for genetic and/or morphological changes in indigenous populations. Although natural selection normally favours native genotypes, continuous infiltration or introgression of an alien's genes into a native population can eventually have an effect which may be beneficial or detrimental. A topical case at the time of writing is that of the Ruddy Duck *Oxyura jamaicensis* which escaped into the wild in England in the 1950s, from where it has spread to parts of southern Europe and North Africa, where it is hybridising with the native White-headed Duck *O. leucocephala*, which is classified as Vulnerable by the World Conservation Union. Strenuous efforts are currently being made to eradicate Ruddy Ducks in Britain (and on the continent) to preserve the genetic integrity of *O. leucocephala*. Smout (2003: 11), with whom the author agrees, argues persuasively against such extermination campaigns, and suggests that 'A more defensible approach might be to revive the notion of some species as pests, but to hesitate before involving conservation in anything analogous to ethnic cleansing for other species'.

Naturalised raptors have been implicated in the decline or extinction of native species. On Easter Island, where they were introduced as scavengers, Chimango Caracaras are a threat to the survival of both native Red-tailed Tropicbirds *Phaethon rubricauda* and Kermadec Petrels *Pterodroma neglecta*, and also introduced Chilean Tinamous *Nothoprocta perdicaria*.

Extensions of a species' distribution sometimes result in considerable genetic variation, such as has occurred in the House Sparrow in North and South America and in the Hawaiian Islands.

Aliens all too often cause damage that is of only minor importance or unknown in their native range; thus the Yellow-fronted Canary *Serinus mozambicus* introduced to the Mascarene Islands and the Village Weaver *Ploceus cucullatus* on Hispaniola are far more serious pests there than in their African homelands.

The benefits derived from naturalised birds include the provision of new game species; an additional source of food; an added aesthetic amenity; more opportunities for human employment; an economically valuable extension of a country's natural resources; and, as for example in the case of the Golden Pheasant *Chrysolophus pictus* and Mandarin Duck in Britain, the provision of populations of conservation importance.

Habitat Variables

Alien species often succeed in becoming established because man has created an artificial 'disturbed' niche to which they, but not natives, are pre-adapted. Especially in North and South America and the Hawaiian Islands, relatively few alien birds have become naturalised in native unmodified habitats already occupied by indigenes, and the successful establishment of most exotics has been due in part to their close association with human-modified habitats. In Australia and New Zealand, the proportion of exotic to indigenous birds is much higher in suburban than in rural habitats. The presence of exclusively native vegetation is the most important factor governing the abundance of both native and exotic birds, showing a positive and negative correlation respectively. Native species feed proportionately more than aliens on indigenous rather than introduced plants. When not foraging, native birds are observed proportionately more often than aliens on native rather than introduced vegetation, and exotics are noticed proportionately more often than natives on man-made structures. Relatively few alien birds occur regularly inside native forests and few natives are to be found in exotic woodland.

Controlling Factors

Introduced animals can be limited by a single factor or by a combination of several, such as a shortage of (usually winter) food or the effects of predators, parasites and diseases. In the case of predators, a reduction in their number allows that of the prey to recover, which in turn stimulates the population of the predator to increase; this rise in the number of predators depresses that of the prey, eventually resulting in a reduction in the population of predators. As J. R. Krebs wrote (pers. comm. 1992), 'People used to say that predators do not over-exploit their prey; now one thinks of them doing their best to if possible – the evolutionary process of natural selection does not act to favour harmonious properties of communities and ecosystems, but rather acts to favour efficient performance (transfer of resources such as food into reproductive output) at the level of the individual'. Conversely, an absence of regulatory factors and an abundance of natural food resources may allow a species to increase rapidly; such abundant food resources enable birds like the Northern Cardinal *Cardinalis cardinalis*, introduced to the Hawaiian Islands, to breed throughout the year rather than seasonally and to raise far more young than it does in its native North and Central America.

Introduction and Speciation

The colonisation of a new region by an introduced species may be a major event in the evolution of that species and can result in the creation of a new species. This can happen if the colonising event causes isolation between different populations which then genetically diverge as a result of micro-evolutionary processes (as in the case of the White-tailed Jay *Cyanocorax mystacalis* and Tufted Jay in South America and Mexico respectively), or if the colonising event, in cases where the propagule size is low, causes a radical genetic alteration in the founder population. The House Sparrow in Australia and North and South America may be in the course of such speciation.

It is not always easy to get an introduced species established in a new region, even when the conditions appear to be favourable. Factors that increase (but by no means guarantee) the likelihood of success are a - congenial climate; a suitable habitat; a vacant ecological niche; a plentiful supply of acceptable food; generalised rather than specific food requirements; an absence of potential predators; a lack of competition from native species; low mortality and high fecundity rates; a large enough founder stock; a degree of adaptability and behavioural flexibility; and the ability to disperse. To these may be added, in the case of birds, nest site selection; large clutches of eggs; small body mass; and the absence or abandonment of the instinct for full migration, as for example in the case of the Canada Goose *Branta canadensis* in Britain.

Where enough of the factors occur a species' naturalisation typically follows a classic sigmoid growth curve; the initial stock may be severely depleted as a result of predation or natural causes; next, following adaptive changes in the behaviour and ecology of survivors, there may be a population explosion to the maximum numbers that the colonised area will support, followed by a contraction in numbers (and possibly range) to a point where both become stabilised.

In the past decade much research has been done (some of which reaches contradictory conclusions) on the reasons for the success or failure of an introduced bird to become established in a new environment.

Forsyth & Duncan (2001) and Cassey *et al.* (2004) stress the importance of propagule size (introduction effort) as a key determinant of the successful establishment of exotics, and claim that propagule size is both the strongest correlate of introduction success and correlates with many variables previously believed to influence such success. The latter authors believe that apart from the size of the founder stock, only habitat generalism relates to successful establishment in birds (but see Moulton *et al.* 2001a, b below). Although Moulton (1993) argues convincingly that interspecific competition (and other biotic features of the community) play an important role in influencing the success of invasives, Blackburn & Duncan (2001a) suggest that success depends more on the suitability of the abiotic environment for the invasive species rather than the degree of biotic resistance.

Sol & Lefebvre (2000) and Sol *et al.* (2002) show that adaptability and behavioural flexibility are important criteria for invasion success. These criteria are known to be linked to relative brain size, and species with relatively larger brains tend to be more successful invaders.

It has been hypothesised that there is a relationship between the body size of introduced animals and their success rate, and predictions suggest that the success of introductions should be negatively correlated with body size across taxa but positively correlated within closely related taxa. Cassey (2001) found that introduced terrestrial birds have, on average, larger bodies than extant land birds, but that across species, families, and higher family nodes, introduction success is significantly related to smaller body size. Within taxa, however, there is a noticeable positive relationship between successful introduction and body mass. Cassey (2001) concluded that there is an indirect but genuine relationship between the introduction success of terrestrial birds and their body size.

Duncan *et al.* (1999) found that the geographic range of alien birds in New Zealand is unrelated to the period of their establishment. Large geographical ranges are dependent more on an abundance of preferred habitat, fecundity, rapid development, small body size, many and large-scale introductions and a partial migratory instinct (Duncan *et al.* 2003). Several authors (e.g. Moulton *et al.* 2001a, b) have found that successfully introduced species tend to have larger natural geographical ranges than unsuccessful ones, which supports the hypothesis that range size is correlated with adaptability and behavioural flexibility. There is a strong correlation between range size in the British Isles (the source of many New Zealand aliens) and New Zealand: Duncan *et al.* (2001) found much the same in Australia.

Case (1996) suggested that the most important correlate of successful introductions is the number of indigenous species that have died out during the past 3,000 years, which is linked to the amount of human activity and habitat destruction through the effects of exotic predators, herbivores, and parasites. Thus the number of successful invaders is close to the number of native species lost. In the case of islands, their area correlates positively with the number of introduced species. Successful introductions are not directly linked to the richness of the indigenous avifauna nor the variety of potential mammalian predators. The relative proportion of extinct native species is positively correlated with the numbers of aliens and endemics. There is a strong correlation between the numbers of successes and failures among invasives, and the relative success to failure rate increases with the number of extinct natives. Case (1996) believed that the correlation between introductions and native extinctions exists because native species are usually more common in pristine habitats whereas exotics prefer disturbed habitats. As more of an island's area becomes disturbed, most indigenes lose their habitat, while exotics gain.

Although Case (1996) found little evidence that a rich native avifauna will inhibit the establishment of an alien species, interactions between naturalised and indigenous species may influence habitat distribution of species within islands. In both pristine and man-made habitats, the numbers of exotics and their relative abundance is negatively related to the number of native species.

McLain *et al.* (1995, 1999) and Sorci *et al.* (1998) found that on a number of widely dispersed oceanic islands and in New Zealand the introduction success rate is lower for birds with sexually dichromatic plumage than for those with sexually monochromatic plumage. The diets of the two groups do not differ, but a broader-based diet is associated with a higher rate of introduction success. It was also found that species nesting principally in bushes are more successful than those nesting in trees or on the ground, but that plumage type does not affect nest-site selection. Sexual selection governs the evolution of sexual dichromatism, and thus sexual selection indirectly causes the extinction of small colonising populations – in particular of passerines – meeting new environmental requirements by constraining ecological plasticity and evolutionary response to pressures of natural selection.

Interspecific competition, associated with morphological over-dispersion (where individuals are more dissimilar in size than would be expected by chance), is a limiting factor for the successful introduction of Passeriformes to oceanic islands. Moulton *et al.* (2001b) found that in the Hawaiian Islands and New Zealand, introduced Galliformes were similarly consistently morphologically over-dispersed. They also re-examined the role of propagule size in introduction success, and found that the evidence supporting this proposition is poor, and that community-based factors, including environmental ones and interspecific competition, are important determinants of the success of gamebird introductions. Duncan & Blackburn (2002), however, conclude that competition among morphologically similar species could not have been responsible for the failure of gamebird introductions in New Zealand because the majority of species were liberated at widely separated locations or at different times, did not spread and soon died out if they failed to become established, and could never have encountered other morphologically similar exotics. Even when morphologically similar species were released in the same area and at the same time, historical records suggest that it is unlikely that two species were ever released at the same site, and even if they were, interspecific competition is an improbable cause of failure because most species occurred in extremely low numbers. Duncan & Blackburn (2002) infer that factors other than competition can produce patterns of significant morphological over-dispersion among alien avifauna, and that greater introduction effort expended on more morphologically distinct species may account for the over-dispersion of exotic gamebirds in New Zealand.

Introduced populations may have genetic characteristics, frequently caused by small propagule size, that differ from those in their natural range. This leads to founder effects and subsequent genetic drift, often resulting in greater differences in allozyme patterns between naturalised populations than between natural ones. In many instances, a large proportion of alleles are lost within a few generations of the introduction event, and the mean level of heterozygosity can also be significantly depleted. Sjoberg (1996) could find no evidence of lowered potential to track environmental changes following a reduction of the number of alleles in an introduced population, nor for inbreeding depression.

The degree of genetic variability occurring in a population is important for its survival and evolution, and populations with a small introduction effort have reduced genetic variation. Many introductions, however, have been made successfully with a small propagule size – Sjoberg (1996) quotes Fabricius (1983a, b) regarding the Canada Goose in Sweden.

Lockwood (1999) concluded that taxonomy is a strong predictor of successful avian introduction; she pointed out that six families (Anatidae, Phasianidae, Passeridae, Psittacidae, Columbidae and Odontophoridae) contain more successfully established exotics than would be expected by chance, and that human influence on probability of transport appears to govern this taxonomic pattern. Three families (Anatidae, Odontophoridae and Phasianidae) hold many more species than expected that were introduced for sporting purposes. Similarly, Passeridae and Sturnidae have far more cage-bird species than expected by chance. Thus, traits that enhance the likelihood of deliberate transport show a definite taxonomic pattern. Brooks (2001) concluded that human preferences may govern the selection of particular families for introduction, with the success of individual species being simply due to increased propagule pressure.

Global information on avian introductions is a valuable tool for studying the factors governing the success or failure of such introductions. The value of this resource, however, may be compromised by two features associated with the non-random nature of introductions (see Lockwood 1999). Blackburn & Duncan (2001b) assess the probable importance of these two features.

Firstly, the characteristics of the species and regions selected for introduction are not representative of species and locations generally, which may bias the perception of the factors affecting the outcome of introductions. Secondly, the spatial and taxonomic clumping of introductions causes difficulties of confounding and lack of independence in statistical analyses of introduction rates of success. Introductions can, however, be analysed validly as independent observations providing this lack of independence can be expressly incorporated in the model, and this technique should be standard practice in any analysis of introduction results.

Every introduction of an alien species is a unique event, because the precise circumstances of each case can never be exactly replicated. Nor are they invariably entirely predictable, since exotic animals react with the native biota in a variety of ways which can often be impossible to forecast (Lever 2005).

The establishment and spread of introduced species is recognised as a major ecological and economic threat throughout the world, and this threat is likely to grow as greater volumes of transport and trade increase the rate of species' introductions. Measuring, assessing, and understanding the impact of invasives is a major, and so far unresolved, problem in invasion biology. Defining and assessing exactly what is meant by 'impact' is not easy, but is crucial in establishing priorities for the management of invasive species. If impacts can be quantified, it should be possible to apply comparative methods to identify why some invasives have a more serious impact than others, and to make use of these data in explanatory models. It is important to study how attributes and characteristics of invasives and of the biotope interact. The biota of islands, for example, are believed to be more susceptible to the impact of exotics because insular species have not been exposed to mainland selective pressures; data on introduced birds may provide opportunities to test these and associated hypotheses. The 'enemy release' hypothesis, for example, suggests that some invaders are more successful in their naturalised than in their native range due to an absence of such natural enemies as predators, competitors, and pathogens. Species with a rapid rate of population increase may have larger distributions because they are less vulnerable to local extinction when attempting to become established (Duncan *et al.* 2003).

Naturalised Species

TINAMIDAE (TINAMOUS)

Chilean Tinamou
Nothoprocta perdicaria

Natural Range: NC and S Chile.
Naturalised Range: Easter I.

Easter Island

In 1885 Chilean Tinamous of the nominate form (NC Chile) were introduced to Easter Island (Hellmayr 1932). Although they remain established over a century later (Araya *et al.* 1993, Jaramillo *et al.* 2003) they have not spread far, perhaps due to predation by the Chimango Caracara *Milvago chimango*, which was introduced in 1928 (Johnson *et al.* 1970).

Impact: By providing them with an additional source of food, Tinamous may be helping to sustain the population of Caracaras on Easter Island.

STRUTHIONIDAE (OSTRICHES)

Ostrich
Struthio camelus

Natural Range: From S Morocco and Mauritania to Sudan, Ethiopia, N Uganda, Somalia, Kenya, C Tanzania and southern Africa. (Formerly also Syrian and Arabian deserts).
Naturalised Range: Australia.

Australia

In 1869 four Ostriches were despatched from Paris to Melbourne, Victoria, as the intended founder stock of a breeding facility for the production of aigrettes (plumes) used in the millinery trade. From Melbourne the birds were transferred by their owner, Mr (later Sir) Samuel Wilson to his estate at Longerenong in the Wimmera district. Although the Ostriches bred successfully at Longerenong, the wet climate and predation by marsupial cats (*Dasyurus* spp.) forced Wilson in 1874 to send his surviving stock to a station owned by C. M. and S. H. Officer at Murray Downs on the Murray River in New South Wales. After an initially unsatisfactory start the birds started to flourish, and their plumes, marketed in London, were said to be superior to those produced in South Africa.

By 1882 the population at Murray Downs had increased to over 100. In the following year Murray Downs was sold, part of the stock being transferred to a property near Kerang, Victoria, and part to the Kallara

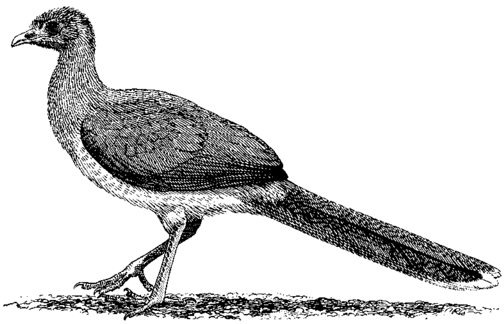
Ostrich

Station on the Darling River in New South Wales. The birds at Kerang eventually increased to 120, but the chicks of those at Kallara all succumbed to the mineral salts in the station's artesian wells.

In the early 1880s Ostriches were also introduced successfully to some of the drier parts of South Australia, where at Port Augusta by 1888 the South Australia Ostrich Company owned a population of 510. Some of these may have been released prior to the First World War, and before 1933 others were freed at Point Sturt on Lake Alexandrina and on Mundoo Island at the mouth of the Murray River, where they multiplied so rapidly that they eventually became a pest.

After the First World War the trade in aigrettes declined dramatically, partly as a result of a change in fashion, partly due to the difficulties in catching the birds for plucking and partly when it became apparent that sheep were more profitable than ostrich plumes. When Ostrich farms closed down most of the surviving stock escaped or were released, and feral populations became established at Murgah, New South Wales, at Redcliffe Station northwest of Morgan, and in the sandhills of the Coorong, Narrung and Port Augusta districts of South Australia (Frith 1979).

Despite predation and shooting, small feral populations of Ostriches survive north of Port Augusta and at Redcliffe, and hundreds or even thousands around the Flinders Range northeast of Port Augusta (Blakers, Davies & Reilly 1984). The Ostriches in South Australia are believed to be mainly *S. c. australis* (southern Africa), possibly intermixed with some of the nominate form from northern and parts of eastern Africa.



Plain Chachalaca

CRACIDAE (CHACHALACAS, CURASSOWS AND GUANS)

Plain Chachalaca
Ortalis vetula

Natural Range: From N Mexico (and a small area of extreme southern Texas) south to Costa Rica. Also on Utilia I., Honduras.
Naturalised Range: USA.

United States

In 1923 Howard E. Coffin obtained 42 Plain Chachalacas of the form *O. v. mccallii* from eastern Mexico which he released on Sapelo Island off the coast of Georgia. In the spring of 1924 some of the birds nested successfully, and within two years they had colonised most of Sapelo and had also flown to the neighbouring Blackbeard Island (Phillips 1928). Plain Chachalacas still occur on Sapelo and Blackbeard Islands, and according to the AOU (1998) also on Little St Simons Island.

NUMIDIDAE (GUINEAFOWL)

Helmeted Guineafowl
Numida meleagris

Natural Range: Much of sub-Saharan Africa. Also in NW Morocco until recently but now believed extinct (Thévenot *et al.* 2003).
Naturalised Range: Asia: ?Japan; ?Yemen. North America: West Indies. South America: Brazil. Australasia: Australia; New Zealand. Atlantic Ocean: ?Annobón I.; Ascension I.; Canary Is., Cape Verde Is. Indian Ocean: ?Chagos Is.; ?Comoro Is.; Mascarene Is. Pacific Ocean: Hawaiian Is.

When Helmeted Guineafowl (ancestors of the domestic variety) were first imported to Europe is uncertain, but they are known to have been domesticated by both the ancient Greeks and the Romans. There is, however, no evidence of their continuous domestication, and they were probably reintroduced by Portuguese traders from west Africa in the late fifteenth/early sixteenth centuries, when in England they were called the 'Tudor Turkey'. The birds were not well known in Europe until the middle of the 16th century.

Japan

Matsuo (1990) says that Guineafowl were imported to Japan from Europe by the Dutch in the mid-nineteenth century; whether any occur there in the wild today is unknown.

Yemen

Meinertzhagen (1954) says that Helmeted Guineafowl were probably introduced to the Arabian Peninsula, where today they occur only in parts of Yemen. The race in Yemen is the nominate *meleagris*, which is found on the other side of the Red Sea in Africa, but natural immigration seems improbable.

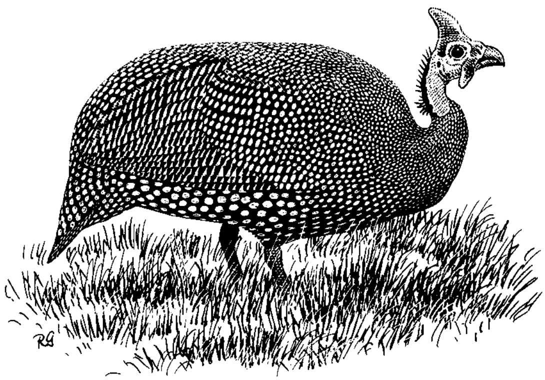
West Indies

Wetmore (1927) repeated the unsubstantiated claim by Karl Ritter who, writing in 1836, stated that Guineafowl were first introduced to the Antilles around 1500. The species is now widely kept in domestication in the Caribbean, and would doubtless also have become widely feral were it not for predation by the also introduced Small Indian Mongoose *Herpestes javanicus* (see Lever 1985). Guineafowl occur in the wild in most lowland parts of Hispaniola, on Cuba, on the Isle of Pines, on Puerto Rico, Barbuda, the Virgin Islands (St Croix), and St Martin (Isle Pinel) (Raffaele *et al.* 1998).

On Hispaniola, Guineafowl were well-established and widely distributed by at least 1733, and remained so for the next 200 years. Wetmore & Swales (1931) found them in numerous localities, though mainly in Haiti. Although the birds are well-established in the foothills of the Sierra de Baoruco in the Dominican Republic they are declining due to overshooting, and predation by Mongooses.

Bond (1979) says that Guineafowl are established on Cuba eastward from Las Villas Province, on the neighbouring Isle of Pines, and on Barbuda in the Leeward Islands, where the Moroccan form *N. m. sabyi* has occurred in the wild since before 1889.

In Puerto Rico, Helmeted Guineafowl occurred in montane areas as early as 1836, but Wetmore (1927) believed that they had by then died out. The AOU (1998), however, lists the species as still established on Puerto Rico.



Helmeted Guineafowl

Brazil

Helmeted Guineafowl have been successfully introduced to the island of Trinidade off the coast of Brazil (AOU 1998, R. C. Banks pers. comm. 2004).

Australia

Simpson & Day (1994) refer to populations of Helmeted Guineafowl on Heron and other Great Barrier Reef islands, and E. F. J. Garcia (pers. comm. 2005) saw a small flock of 20 near Mareeba in the Atherton tablelands, Queensland, in 1999. These Guineafowl populations are not mentioned by Barrett *et al.* (2003).

New Zealand

Several attempts were made in the nineteenth century to establish Guineafowl on South Island but none succeeded, probably due to the severe winters. In North Island, birds were released in various localities, but by the 1920s were established only at Aberfeldy, 65km east of Wanganui. Today they also occur on rough farmland in parts of Northland, Waikato, and Rotorua (Heather & Robertson 1997).

Annobón Island

Guineafowl on Annobón Island off Gabon may be descended from deliberate releases, but could also be natural immigrants from West Africa (Fry 1961).

Ascension Island

According to the AOU (1998) Guineafowl are established on Ascension Island. See also McCulloch 2004.

Canary Islands

According to Langley (2004), a small (< 20) and declining population occurs on Tenerife.

Cape Verde Islands

In 1461 Prince Ferdinand of Portugal imported slaves, and probably Helmeted Guineafowl of the race *N. m. galeatus* from west Africa, to the Cape Verde Islands. They were observed on Sal by the English buccaneer, William Dampier, in 1683, were said to be abundant on Maio in 1709, and were noted on São Thiago by Charles Darwin in 1832. According to Bannerman & Bannerman (1968), they occurred during the nineteenth century on São Nicolau, São Vicente, Fogo, Maio, São Thiago, Brava, Santo Antão and Boa Vista. Guineafowl now occur on most of these islands apart from São Vicente and Brava (Hazevoet 1995).

Chagos Islands

In 1907, Gadow & Gardiner (1907) found a few feral Guineafowl on Takamaka, Fouquet and Anglaise Islands; Bourne (1971) heard reports of them on Salomon Island, and it is possible that a few may survive on some of the less frequented islands.

Comoro Islands

According to Benson (1960), Guineafowl of the form *N. m. mitrata* were probably introduced to Grande Comore, Anjouan and Mayotte, where they were first reported in 1843. They could, however, be natural immigrants from east Africa.

Mascarene Islands

Introduced between 1803 and 1832 (Cheke 1976), Helmeted Guineafowl of the form *mitrata* (eastern and southern Africa) were by 1857 considered to be abundant in northern, central and western Rodrigues (Staub 1973b), but by around the time of the First World War had become rare, apparently due to nest predation by feral Pigs *Sus scrofa* (see Lever 1985), and died out before 1964 (Diamond 1987). However, Showler (2002) states that in 1999 a pair of free-ranging Guineafowl with young was observed on Mont Malartic, and another pair was noted at La Source, so the possibility of the re-establishment of a feral population cannot be discounted.

Jones (1996) lists Helmeted Guineafowl as introduced in the eighteenth century to Mauritius, where they occur in lowland exotic savanna.

Impact: Staub (1973, 1976) and Cheke (1987) say that Helmeted Guineafowl on Rodrigues have been seen as a threat to sown maize, and between 1955 and 1968 were systematically destroyed (North-Coombes 1971).

Hawaiian Islands

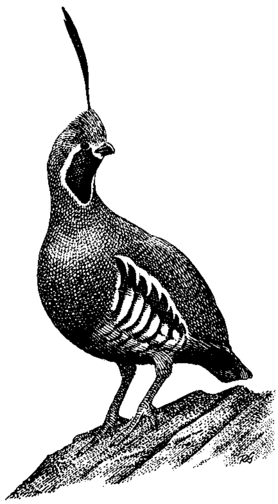
Since 1874 Guineafowl have occasionally occurred in the wild on several Hawaiian islands, but in most have failed to establish. Schwartz & Schwartz (1949) located a small population of about 500 birds whose numbers were declining, on Lanai, Molokai, Maui, Kauai and Hawaii, and believed the species would soon disappear. A few, however, may survive on Hawaii, Maui, Molokai and Lanai (Pratt *et al.* 1987), though they are 'perhaps not well-established' (AOU 1998: 123).

ODONTOPHORIDAE (NEW WORLD QUAILS)

Mountain Quail
Oreortyx pictus

Natural Range: From SW Washington, Oregon, Nevada and California (including the Little San Bernardino Mts) to N Baja California.
Naturalised Range: North America: Canada.

Canada
Mountain Quail were first introduced to Canada in 1860 or 1861 when Charles Wylde released some at his home near Victoria on Vancouver Island, British Columbia (Wylde 1923, Alford 1928). Others were probably liberated at around the same time on the Gulf islands and on the mainland in the Lower Fraser Valley (Phillips 1928). Although both these introductions ultimately failed, from subsequent releases said to have taken place in the 1870s and 1880s a sizeable population built up at the southern end of Vancouver Island, where Phillips (1928) recorded their presence along the mountain ridges from Victoria to Cowichan Valley at Duncan. Fifty years later, between 300 and 500 were established on southern Vancouver Island as far north as Duncan, where the species still occurs (Johnston & Garrett 1994, AOU 1998).



Mountain Quail

California Quail
Callipepla californica

Natural Range: From W and C Oregon south through California (including Santa Catalina I.) to Baja California and NE Mexico.
Naturalised Range: Europe: France; ?Spain; ?Italy. North America: Canada. South America: Argentina; ?Brazil; Chile. Australasia: Australia; New Zealand. Pacific Ocean: Hawaiian Is.

France
Unsuccessful attempts to establish California Quail on the French mainland have been made since the 1840s (Phillips 1928). Today, the species occurs in the wild only on the island of Corsica, where it became established during the 1960s (Yeatman 1976). Most of the population is found where arable land is associated with patches of maquis (scrub) formed of Cork Oak *Quercus suber*. The species also occurs in much smaller numbers in non-arable localities where human activities (e.g. grazing, woodcutting and burning) have created open grassy and scrubby clearings in the Cork Oak forests. The birds are uncommon and extremely shy (Dubray & Roux 1989, Pietri 1993, Baccetti *et al.* 1997, Aebischer & Pietri 1997).

Summing up the potential habitats of California Quail on Corsica, Pietri (1995) said that between 2,900 and 4,900 birds had been liberated in various localities, more than 70% of which were released during the 1960s. By 1992 the birds occupied nearly 620 sq km in the mid-eastern part of the island (the Aleria plain). Habitat factors and climate are likely to be the principal factors that affect the success or failure of the species to become established. The Aleria plain, where sound agricultural practices since the 1960s and the extension of vineyards provide the birds with a favourable anthropic habitat, is the species' stronghold on Corsica, where Langley (2004) said the population is increasing.

Italy

California Quail have occurred in the wild in parts of northwestern and central Italy and in northwestern Sicily, but may be established only on the island of Maretimmo off Trapani, Sicily, in the Isole Egadi archipelago (Bonelli & Moltoni 1929, Baccetti *et al.* 1997).

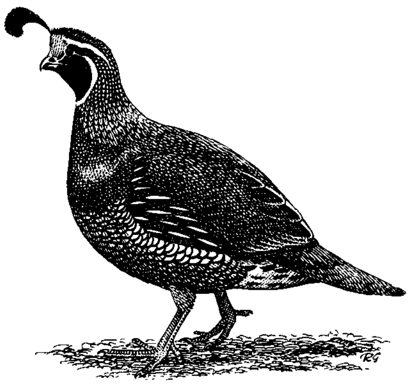
Spain

According to Langley (2004), the California Quail is in the process of becoming established in Spain but Clavell (in Martí & del Moral 2003) notes only that it has bred in Madrid, Catalonia and Mallorca.

Canada

In 1860 or 1861 Charles Wylde released some California Quail near Victoria on Vancouver Island, British Columbia (Wylde 1923); at around the same time H. M. Peers introduced others to Colquitz Farm, while more were planted further west at Metchosin. In the 1870s others were liberated in the same areas, and from 1886 until the 1890s more were released on southern Vancouver Island and on the lower mainland. Between 1907 and 1910 several further introductions were made on Vancouver Island and on the mainland, as well as on South Pender and Denman Islands and on the Queen Charlotte Islands.

By the mid-1950s, California Quail were well-established on Vancouver Island – mainly on the Saanich peninsula, near Victoria, and in the southwest around Sooke; a few remained



California Quail

on South Pender Island (but not on the Queen Charlottes); although the lower mainland introductions had been largely unsuccessful, a few isolated populations survived.

Up to a quarter of a million birds are established locally in southern British Columbia (AOU 1998) especially on southern Vancouver Island and in the Okanagan Valley, where their principal limiting factor seems to be exceptionally heavy winter snowfalls.

Power (1994) suggests that the form *catalinensis* on Santa Catalina Island in the Channel Islands off the coast of California may have been introduced by Native Americans, perhaps thousands of years ago. California Quail from Santa Catalina were successfully transferred to Santa Rosa between 1935 and 1940 and to Santa Cruz in 1946 (Power 1994), and unsuccessfully to San Clemente around 1890.

Argentina

California Quail were first introduced to Argentina by Carlos S. Reed, who in 1920 released 25 pairs in the suburbs of Mendoza in southwestern Argentina, followed at a later date by a further 4,000 individuals. Although Reed claimed that the birds became established, they seem subsequently to have died out.

In 1943, ten pairs imported from Chile were liberated on the Primavera *estancia* (ranch) on the Traful River in Neuquén Province south of Mendoza. These birds became well established, and their descendants colonised an extensive area centred on the Traful and Limay Rivers, stretching to the Nahuel Huapi Lake and thence westward over the El Condor *estancia* on the Nahuel Huapi *pampa* (treeless plain) and eastward to the River La Fragua on the San Ramón estancia. North of the Traful, California Quail have spread through the valleys of the Rivers Córdoba and Catedral as far as the outskirts of San Martin de los Andes.

In northern Neuquén Province *C. californica* occurs in considerable numbers in the region between the Chos Malal, Andacollo and El Huecú. This population originates from releases that are believed to have been made between 1968 and 1971 on the Norquin, Parque El Morado pampa near El Huecú. Navas (1987), from whom this account is derived, saw the species in large numbers in the valley of the River Curi Leuvu and along the road between Chos Malal and Andacollo. See also Mazar Barnett & Pearman 2001.

Impact: Navas (1987) says that in Argentina, where the species has found a vacant ecological niche with no competitors, California Quail provide a new source of food for native predators.

Brazil

Inskipp (1975) says that California Quail have been exported annually from Chile to Argentina and Brazil; their status in the latter is unknown.

Chile

In around 1870 an unsuccessful attempt was made to introduce *C. californica* from California to the Southern Lakes region of Chile, but from other introductions made elsewhere at about the same time California Quail were subsequently successfully translocated to other localities such as the Nilahue Valley in Curico Province in 1914 (Barros 1919). In 1881 or 1882 C. J. Lambert imported large numbers of birds from San Francisco, which he released at La Compañia in Coquimbo Province, where they multiplied and spread (Hellmayr 1932). Phillips (1928) said that California Quail were already important game-birds in Chile, where Hellmayr (1932) recorded the species as common in the central provinces.

Johnson (1965) reported *C. californica* to be well established from Atacama south to Concepción, while Sick (1968) said that from Coquimbo they had spread south to Puerto Montt and inland to Los Angeles. Johnson (1965) indicated that the species' northern limit was the desert and the southern one the area of high precipitation. According to Jaramillo *et al.* (2003: 28), California Quail are currently 'more abundant in Chile than within [their] North American range'.

Pietri (2001: 265) indicates the species' occurrence on Isla Más á Tierra in the Juan Fernandez group 'according to the bibliographic data available …' but gives no further details.

Impact: Vuilleumier (1991: 336; 339) says that the California Quail 'is an ecologically important member of the mediterranean avifauna of Chile', and that its ecological impact is 'significant', but provides no examples. The only native species with which it might compete is the Chilean Tinamou *Nothoprocta perdicaria*; although the range and habitats (farmland, grassland edges near thickets, and native vegetation) of both species overlap, there is no apparent evidence of significant competition. The form established in Chile is *C. c. brunnescens.*

Australia

Between 1862 and about 1930 numerous introductions of California Quail were made from New Zealand to Australia (Victoria, Phillip Island, Tasmania, Huon Island, Rottnest Island, South Australia, New South Wales, Queensland, King Island (Bass Strait) and Norfolk Island). Although in several places the birds bred successfully and became established locally (Ryan 1906, Chisholm 1919, Tarr 1950), the species is said to survive only on Norfolk Island; near Wonthaggi, Victoria; perhaps near Newcastle, New South Wales (Pietri 2001); on King Island in the Bass Strait (Pietri 2001); and perhaps in Tasmania (Barrett *et al.* 2003).

New Zealand

As in Australia, there were many introductions – mostly between 1862 and 1875 – of California Quail to New Zealand (Auckland, Nelson, Kawau Island, Canterbury, Otago, Southland, Wellington, Hawke's Bay, Chatham Island). The birds became widely established, and seem to have reached their maximum numbers and distribution within about 25 years of their introduction (i.e. between *c.* 1890 and 1900) (Oliver 1930). Thereafter they declined, due more to habitat loss rather than to predation by man and introduced mustelids (see Lever 1985).

Thomson (1922) believed that the failure of most game birds to become better established throughout New Zealand was largely due to competition for food with native species and introduced passerines. Nevertheless, California Quail are now widely distributed in New Zealand, occurring throughout most of North Island and South Island; north and east of the Southern Alps, on some offshore islands, and on the Chatham Islands (Pietri 2001), where they were introduced prior to 1900. They are rare or absent in regions with high rainfall. California Quail in New Zealand are both the nominate form and *C. c. brunnescens* (Heather & Robertson 1997)

Impact: As early as 1913, California Quail had become an agricultural pest in some parts of New Zealand, where they ate young clover plants and seeds, and newly sown and germinating turnip seeds (Thomson 1922); forty years later they were reported (Oliver 1955) to be damaging grape and strawberry crops. They were also accused of spreading the seeds of Blackberry *Rubus fruticosa*, which was probably introduced by the early settlers (Lever 1987). On the other hand, California Quail also eat injurious insects and the seeds of noxious weeds.

Hawaiian Islands

California Quail (both *C. c. californica* and *C. c. brunnescens*) were first introduced from California to Oahu before 1855; at a later date more were released on all the other main islands, where within a decade Walker (1967) said they were well established and a valuable game bird. Munro (1944) indicates that by 1890 they were common and abundant on Hawaii and Molokai, and that by the turn of the century they were also established on Niihau and Kauai.

Between 1895 and 1928 the populations on Hawaii and Kauai considerably declined, due mainly to overgrazing by domestic stock, and land reclamation on the latter for sugar and pineapple plantations. Nevertheless, Caum (1933) found California Quail to be fairly common on Hawaii and Molokai, though less so on Oahu, Maui and Kauai, and absent from Lanai. In 1936–37 a dozen pairs were released on Lanai, and sporadic importations to the islands continued until 1940. Between 1959 and 1961 412 California Quail were liberated on the Puu Waawa Ranch on Hawaii, where by the early 1970s the birds were well established and abundant.

Schwartz and Schwartz (1949) found the species on all the larger islands apart from Oahu, and also on Niihau, and estimated the total population to be about 78,000, of which over 62,000 were on Hawaii and nearly 12,000 on Molokai. Today, California Quail are established on Maui, Molokai and Kaui and on the leeward (drier) side of Hawaii. There they are common in North Kona, Mauna Kea and the Hawaii Volcanoes National Park (Pratt *et al.* 1987), where their principal limiting factors seem to be the intensity of grazing by domestic stock and the availability of water.

Impact: California Quail in the Hawaiian Islands have been implicated in the spread of various exotic grasses, herbs and shrubs (Lever 1994). The species diversity of alien flora is generally highest in broken woodland, and is much influenced by the presence of naturalised game birds (Cuddihy & Stone 1990).

Gambel's Quail
Callipepla gambelii

Natural Range: SW USA and Mexico (including Tiburon I.) south to S Sonora.
Naturalised Range: Pacific Ocean: Hawaiian Is.

Hawaiian Islands

Gambel's Quail has been established on the island of Kahoolawe since the species was imported by H. A. Baldwin in 1928 (Caum 1933). Between 1958 and 1963 a total of 607 were imported to Hawaii, where 294 were released at Puako on the northwest coast and 114 on Lanai and an unknown number on Maui (Walker 1967). Today, Gambel's Quails are established on Lanai, Kahoolawe and perhaps Hawaii (Pratt 1994, AOU 1998).

Northern Bobwhite
Colinus virginianus

Natural Range: From C and E USA south to Florida, and in Central America to NW Guatemala; also on Cuba.

Naturalised Range: Europe: ?Croatia; ?France; Italy; Portugal; ?Spain. North America: ?Canada; West Indies. Australasia: ?New Zealand.

Croatia
Northern Bobwhites have been introduced to Croatia since the 1960s, and are presently established only near Istra where although the population may be self-sustaining it also recruits from periodic stocking (Gariboldi 1997).

France
Although Northern Bobwhites have been introduced to France for sporting purposes on numerous occasions since 1816, only around Sologne and Puisaye in the centre of the country and Les Landes in the southwest are breeding populations established, though whether these would be self-sustaining without regular stocking is uncertain (Voisin 1994, Gariboldi 1997).

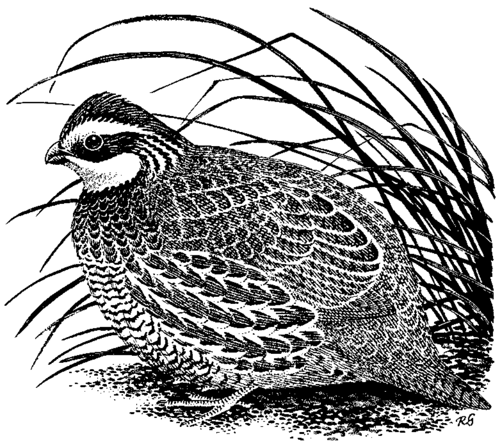
Italy
Italy is the only country in Europe in which Northern Bobwhites are definitely naturalised, having been admitted to the official *Checklist of Italian Birds* in the early 1980s. The species has been introduced to various parts of the country since 1927, its present distribution being confined to some 960 sq km of the plains and hills in Piemonte and Lombardy in the northwest (Canavese, Astigiano, Allesandrino), especially in the Ticino Valley, where the population has declined to between 5,000 and 8,000 breeding pairs which nest in the region between the Sesia and Ticino Rivers. Northern Bobwhites are also said to be established on the island of Mozia off Trapani, Sicily (Fasola & Gariboldi 1985, Iapichino & Massa 1989, Brichetti *et al.* 1992, Meschini & Frugis 1993, Baccetti *et al.* 1997, Gariboldi 1997, Bertolino 1999). The form established in Italy is the nominate *C. v. virginianus* (central and eastern United States).

Portugal; Spain
Langley (2004) lists *C. virginianus* as established in Portugal and apparently becoming so in Spain. Clavell (in Martí & del Moral 2003) only cites breeding in Mallorca in 1996 and males heard calling in Catalonia in 1989 and 1994.

Canada
Several attempts have been made to establish Northern Bobwhites in Canada – in Nova Scotia, Ontario and Manitoba (Phillips 1928) – but only a few descendants of those released in the Okanagan Valley in southwestern British Columbia may survive today (AOU 1998).

West Indies
Northern Bobwhites have been successfully introduced in the Bahamas (Andros, New Providence and Eleuthera); the Greater Antilles (Hispaniola, Puerto Rico); and formerly the Virgin Islands (St Croix), where the species has since died out (AOU 1998).

Cory (1880: 143) was told that the species had been imported to New Providence



Northern Bobwhite

'many years ago' and was then abundant around Nassau. Today, birds of the subspecies *floridanus* are established in pine barrens, thick wooded undergrowth, wasteland, rough pasture and arable land on New Providence, Andros and Eleuthera, and according to the AOU (1998) (which omits Eleuthera) also on Abaco Island.

Cory (1880) believed that the species was introduced to Haiti (Hispaniola) during the period of French rule (1697–1803) where it became established on the southern peninsula.

Northern Bobwhites were imported to Santo Domingo in the Dominican Republic (Hispaniola) around 1890 (Cherrie 1896), where they are still established (AOU 1998).

According to Gundlach (1878a) Northern Bobwhites were introduced to Puerto Rico from Cuba in 1860 by Don Ramón Soler on his *hacienda* Santa Inés near Vega Baja; they still survive on the island today (AOU 1998).

Newton & Newton (1859) record that Northern Bobwhites were introduced to St Croix in about 1810, where the birds have since died out.

Phillips (1928) says that Northern Bobwhites (probably from Florida and perhaps Texas) were introduced to Cuba before 1923, where Dickinson (2003) implies that the form *cubanensis* is indigenous, although the AOU (1998) says the species is introduced. See also Raffaele *et al.* 1998.

The principal limiting factors for Northern Bobwhites in the West Indies are the marginal habitat, overshooting, and predation by the Small Indian Mongoose *Herpestes javanicus* (see Lever 1985).

New Zealand

In 1898–99 the Wellington Acclimatisation Society (see Lever 1992) unsuccessfully imported a total of 1,156 Northern Bobwhites (probably *C. v. taylori*) from the United States, which were widely distributed in North and South Islands: in 1947 the Otago Society imported 200 eggs from California, but the resulting chicks all died. None have been reported since the 1970s (Heather & Robertson 1997).

PHASIANIDAE (TURKEYS, GROUSE, PHEASANTS AND PARTRIDGES)

Wild Turkey
Meleagris gallopavo

Natural Range: SE USA to WC Mexico
Naturalised Range: Europe: Germany; ?Austria; ?Former USSR. Asia: ?Japan. North America: Canada. Australasia: ?Australia; New Zealand. Pacific Ocean: Hawaiian Is.

Germany; Austria; Former USSR

Turkeys were probably originally imported to Europe in the early sixteenth century; they were first noted in Germany around 1530 and were being reared in captivity by at least 1571. Turkeys have a long history in German sporting lore, and small populations survived in the wild in the valley of the River Danube until the outbreak of the Second World War (Niethammer 1963). By the mid-1960s small populations existed only in Kottenforst, Buschoven and Boenning Hardt in the Rhineland (Aliev & Khanmamedov 1966). These authors also refer to the species as feral in parts of Austria and the Latviya SSR of the former USSR. Gebhardt (1996: 206) mentions that 'locally small populations' occur in Germany, although these may not be viable without regular stocking (Spittler 1993).

Japan

According to Matsuo (1990), Wild Turkeys from Europe were imported to Japan by the Dutch in the mid-seventeenth century; whether any occur in the wild is unknown. These are not mentioned by Brazil (1991).

Canada and California

Between 1910 and 1962 a number of unsuccessful attempts were made to establish Wild Turkeys in British Columbia. In the latter year, some wild-caught birds from South Dakota (presumably *M. g. merriami*) were released in the Alberta portion of the Cypress Hills Provincial Park on the

Alberta–Saskatchewan border, where within a year the population had increased to around 50. According to the AOU (1998: 122) Wild Turkeys are currently 'established locally [in] southern British Columbia, southern Alberta, southern Saskatchewan, southern Manitoba, and southern Ontario'.

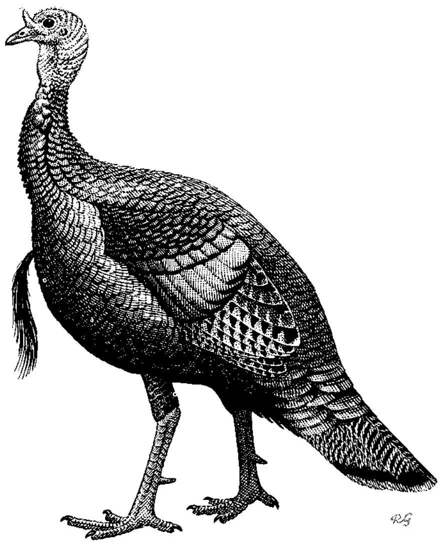
Power (1994) records the successful establishment and breeding of Wild Turkeys introduced to the Channel Islands off the coast of California.

Australia

Barrett *et al.* (2003) record the presence of Wild Turkeys at a single site in South Australia, and at seven on Tasmania where breeding has occurred.

New Zealand

Thomson (1922) recorded the establishment of feral Wild Turkeys, which were first introduced around 1890, in several localities in New Zealand, where he believed their recent decline was due, as in the case of other exotic game birds, to competition for food (especially insects) with introduced songbirds. Today, Turkeys occur on rough farmland in many North Island and a few South Island localities, and also on Moturoa Island in the Bay of Plenty (Heather & Robertson 1997).



Wild Turkey

Hawaiian Islands

According to Locey (1937), Wild Turkeys were first introduced to the Hawaiian Islands as game birds from China in 1788. More were imported, from Chile, in 1815, and by the outbreak of the Second World War they were said to be abundant in the wild, and according to Schwartz & Schwartz (1949), remained so on Niihau (where thousands are said to have been released) after the Second World War; less than 200, however, were found elsewhere, most of which were on Hawaii. Between 1958 and 1962 large numbers of Wild Turkeys of several forms (*silvestris*, *merriami*, *intermedia*, *gallopavo*) were liberated on Hawaii, Kauai, Molokai, Lanai and Maui, where by the latter year they were said to be breeding on Hawaii and Molokai, surviving on Lanai, but declining on Maui and Kauai (Scott *et al.* 1986). The AOU (1998) lists the species as occurring on Hawaii, Maui, Lanai, Kauai and Niihau.

Impact: According to Lewin (1971), Wild Turkeys in the Hawaiian Islands are implicated in the spread of the alien Banana Poka *Passiflora mollissima*, an aggressive species of vine, though Van Riper (1980) suggests they may also help in the expansion of range of native Naio *Myoporum sandvicensis* trees on the slopes of Mauna Kea on Hawaii.

Himalayan Snowcock
Tetraogallus himalayensis

Natural Range: From W Turkistan through the Himalayas to China.
Naturalised Range: North America: USA.

United States

In 1948 the US Fish and Wildlife Service inaugurated a Foreign Game Investigations Program with the ultimate objective of the provision of additional game species. As part of this project, between 1960 and 1970 Himalayan Snowcocks were released in five regions of Nevada, and also on the slopes of Mauna Kea on Hawaii. (Bland & Temple (1993: 151) give the initial date of introduction of the Himalayan Snowcock in North America as 1933, but with no further details. Johnston & Garrett (1994: 222) give 1962 as the earliest date of introduction. Stiver (1984; quoted by AOU 1998) gives the earliest date as 1963.)

In 1963, the Nevada Game Commission imported 35 Snowcocks from Gilgit, Pakistan, the 19 birds which survived the journey being liberated in April in the Ruby Mountains in northeast Nevada, where they soon disappeared. Subsequently, the Nevada Department of Wildlife established a captive flock whose offspring were released in succeeding years (Christensen 1963, Bump & Bohl 1964). A total of 107 birds were imported from Pakistan, and between 1963 and 1979 2,025 of their offspring were introduced to the wild, of which 1,717 were planted in the Ruby Mountains. Breeding was confirmed in 1977, and three years later the first shooting season was declared. In 1985 the Department of Wildlife estimated the population in the Ruby–East Humboldt Range of the Humboldt National Forest at between 250 and 500 birds.

The breeding range of Himalayan Snowcocks in the Ruby–East Humboldt Range seems confined to elevations above 3,000m (Bland & Temple 1990). Since under 50 sq km of the Range meets this criterion, and the species' breeding densities in China range from 1.3 to 2.0 per square kilometre, the number of birds in the Range is unlikely ever to be large. In the Ruby Mountains, Snowcocks appear to favour deep glacial cirques (steep-sided hollows at the head of a valley or on a mountainside) rimmed by extensive moist meadows and precipitous cliffs (Bland & Temple 1990), and the discontinuous distribution of such cirques and alpine meadows limits the number of localities in which large flocks can establish home ranges (Bland & Temple 1993). The majority of Nevada's Snowcock population occurs in the Thomas Peak–Ruby Dome region of the Ruby Mountains, although coveys are regularly reported to the north and south (Bland & Temple 1993, AOU 1998, Sibley 2000). Because Nevada's Snowcocks are marooned on an alpine island at the centre of the Great Basin, their natural dispersal into other alpine habitats seems unlikely (Bland & Temple 1993).

Impact: The small and isolated alpine meadows of the Ruby Mountains are, like most other alpine meadows, extremely fragile, and possess the richest and most diverse alpine plant community in the Great Basin. Since the introduction of Himalayan Snowcocks was virtually unmonitored, with no prior assessment of these large (60cm high) birds' potential ecological impact, the state of the area's biotic community before, during and after the introduction is largely unknown (Bland & Temple 1993).

Chukar Partridge
Alectoris chukar

Natural Range: From NE Greece through Asia Minor and Arabia to NW India, W Mongolia, S Manchuria and N China.

Naturalised Range: Europe: British Isles; France; Italy. Asia: Oman; UAE. Africa: South Africa. North America: Canada; Mexico; USA. Australasia: New Zealand. Atlantic Ocean: St Helena I. Pacific Ocean: Hawaiian Is.

Europe
Chukar Partridges have been widely introduced as game birds to countries in Europe other than those mentioned above, including Portugal (Dias 1992) and Spain, but are apparently unable to survive in the wild without regular stocking.

British Isles
Since between the two World Wars Chukar Partridges have been released as game birds in parts of England and Scotland, but have seldom been self-maintaining for any length of time. Nevertheless, Aebischer (1997) recorded small established populations, mainly in southwestern and northern England and northern Scotland.

France
According to Aebischer (1997), small populations of 10–100 pairs of Chukars occur south of Paris in central France.

Italy
Attempts have been made since about 1930 to establish Chukars in Italy (mainly in the north), but the species is apparently only naturalised on the islands of Giglio and Montecristo northwest of Rome (Baccetti 1989, Baccetti *et al.* 1997).

Impact: Wherever the ranges of the two species in Europe overlap, the Chukar has tended to hybridise with the native Red-legged Partridge *A. rufa* (Allard 1999).

Oman; United Arab Emirates
The Chukar Partridge 'inhabits rocky and cultivated areas of the Musandam mountains [Oman] and perhaps the UAE mountains … this isolated eastern Arabian population is probably derived from escaped birds which have been imported for food' (Jennings 1981b: 58). Chukars are currently in 'Musandam: breeding resident in mountains' (Anon 2004: 9). Richardson (1992) also records the introduction and escape of Chukars of the Iranian race *werae* in the United Arab Emirates, where he records them as breeding on the high plateau above Wadi Bih, on Sir Bani Yas Island (since 1989), and in the al Ain area where large numbers were released in 1982.

South Africa
In 1964 six Chukar Partridges were seized by customs officers in Cape Town and despatched to Robben Island in Table Bay, where Siegfried (1971) estimated the population to number around 500. P. A. Clancey (pers. comm. 1985) wrote that this 'flourishing population' is 'racially composite' (derived from more than one race), 'so derives from game-farm bred stock'.

Canada
The first Chukar Partridges in Canada were released unsuccessfully in Nova Scotia prior to 1934 – possibly as early as the turn of the century. In 1940 A. D. Hitch of Whonock, British Columbia, unsuccessfully freed some birds at Alkali Lake and Dog Creek, and between 1950 and 1955 a total of 2,463 Chukars were liberated in British Columbia, where by the final year the birds were sufficiently well-established for shooting to be allowed (Carl & Guiguet 1972). Chukar Partridges are presently established in suitable habitats in the Thompson, Fraser, Okanagan and Similakmeen Valleys, and around Shuswap Lake between Kamloops and Revelstoke, in southcentral British Columbia (Johnston & Garrett 1994, AOU 1998).

Mexico
According to Peterson & Chalif (1973), Chukar Partridges have been successfully introduced to the mountains of northern Baja California.

United States
According to Bump (1941), Chukar Partridges have probably been introduced to every state in the USA, but have only become well established in, and to the west of, the Rocky Mountains. W. O. Blaisdell is believed to have imported the first Chukars to the United States, to Illinois, in 1893, the offspring of which he unsuccessfully released at McComb in the following spring. Chukars were first released successfully in Washington in 1938; shooting was first permitted in 1949, and in

Chukar Partridge

1978 stocking ceased (Moreland 1950). The earliest of no fewer than 89 releases of Chukars in Montana was made in 1933, and by 1958 the birds had become locally self-maintaining in the Fromberg–Red Lodge– Bighorn Canyon region south of Billings, where controlled shooting began in the following year (Whitney 1971). Between 1951 and 1955 some 50,000 Chukars were planted in Oregon with such success that shooting was permitted in 1956. Between 1938 and 1942 around 3,000 Chukars were liberated in some 18 or 20 counties in Idaho, where the first shooting season was declared in 1949 (Salter 1952). The earliest planting of Chukar Partridges in Wyoming was made by Judge W. S. Owens at Cody; between 1939 and 1955 a state-owned game farm released an average of nearly 1,000 a year, resulting in the formation of several discrete populations (Bossenmaier 1957).

In 1925 Chukars were imported from India to San Francisco, California, by E Booth, from whom the State Department of Fish and Game acquired five pairs, followed in 1929 by a further five pairs direct from Calcutta, with which they established a breeding stock. The first plantings were made in 1932, and by 1936 a total of 4,600 birds had been released in 26 counties, where they became established in Owens River Valley and the Mojave Desert. A further 7,000 Chukars were liberated by the Department of Fish and Game in 1947–49, and it is believed that by 1955 some 85,500 birds had been freed throughout the state.

After several introductions to California's Channel Islands by the Department of Fish and Game, Chukars eventually became established on San Nicholas Island in 1975, and in 1985–86 on Santa Rosa Island. Releases on San Clemente in 1960 and on Santa Catalina were unsuccessful (Power 1994).

Chukars were planted in almost every county in California in a wide variety of habitats and climates, ranging from dense stands of timber and brush in warm and damp coastal ranges through inland montane areas to hot and arid semi-desert country, and in localities where the annual rainfall is between 13 and 130cm. They did best in semi-arid and lightly cultivated places, where the annual precipitation seldom exceeds 25cm. Shooting was first permitted in 1954 and stocking ceased in 1968.

In 1934, 50 Chukar Partridges were released on the R. L. Douglass Ranch in Churchill County, Nevada, followed in 1935 by a further 289 in western and central Nevada, and by 1941 Chukars had been planted in most, if not all, counties in the state, where they flourished in rugged and semi-desert country at between 1,500 and 2,100m. Shooting began in 1947, when the birds covered some 100 sq km of western and central Nevada (Alcorn & Richardson 1951).

Numerous plantings of Chukar Partridges in Utah between 1936 and 1949 were universally unsuccessful. From later plantings near Salt Lake City in 1951–52 the species became somewhat tenuously established, but from here the birds spread elsewhere in the state (Popov & Low 1953).

Prior to 1961 at least 8,000 Chukars were released in Colorado, when a further 1,000 were planted in some western localities, where they became established.

In 1957–58 333 wild-caught Chukars were liberated with mixed results at Jerome in Arizona, and 800 captive-bred birds were released at Snake Gulch.

Between 1950 and 1964 (when releases ceased) a total of 16,621 Chukar Partridges were planted in 13 counties in New Mexico, where by the end of the decade they were said to be doing reasonably well in the San Juan–Animas–La Plata drainage area of San Juan County, and in the Pyramid Mountains of Hidalgo County.

In the Great Basin (between the Wasatch and Sierra Nevada Mountains) Chukars are found especially on grassy mesas (flat-topped rocky hills with steeply sloping sides) and rocky sage-covered slopes of arid and rugged canyons in semi-desert montane regions (Small 1974). The inclusion of the more lowland forms *A. c. cypriotes* and/or *kurdestanica* among the other races introduced (believed to be the nominate *chukar* and *koroviakovi*) has enabled the species to broaden its range, which now stretches locally from northern Idaho and central and eastern Montana south to southern California, southern Nevada, northern Arizona, and western Colorado (AOU 1998).

Impact: According to Alcorn & Richardson (1951), Chukar Partridges in Nevada eat some corn (maize) and wheat, especially in winter and spring; they uproot germinating corn shoots and prise out the kernels from their cobs. They have also caused damage to - potato, raspberry, currant, strawberry, apple and Russian olive crops (Lever 1994). In California, Harper *et al.* (1958) refer to damage to apples, pears, peaches, apricots, grapes, potatoes, beans, watermelons, tomatoes, corn (maize), wheat, oats, alfalfa (lucerne) and clover in summer and autumn. The amount of harm Chukars cause is, however, economically negligible (Vuilleumier 1991), and is far outweighed by their value as game birds (Lever 1994). Despite claims to the contrary, there is no evidence of competition with any native species, since Chukar Partridges in the United States occupy a vacant ecological niche devoid of native game birds.

New Zealand

Between 1920 and 1933 a number of unsuccessful attempts were made by various regional acclimatisation societies to establish Chukar Partridges (mainly in South Island) in New Zealand. In 1926 Chukar Partridges from Calcutta were successfully released by Colonel R. B. Neill on behalf of the Ashburton Acclimatisation Society (see Lever 1992) on his property in the Lake Heron region, and later in the same year a further 24 were planted by the Otago Society in the Hunter Valley at the head of Lake Hawea. In 1932, 192 birds from an original shipment of 200 (*A. c. koroviakovi*) from Quetta in Baluchistan were released by the North Canterbury Acclimatisation Society in half-a-dozen localities, where they became established. By 1950, Chukars occurred in South Island from the Wairau River in Marlborough south to Kingston in central Otago. They are now to be found in high country east of the Southern Alps from Marlborough (Nelson Lakes National Park, Wairau River, Seaward Kaikoura Range) to central Otago (especially between Lakes Coleridge and Wakatipu). Releases in North Island as recently as 1987 have been largely unsuccessful, though a few persist near Tauranga and in Hawke's Bay (Heather & Robertson 1997).

St Helena Island

According to Brooke (1808: Appendix 9, quoted by Rowlands *et al.* 1998), Chukar Partridges were imported to St Helena by Fernão Lopes in about 1531. The earliest recorded reports of the species were by O. Lopes in 1578 (Hartwell 1745, quoted by Rowlands *et al.* 1998), and in 1588 by the English circumnavigator Thomas Cavendish.

By the late sixteenth century Chukars were said to be both tame and abundant (Basilewsky 1970), and were the most frequently reported species of landbird on the islands. Shooting was first recorded in 1666 (Renefort 1668, quoted by Rowlands *et al.* 1998), though it seems likely to have started at an earlier date. By the end of the seventeenth century Chukars were regularly observed by numerous visitors to the island.

During the nineteenth century the birds became considerably less common than hitherto (Baker 1868, Melliss 1870) possibly partly due to heavy predation by feral domestic Cats *Felis catus* (see Lever 1985), though they appear to have been still fairly numerous. This decline continued into the twentieth century, and although Chukars remained reasonably common until the 1950s the decline since then seems to have accelerated (Loveridge 1977). Small numbers have been sporadically recorded from various localities during the 1980s and 1990s, but nowhere on St Helena do Chukars remain abundant (Rowlands *et al.* 1998). According to Watson (1966), the race introduced to St Helena is *A. c. werae* (E Iraq and SW Iran).

For a full list of references see Rowlands *et al.* (1998). See also McCulloch 2004.

Hawaiian Islands

Between 1923 (Caum 1933) and 1936 Chukar Partridges of the nominate form were introduced to Lanai, Oahu, Molokai and

Kahoolawe, on all of which they became established (Locey 1937). In 1949, 17 pairs were released at Pohakuloa at the base of Mauna Kea on Hawaii, and were said to have increased to some 30,000 by 1955; since then the numbers have declined, but the species is still common on the island. In 1959, birds transplanted from the American mainland became established on Kauai, where some still survive. In 1961 some Chukars from California were unsuccessfully released on the Puu Waawaa Ranch on Hawaii, and in the same year 304 were planted on Maui, Lanai, Molokai, Oahu and Kauai (Berger 1981). The species is currently well established in dry upland habitats on Hawaii, Lanai, Maui (Pratt 1994), locally on Kauai, Molokai and Kahoolawe, but no longer on Oahu (AOU 1998). It is most abundant on the upper slopes of Mauna Kea on Hawaii and Haleakala on Maui (Pratt *et al.* 1987).

Impact: Writing of the Common Pheasant *Phasianus colchicus* and the Chukar Partridge in the Hawaiian Islands, Cuddihy & Stone (1990) and Cole *et al.* (1995a, b) say that the role of these two species in facilitating the dispersal and germination of the seeds of native plants is beneficial in restoring degraded ecosystems on Maui; these include shrubs such as *Vaccinium reticulatum*, *Styphelia tameiameiae*, *Coprosma* spp. and *Geranium cuneatum* in the Haleakala National Park. Cole *et al.* (1995a, b) say that the Chukar's impact on native invertebrates is minimal, and that the birds are not significant competitors with the endemic Hawaiian Goose or Nene *Branta sandvicensis*, a species which is classified as Vulnerable by the World Conservation Union. Scott *et al.* (1986), however, considered that Chukars may compete with Nenes for browse.

Barbary Partridge
Alectoris barbara

Natural Range: Morocco, Algeria, Tunisia, NE Libya and NW Egypt.

Naturalised Range: Europe: Gibraltar; Italy; ?Spain. Atlantic Ocean: Canary Is.

Gibraltar

The earliest reference to Barbary Partridges in Gibraltar is by the garrison's chaplain, the Rev John White (brother of Gilbert White, author of *The Natural History of Selborne*) in 1771, when he reported them to be widely distributed. A further introduction possibly took place in the late nineteenth century (Aebischer 1997). The birds are now found on the upper parts of south-facing stony terraces covered with sparse short vegetation and open scrub, on the Upper Rock, Windmill Hill and above Catalan Bay (Cortes *et al.* 1980; Finlayson & Cortes 1987, Finlayson 1992). In the late 1980s the population was around 30 breeding pairs; Aebischer (1997) said that the apparently stable population numbered some 50 breeding pairs in an area of 1.1 sq km. The form present in Gibraltar is the nominate *A. b. barbara* of the Maghreb.

Italy

Barbary Partridges are believed to have been introduced to the island of Sardinia by the Romans (Aebischer 1997), although Spanó (1975) believes that they were natural colonists in the late Miocene – a seemingly unlikely occurrence for a relatively sedentary species. In Sardinia, Barbary Partridges occupy a wider variety of habitats than in Gibraltar, occurring on steep mountain slopes in the interior and rocky hillsides, open or degraded *maquis* (scrub), unimproved agricultural land and vineyards (Aebischer 1997). Outside the breeding season the birds gather in coveys of 10–15 individuals, often moving in winter to lower altitudes near farmland (Mocci Demartis 1992). The species has markedly declined to less than 10,000 breeding pairs, largely through overshooting and poaching but also in consequence of the intensive use of pesticides and loss of habitat due to summer fires (Mocci Demartis & Massoli-Novelli 1978).

Spain

The earliest published reference to *A. barbara* in Spain appears to be that of Gonzalez-Diez

(1958). Those observed in the vicinity of Gibraltar and from further afield in Cadiz may be natural dispersers from Gibraltar (though *A. barbara* is a largely sedentary species) or a result of other unrecorded introductions.

Canary Islands

Barbary Partridges, of the western Moroccan race *koenigi*, have been introduced to the Canary Islands. According to Bannerman (1963) they were established on Fuerteventura from 1913 until at least 1957, and were still present on Tenerife (where they are believed to have been introduced before 1892) and La Gomera but had become rare or extinct on Lanzarote. Following later introductions, the species is abundant and common throughout all the principal islands of the archipelago; Gran Canaria, El Hierro, La Palma, Fuerteventura, Lanzarote, Tenerife and La Gomera, and also on Lobos, La Graciosa and Allegranza (Martí and del Moral 2003).

Red-legged Partridge
Alectoris rufa

Natural Range: From the Iberian Peninsula north to the Pyrenees and S France, east to the Balearic Is., Corsica, Elba and N Italy. (It has been suggested that the appearance of *A. rufa* in the Balearic Islands may be as a result of human introduction, reintroduction or translocation.)

Naturalised Range: Europe: British Isles. Australasia: ?New Zealand. Atlantic Ocean: Azores Is., Canary Is., Madeira Is.

British Isles

Since 1673 Red-legged (or French) Partridges have been introduced on numerous occasions to England, where they did not, however, become established (in Suffolk) until about 100 years later (Harting 1883). By the late 1930s, Red-legged Partridges were abundant in parts of Yorkshire, the Midlands and in the southwest as far as Somerset; smaller numbers occurred in north Wales. In the early 1970s, Red-legged Partridges were introduced on the Isle of Man.

In Scotland, *A. rufa* was imported to the Orkney Islands in 1840 (Baikie & Heddle 1848). In the early 1970s birds were introduced to the Scottish mainland from Kirkcudbrightshire in the south to Caithness in the north, and the species has become widely established in a number of localities.

Although Fitter (1959) traced at least a dozen introductions of Red-legged Partridges to seven Welsh counties, the birds are presently established only in parts of Glamorganshire, Brecknockshire, Radnorshire, Montgomeryshire and Denbighshire.

A. rufa was first introduced to Ireland in Co Tyrone, in 1767, and was presumably established in the wild by at least 1810 when it appears on an Irish game list. In 1979–80 attempts were made to introduce more Red-legged Partridges to Ireland, where breeding was recorded in County Tipperary, Louth, Dublin and Wexford; Red-legged Partridges in Ireland are, however, not self-sustaining.

Essentially a bird of open ground, the Red-legged Partridge favours a warm and dry climate, with a well-drained soil and a combination of low bushy vegetation for shelter with more open areas for feeding: throughout much of its range it is associated with arable farming, especially low-intensity cropping with a mixture of cultivated and fallow land (Potts 1980). In England it is most at home on the dry sandy or calcareous soil with a continental climate and low rainfall of East Anglia, although it also occurs in many other counties north to north Yorkshire and west to east Devon. A decline in numbers and distribution between about 1930 and 1960, partially caused by the increase in intensive farming, with the concomitant use of pesticides, mechanization, irrigation and the removal of hedgerows (Rands 1986) and heavy shooting pressure, has been reversed, largely by large-scale annual restocking.

Impact: In East Anglia, Red-legged Partridges cause some damage to sugarbeet seedlings.

Where the two species exist together, *A. rufa* x *A. chukar* hybrids occur.

New Zealand

In spite of failed introductions in the late nineteenth century, attempts have been made, using eggs imported from Britain, to establish *A. rufa* since 1980; birds have been released between Kaipara Harbour and Taumarunai, in the Bay of Plenty, Gisborne, Hawke's Bay, in the Upper Moutere Valley near Nelson, and in Marlborough and Canterbury, but the outcome is as yet uncertain (Heather & Robertson 1997).

Azores Islands

Red-legged Partridges were introduced to the Azores in the eighteenth century, where in 1865 they were said to be abundant on Santa Maria but rare on São Miguel and Terceira. At various times during the next 100 years they were recorded with varying abundance on these islands and also on Pico (Bannerman & Bannerman 1966). The map in Aebischer & Lucio (1997: 208) indicates probable breeding in the Azores.

Canary Islands

Red-legged Partridges were first recorded on Gran Canaria in 1866, where Peters (1934) and Bannerman (1963) agreed they had most probably been introduced. Aebischer & Lucio (1997: 209) say only that Gran Canaria is a 'successful historical introduction site' and the species remains well-established there (Martí & del Moral 2003).

Madeira Islands

A. rufa may have been first introduced to Madeira and Porto Santo by the Portuguese Prince Henry the Navigator, who colonised the islands in 1424–25. In 1851 and 1871 the species was said to be scarce on Madeira and was not mentioned on Porto Santo. Two pairs were successfully released on Porto Santo in 1925 and the species may still occur on the island. On a number of occasions before 1965 Red-legged Partridges were successfully planted on Madeira (Bannerman 1965). Aebischer & Lucio (1997: 209) say only that Madeira is a 'successful historical introduction site'.

Black Francolin
Francolinus francolinus

Natural Range: From Cyprus and Turkey through Asia Minor to Transcaucasia and SW Turkmenistan, Iraq, Iran, Afghanistan, Pakistan, India, Nepal, and Bangladesh to Assam.

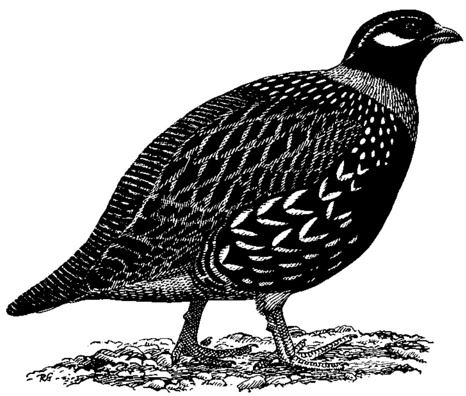
Naturalised Range: Europe: ?Portugal. Pacific Ocean: Hawaiian Is.; Mariana Is.

Portugal

Costa *et al* (1997: 562), quoting Vowles & Vowles (1994), says that Black Francolins are '… apparently established in some hilly grassland areas in the northeastern Algarve' of southern Portugal. No further information is available.

Hawaiian Islands

Between 1959 and 1961 a total of 864 Black Francolins were imported from game farms in Texas and California to Hawaii, Maui, Kauai and Molokai (Berger 1981); the birds rapidly dispersed from their points of release and became established on dry agricultural land, in irrigation ditches and in fields surrounding



Black Francolin

sugar-cane plantations (Bump & Bohl 1964). The species is well established in dry scrubland and savannah and pastureland at low elevations on all the islands to which it was introduced (Scott *et al.* 1986, Pratt 1994, AOU 1998). Pratt *et al.* (1987) list it also on Lanai.

Impact: The Black Francolin is one of the species of introduced birds that helps to spread the alien Banana Poka *Passiflora mollissima* in the Hawaiian Islands (Lewin 1971, Warshauer *et al.* 1983).

Mariana Islands
In 1961, 200 wild-caught Black Francolins were liberated at the Naval Magazine on the island of Guam, where within a couple of years birds were being frequently recorded within 16km of the release site (Bump & Bohl 1964). The species became widespread in southern Guam (Pratt *et al.* 1987) and in 1967 the first shooting season was declared.

Grey Francolin
Francolinus pondicerianus

Natural Range: From S Iran to W Pakistan, India and Sri Lanka.
Naturalised Range: Asia: Bahrain; ?China; ?Oman; Qatar; UAE. Indian Ocean: Andaman Is.; Mascarene Is.; Seychelles Is. Pacific Ocean: Hawaiian Is.

Arabia
Jennings (2004) records breeding in Bahrain (Manama), Qatar (Doha), the United Arab Emirates (Dubai and Abu Dhabi), and Oman (Muscat). (See also below).

Bahrain
According to Hirschfeld & King (1992: 12), 'this species is now one of the most common breeding species in Bahrain', where it was introduced to Al Areen around 1981 (possibly even before 1977), and has spread in both gardens and desert areas throughout Bahrain and the Muharraq Islands.

Oman
Although Gallagher & Woodcock (1980: 24) say that Grey Francolins of the form *mecranensis* were 'probably introduced to Oman', Dickinson (2003) does not list the species as present in the Arabian Peninsula. However, according to Anon (2004: 9) it occurs in northern Oman as a 'common breeding resident along Batinah and in some wadis [channels that are dry except in the rainy season] in foothills on both sides of the Hajas mountains and southwards [and in central Oman as a] breeding res ident in coastal areas south to 19°N' (see also Johnsgard 1988).

United Arab Emirates
In the early 1980s Grey Francolins were introduced to Sir Bani Yas Island on the Trucial Coast, and perhaps also in Dubai. They now occur in cultivated localities (even in remote mountain regions), gardens, parks and scrub with dense cover and a supply of water, mainly north and east of a line between Al Ain and Jebel Ali; the species has also been recorded in Abu Dhabi, most frequently in Bateen Wood (Richardson 1992).

China
Johnsgard (1988) refers to the introduction of Grey Francolins to the island of Hainan, but provides no further information.

Andaman Islands
Grey Francolins of the nominate subspecies were released at Port Blair on South Andaman around 1890, where Ali & Ripley (1969) said the birds were well established near Port Blair, and where the AOU (1998) confirms their survival.

Mascarene Islands
The nominate race of the Grey Francolin was introduced by the French to Mauritius and Réunion in about 1750, where the species was soon widespread and abundant. By the early 1950s, however, probably as a result of predation by the introduced Small Indian Mongoose *Herpestes javanicus* (see Lever 1985), the birds were said to be restricted to the rocky coastal plains. By the end of the

decade they were apparently precariously established in some of the drier regions (Benedict 1957). Jones (1996) lists them as occurring in lowland secondary scrubland, lowland exotic savanna, open grassy areas and cultivated land.

On Réunion the population has declined considerably due to cyclonic winds and prolonged droughts, but a small number survive (AOU 1998) on the plain of St Paul (Barré & Barau 1982).

According to Colin (in Kennedy 1893, quoted by Cheke 1987), 36 Grey Francolins imported to Rodrigues from Tranquebar in southern India between 1862 and 1871 were released at Baie aux Huitres (North-Coombes 1971). Bertuchi (1923) says the date was 1862. Slater (*c.* 1875; quoted by Cheke 1987) reported the birds to be well established, and a century later Staub (1976) found them to remain widely distributed but less abundant. The birds are said still to occur in *Acacia eburnea* and *Lantana camara* scrub around St François and Point Cotton in the east of the island. In 1999, droppings believed to be those of Grey Francolins were discovered on Île Frêgate, 750m off the southwestern coast of Rodrigues, which had at one time been stocked with the birds for shooting purposes (Showler 2002).

Impact: Grey Francolins on Réunion have caused some damage to maize *Zea mays* seedlings (Barré & Barau 1982).

Seychelles Islands

Grey Francolins were introduced to several islands in about 1872 by Admiral Sir William Kennedy. Although by the turn of the century they were said to be widely distributed, today they survive only on Desroches and Coëtivy (Skerrett *et al.* 2001) and in the Amirante Group (AOU 1998).

Hawaiian Islands

In 1958–59, 1961 and 1965–66, a total of 214 game-farm-reared Grey Francolins were imported from California and released on the Pun Waawaa Ranch on Hawaii. A further 353 were liberated in 1961–62 at several sites on and near the slopes of Mauna Kea, also on Hawaii; in all these localities the birds quickly became established and spread.

Between 1960 and 1962 a total of 1,710 birds from northern India (*F. p. interpositus*) were liberated on Maui, Lanai, Hawaii, Kauai and Molokai, where Bump & Bohl (1964: 12–13) reported that they were 'Reproducing on Hawaii and Maui. Seen to be established on Lanai. Most birds have remained in release area …'. By 1963, 'adults and broods reported from all islands except Kauai. Lanai continues most encouraging, and expansion of range continues. … this species continues to be the most promising import to the State'. Grey Francolins are now well established in lowland dry and open pastureland with some shrub cover on Hawaii, Maui, Lanai and Molokai (Pratt 1994, AOU 1998), where they are 'common to abundant in lowland areas' (Pratt *et al.* 1987: 118). They are said to occur locally on Oahu and Kauai, but are seldom seen (Pratt *et al.* 1987).

Impact: The Grey Francolin is one of the introduced species responsible for the spread of the alien Banana Poka *Passiflora mollissima* in the Hawaiian Islands (Lewin 1971, Warshauer *et al.* 1983).

Erckel's Francolin
Francolinus erckelii

Natural Range: NE Sudan, Eritrea and Ethiopia.

Naturalised Range: Europe: Italy. Pacific Ocean: Hawaiian Is.

Italy

Erckel's Francolins were first imported to Italy in 1948, where two years later they were released in a number of localities (e.g. in alpine and subalpine zones on Monte Baldo, Verona and Serra Vito di Cadore, Belluno) in the north; in the Appenino Pistoiese; and on the islands of Elba, Livorno, di Zannone, Latina and Sardinia. The Francolins are only properly established (since about

1960) in Toscano and Lazio (Capalbio, Grosseto and Circeo, Latina) (Baccetti *et al.* 1997).

Hawaiian Islands

In 1957, 38 Erckel's Francolins from game-farms on the mainland were imported to Hawaii, where they were released at Puako on the northwest coast. In 1958–59 151 more were freed near Pohakuloa between Mauna Kea and Mauna Loa, and in 1959–60 a further 107 from game-farms in California and Oklahoma were liberated on the Puu Waawaa Ranch, all on Hawaii. In the latter year, 353 more were released on Hawaii, Oahu, Kauai, Molokai, Lanai, Maui and Kahoolawe. In 1961 an additional 51 birds were freed on Molokai, and a year later 150 more were planted on three (unspecified) islands (Bump & Bohl 1964). Today, Erckel's Francolins are thinly established in alien forest and scrub (Guava *Psidium guajava*, Java Plum *Eugenia cumini* and *Eucalyptus*) and mixed indigenous woodland (Ohia *Metrosideros collina* and Koa *Acacia koa*) on Hawaii, Maui, Molokai, Lanai, Oahu and Kauai (Pratt *et al.* 1987, Pratt 1994), although the AOU (1998) says they no longer occur on Maui. Erckel's Francolins favour open woodland at lower elevations (Scott *et al.* 1986).

Impact: Erckel's Francolin is one of the exotic birds that contribute to the spread of the introduced Banana Poka *Passiflora mollissima* in the Hawaiian Islands (Lewin 1971, Warshauer *et al.* 1983).

Grey Partridge
Perdix perdix

Natural Range: From W Europe (apart from most of the Iberian Peninsula) E through the Urals and Caucasus to SW Siberia, Kazakhstan, NW China and the Tuva Republic.
Naturalised Range: North America: Canada; USA. Australasia: ?New Zealand.

Canada

Table 1 lists releases of the Grey Partridge in Canada between 1904 and 1925.

Grey Partridges seem never to have been deliberately liberated on the British Columbian mainland. According to Phillips (1928), they first arrived in the interior of British Columbia in 1915 as natural dispersers from Washington, and before long had spread further north up the Okanagan and Arrow Lakes Valleys, where the drier climate was more favourable than that in the wetter coastal region. In Alberta, Grey Partridges had spread by 1921 over the border into neighbouring Saskatchewan (Dexter 1922), from where in the following year they dispersed into North Dakota.

By the late 1960s, Grey Partridges were established in the prairie provinces of southern and central Alberta, southcentral Saskatchewan and southern Manitoba where, as in the United States, they thrive on the fertile arable land where small grains (and their associated insects) provide food and cover. In British Columbia, a sizeable population survives in farmland and dry grasslands of the lower Okanagan Valley, in the Thompson and

TABLE 1 Grey Partridge *Perdix perdix* releases in Canada, 1904–1925.

Date	*Province*	*Locality*	*Number*	*Source*
1904–09	British Columbia	Vancouver, Sidney, Saltspring, South Pender, James Is.	1,147+	Canadian government; J. L. & A. E. Todd; A. R. Spalding & H. R. Pooley
1908–*c.* 1920	Alberta	High River, Calgary; Edmonton	664	F. J. Green; Game & Fish Protection League
1924–25	Manitoba	Near Warren; Neepawa	166	Game & Fish Protetion League

Sources: Phillips 1928, Munro & Cowan 1947.

Fraser Valleys, and on southeastern Vancouver Island (AOU 1998), though numbers fluctuate because of the marginal habitat (Carl & Guiget 1972).

In eastern Canada, Grey Partridges occur in southern, central and especially eastern Ontario locally north to North Bay on Lake Nipissing, in extreme southwestern Quebec, in southern New Brunswick, on Prince Edward Island, and locally in Nova Scotia (AOU 1998). These east coast populations are believed to be derived from dispersers from Michigan and New York.

United States

Table 2 lists releases of the Grey Partridge (formerly known in the United States as the Hungarian Partridge) between 1790 and 1972. Today, the species is naturalised, locally and discontinuously, in northern Nevada, western and northern Utah, northern Wyoming, southeastern Nebraska, northern South Dakota, northwestern Iowa (Dinsmore 2001), extreme northern Illinois, northern Missouri, southern Michigan, northern Vermont and northern New York (AOU 1998). In spite of repeated large-scale introductions, Grey Partridges have failed to become firmly established east of the Allegheny Mountains, and even in the above states populations have declined or disappeared in recent decades (AOU 1998). Grey Partridges do best in fertile agricultural areas where small grains (and associated insects) provide food and shelter (Vuilleumier 1991, Johnston & Garrett 1994). Much of the species' success in the northern states may be due to the dispersal of birds from Canada.

Gullion (1965) suggests the Grey Partridge (and Common Pheasant *Phasianus colchicus*) have failed to become naturalised in any new habitats, and have only succeeded in maintaining populations in habitats similar to those in their natural range.

New Zealand

Grey Partridges were widely but unsuccessfully introduced from the 1860s to 1909. Between 1959 and 1970 a further 28,000 birds of Danish origin were released in both North and South Islands, but only in Southland did a few birds persist until recently (Heather & Robertson 1997).

Common Quail
Coturnix coturnix

Natural Range: Canary Is., Madeira and NW Africa, and Europe E to N India and Mongolia; the Azores, Cape Verde Is., southern Africa, Madagascar, the Comores Is. and E and NE Africa.

Blue-breasted Quail (King Quail)
Coturnix chinensis

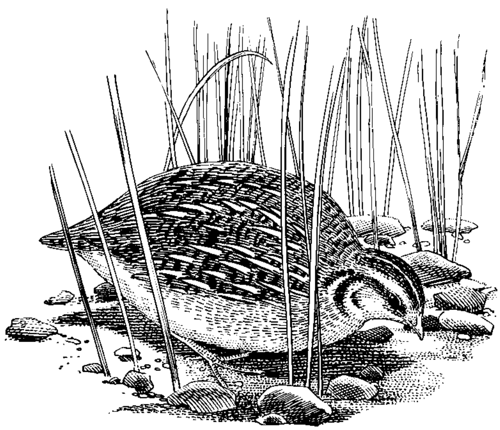
Natural Range: From India through Indonesia to New Guinea, Taiwan, and N and E Australia.

Jungle Bush Quail
Perdicula asiatica

Natural Range: India and Sri Lanka.
Naturalised Range: Indian Ocean: Mascarene Is.

Mascarene Islands

Cheke (1987) has traced the origin of these three species in the Mascarenes.



Common Quail

TABLE 2 Grey Partridge *Perdix perdix* releases in the USA, 1790–1972.

Date	*State*	*Locality*	*Number*	*Source*
c. 1790	New Jersey	Beverley, Delaware R.	?	Richard Bache
1879	New Jersey	Jobstown	?	Pierre Lorillard
1877	California	?	?	?
1908	California	?	35	?
1909	California	90 localities in 5–6 counties	2,000	?
Early 1880s	Massachusetts	S shore Cape Cod	?	Charles B. Cory
1909	Massachusetts	Wenham	?	John C. Phillips
c. 1880s	Virginia	?	?	?
1899–1912	Illinois	?	6,000 prs	?
1900–70	Oregon	Willamette Valley, Marion County & 23 other counties	4,281	?
Early 1960s	Indiana	?	?	?
1904	North Carolina	High Point	?	George Gould
1906–75	Washington	Spokane, Columbia, Lincoln, Chelan & 13 other counties	8,193	?
1907	Nebraska	?	?	?
1969	Nebraska	Dawes & Frontier Counties	67	?
1908–13	Connecticut	?	1,400+	?
1909–40	Iowa	?	17,420	?
1969–72	Iowa	Cass & Shelby Counties	1,455	?
1910–1930s	Michigan	Saginaw Bay; near Oxford; 40 other localities	4,197	H. Jewett & Department of Conservation
1911–48	Utah	Cache, Salt Lake, Servier, Tocele, Utah, Weber, Washington, Box Elder, Uintah counties; near Santa Clara, St George, Brigham City, & Richfield	707	Department of Fish & Game; ShermanHardy; Vance Tingey; Elwin Cloward
Before 1915	Montana	?	?	?
1922–26	Montana	Sheridan & other counties	6,000	?
1916	New York	Batavia, Genesse county	?	?
1921–32	New York	?	27,750	?
1923	Nevada	?	?	?
1924	North Dakota	?	7,500	?
1926–39	Pennsylvania	43 counties	34,059	?
1939–42	Idaho	?	924	?
1970	Wisconsin	Waukesha County	Large numbers	Gustave Pabst
1970–72	Colorado	6 counties	2,056	?

Sources: Phillips 1928; Cottam *et al.* 1940; Gerstell 1941; Dale 1943; Westerskov 1949; Popov & Low 1950; Jewett *et al.* 1953; Brown 1954; Gullion & Christensen 1957; Trueblood & Weigand 1971; Banks 1981; AOU 1998.

Desjardins (1834) referred to the presence of Painted Quail *Coturnix sinensis* (= *chinensis*) on Réunion and on Mauritius, and by 1864 two further species, the Common Quail *C. coturnix* (Carié 1916, Guérin 1940–53) and *'C. cambayensis'* (= *Perdicula asiatica,* the Jungle Bush Quail) had been added (Coquerel 1864). Vinson (1868) said that the Jungle Bush Quail had been introduced some 20 years previously (i.e. around 1850), and implied that Common Quail had been established at an even earlier date. All three species occur on Réunion today (Barré & Barau 1982, Cheke 1987, Hawkins & Safford in prep.).

The few Common Quail now living on Mauritius are probably birds released from quail farms (Staub 1973a, Cheke 1987).

Japanese Quail
Coturnix japonica

Natural Range: Transbaikalia and Mongolia to Sakhalin I., Japan and Korea. Winters from NE India and China to N Indochina.
Naturalised Range: Europe. Pacific Ocean: Hawaiian Is.

Europe
Since the 1970s, and since 1953 in Italy according to Baccetti *et al.* (1997), the decline of occidental populations of the partially migratory Common Quail *C. c. coturnix* has triggered the release in several European countries of Japanese Quail as potential game birds (Guyomarc'h *et al.* 1996).

Impact: Derégnaucourt *et al.* (2005) have suggested that hybridisation between migrant *C. coturnix* and the few remaining residents with introduced non-migratory *C. japonica* (as has occurred in laboratory conditions) could modify the migratory pattern of native populations of *coturnix* and lead to an increased proportion of birds showing sedentary rather than migratory characteristics. Furthermore, hybrids that do show migratory behaviour could facilitate Japanese Quail gene flow into localities where *japonica* has yet to be introduced. This could result in the loss of the partially migratory native species and its replacement by a non-migratory hybrid that would be a more popular game bird.

Hawaiian Islands
Japanese Quail were first liberated on Maui and Lanai in 1921 (Caum 1933). Subsequently, other islands were colonised either through natural dispersal or through apparently unrecorded introductions. In 1944 some birds were imported to Kauai, and by 1946–47 the species occurred on all the main islands (where the population was estimated to be nearly 72,000) but was only transitory on Oahu (Schwartz & Schwartz 1949). The birds favour the more fertile soil of the smoother and less dissected montane slopes used for pasturage, and also frequent some pineapple and sugar-cane plantations and market gardens, but avoid indigenous forests and barren lava fields. They are currently established on Hawaii, Maui, Molokai, Lanai and Kauai (AOU 1998), where they are most frequently seen on the north shore of Kauai and on the northwestern slopes of Haleakala on Maui (Pratt *et al.* 1987).

Brown Quail
Coturnix ypsilophora

Natural Range: Lesser Sunda Is., Savu, New Guinea, Australia.
Naturalised Range: Australasia: New Zealand. Pacific Ocean: Fiji Is.

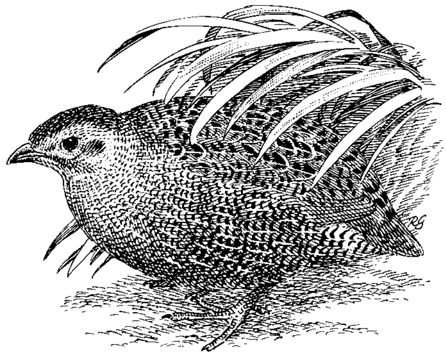
New Zealand
Two races of the Brown Quail (*C. y. australis* from mainland Australia and the nominate *C. y. ypsilophora* from Tasmania) have been imported to New Zealand, as shown in Table 3.

Thomson (1922: 118) wrote that the Brown Quail was 'almost unknown in the South Island, but is fairly common in many parts of the North Island'. Oliver (1955) found the species to be abundant around the Bay of Plenty and further north, and on Three Kings and Mayor Islands, but scarce elsewhere. Wodzicki (1965: 432) said the birds were 'restricted but locally common, North Island and Three Kings, Poor Knights, Alderman, Mayor, Gt and Little Barrier', while Kinsky (1970) reported Brown Quail to be widely distributed in North Island (especially in the north) and on all the above islands plus Mercury. Today, the species is common in Northland and on many of its offshore islands and also on some developed islands in the Bay of Plenty. It is fairly common in the Waikato and the Bay of Plenty, but scarce south of a line between Kawhia, Lake Taupo and Hawke's Bay (Heather & Robertson 1997). Brown Quail favour swamps and the edges of tidal marshes as well as scrub and rough grassland.

Fiji

Watling (1982: 74) records that:

> The Swamp Quail [a synonym for the Brown Quail] was introduced and is found only on the dry, leewardsides of Viti Levu and Vanua Levu in Fiji. It inhabits scrub and grassland, especially in and around the extensive sugar-cane growing districts. The date of the Swamp Quail's introduction is not known but it was almost certainly after the introduction [in 1883] of the mongoose [*Herpestes javanicus*, see Lever 1985], whose presence it has been able to survive. However, it is a rare bird and in Viti Levu may well have declined in recent years.



Brown Quail

According to Pratt *et al.* (1987: 119), Brown Quails are 'established in the drier w. parts of Viti Levu and on Vanua Levu (central Macuata)', but are everywhere uncommon.

Chinese Bamboo Partridge
Bambusicola thoracicus

Natural Range: S & C China and Taiwan.
Naturalised Range: Europe: ?Italy. Asia: Japan.

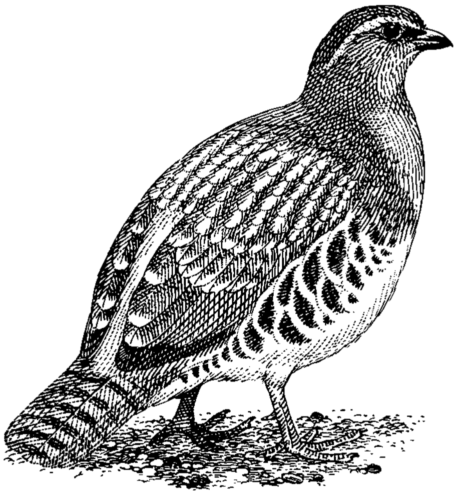
Italy

Between 1927 and 1932, Chinese Bamboo Partridges were introduced to at least four regions of Italy (northeastern Sicily, Emilia-Romagna, Lucania/Puglia, and Toscana/ Umbria), but only in the first two areas did the species ever

TABLE 3 Brown Quail *Coturnix ypsilophora* imported to New Zealand 1866–1930s.

Date	*Numbers*	*Imported by*
1866	2	Canterbury Acclimatisation Society
1868	5	Canterbury A.S.
1871	'a number'	Canterbury A.S.
1900 & 1930s	?	Canterbury A.S.
1867–69	4+	Auckland A.S.
1871	510	Auckland A.S.
1868–70	12	Otago A.S.
1872	4	Southland A.S.
1875–76	44	Wellington A.S.

Source: Thomson 1922.



Chinese Bamboo Partridge

reproduce, and it apparently failed to become established (Baccetti *et al.* 1997).

JAPAN

In 1919 some Chinese Bamboo Partridges of the mainland nominate subspecies were imported from southern China to Japan, where their offspring were released in the Kanagawa Prefecture southwest of Tokyo (Kuroda 1937). A decade later more of the mainland form were liberated in the Hyogo Prefecture on Honshu, where they became established (Sakane 1960). In 1924 birds of the Taiwanese race *B. t. sonorivox* were imported to Japan, where in about 1931 some were freed at Kobe on Honshu and probably also in the Saitama Prefecture north of Tokyo.

By the outbreak of the Second World War, Chinese Bamboo Partridges were widespread throughout Japan (especially south of Kwantô: Kaburaki 1940), and within 20 years had colonised the Seven Islands of Izu Shichito and those of Shikoku and Kyushu (Yamashina 1961). Brazil (1991) records the species as common in much of Honshu from Chiba-ken westwards to Kyushu. Eguchi & Amano (1999: 97) confirm that the species has '… established long-term self-sustaining populations' in Kyushu, Shikoku, southern and western Honshu, and Kobe. To this distribution the OSJ (2000) adds Sado and the Izu and Iwo Islands.

Impact: Although they cause some damage to seedling crops, Chinese Bamboo Partridges in Japan also eat such harmful invertebrates as locusts (Orthoptera), termites (Isoptera) and ants (Hymenoptera) (Yamashina 1961).

Red Jungle Fowl
Gallus gallus

Natural Range: N Pakistan through N and E Assam, C India, N and C Burma, SW Yunnan, Indochina, and C Burma to N and NC Vietnam; also Sumatra and Java.
Naturalised Range: Asia: Indonesia; Philippines. North America: West Indies. South America. Indian Ocean: Mascarene Is. Pacific Ocean: ?Galápagos Is; Hawaiian Is.; Polynesia; Melanesia; Micronesia;

The Red Jungle Fowl is the ancestor of the domestic fowl. It was probably bred in captivity in southeastern Asia in prehistoric times. The species was domesticated in the Indus Valley by about 2500 BC and by 1500 BC had been imported to central and northwestern Europe.

INDONESIA

Red Jungle Fowls may have been introduced to the Malaysian region by the Mongols in the late thirteenth century. The first European to see them there appears to have been the English navigator John Davis in 1598, and they were subsequently noted in the Nicobar Islands in the Bay of Bengal by Sir James Lancaster in 1602. Elsewhere in the region, feral Red Jungle Fowl are known to occur in the Cocos (Keeling) and Christmas Islands, on Borneo, in the Lesser Sunda Islands (including Lombok, Timor, and Wetar), Palawan (where they were first recorded in 1521), Balabac, Sulawesi, and Papua New Guinea (Ball 1933), and almost certainly elsewhere.

PHILIPPINES

Although Delacour (1947) suggested that

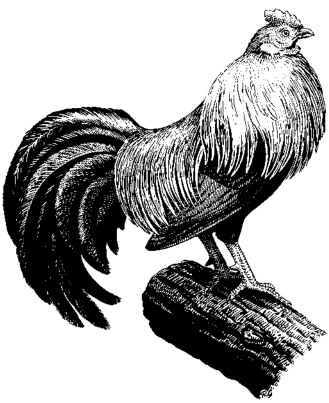
G. gallus was introduced to the Philippines at an early date, Parkes (1962) believed it might be indigenous. Rabor & Rand (1958) considered that the population may represent different colonisations or introductions. Dickinson (2003: 58) says the species was 'introduced to the Philippines (sometimes recognised as *philippensis* ...)'. Feral birds now occur throughout the archipelago.

West Indies

Columbus is known to have included domestic fowl among the stock he landed on Hispaniola in 1493. According to Bond (1979: 65) 'it is said that feral domestic fowl are thriving on the islet of Kick-em-Jenny in the Grenadines and on Mona'. According to the AOU (1998: 117), *Gallus gallus* is established 'on islands in the Bahamas (Little San Salvador), off Puerto Rico (Mona, and possibly Culebra), and in the Grenadines (Kick-em-Jenny)'. Raffaele *et al.* (1998) record the species as occurring very locally in the Dominican Republic at Los Haitises and in the Sierra de Baoruco; among the haystack hills on Puerto Rico; on Mona and possibly Culebra; and in the Grenadines.

South America

Menzies (2002), from whom the following account is derived, argues persuasively that fowl were not introduced to the New World from Europe, as has long been believed, but were first imported by Chinese voyagers in the fifteenth century direct from Asia. They were found in domestication, and no doubt also in the wild, on both the Atlantic and Pacific coasts of the Americas north to Rhode Island, USA, before the arrival of Europeans. Menzies (2002) quotes Carter (1998: 154; 158) who wrote:



Red Jungle Fowl

> Since Asiatic chickens are very different from the Mediterranean chickens and most of the traits that reappear in the flocks of the Amerindians are found in Asia, the obvious conclusion would be that Amerind chickens were first introduced [to South America] from Asia and not from the Mediterranean. ... a conclusion for a Spanish or Portuguese [see Hernandez 1992] first introduction of chickens into America is simply counter to all the evidence. The Mediterraneans, as late as 1600, did not have ... the galaxy of chickens present in Amerind hands ... the only possible conclusion is that chickens were introduced from across the Pacific, probably repeatedly, long before the Mediterranean discoveries of America [see Garcia-Petit 2002].

The principal traits shared by Asiatic and Latin American fowl are blue egg-shells (those of European fowl are brown or white) and melanism. Melanistic fowl are still found throughout Latin America, and blue-shelled eggs from Chile to Mexico. If Europeans had introduced fowl to the Americas the European name would surely have been adopted by the Amerindians, but this did not occur; the names adopted for fowl in South and Central America closely resemble those used in the birds' native Asian range, and the Incas had a word for fowl at least 40 years before the arrival of the sixteenth century conquistadors (d'Acosta 1596). Finally, fifteenth century Europeans were almost unique in eating fowl and their eggs. In southeast Asia and China, and by the Amerindians of South America, fowl were used solely for purposes of divination and not for consumption.

Mascarene Islands

Red Jungle Fowl were introduced to Réunion in the early 1900s, when some were released at

Bras Pinon (Jouanin 1964). Cheke (1987) heard the species in formerly inhabited areas of the Rivière des Remparts, and a few are believed to occur in dense woodland and cirques (steep-sided hollows at the head of a valley or on a mountainside) on the east coast, and more commonly inland from Bras Pinon and in the Liberia region, Eden, and the Morne du Bras des Lianes.

Galápagos Islands

According to B. Barnett (pers. comm. 1982), feral domestic fowl were then established in parts of the highlands of Sierra Negra near Santo Tómas on Isabela (Albemarle). From morphological alterations (e.g. longer wings and tail and characteristic colouration) and changes in behaviour (e.g. the ability to fly and arboreal nesting) they may have occurred in this region for many years – perhaps since the late nineteenth century. They are not, however, mentioned either by Harris (1974) or Swash & Still (2000).

Hawaiian Islands

A domesticated form of the Red Jungle Fowl was almost certainly introduced to the Hawaiian Islands from eastern Asia (principally Malaysia) by early Polynesia settlers, probably around AD 500 (Ball 1933). After their introduction by Europeans in the late eighteenth century, domestic fowl interbred with feral Jungle Fowl, and became established in the wild on all the inhabited islands in the archipelago where, however, except on Kauai, they appear to have died out by the early twentieth century. The reasons for the birds' extinction seems to have been a combination of overshooting, the deforestation of their preferred habitat, continued interbreeding with domestic stock, which tended to undermine the ability of feral birds to survive in the wild, and the introduction of the Small Indian Mongoose *Herpestes javanicus* (see Lever 1985).

Schwartz & Schwartz (1949) found that feral Jungle Fowl were established in small discrete areas on Kauai totalling 173 sq km. The rugged country occupied by the fowl consists principally of narrow ridges alternating with small but deep valleys, where the soil is too acid for the growth of commercial crops but supports a luxuriant forest vegetation of Koa *Acacia koa* and Ohia *Metrosideras collina* with some other native and alien mixed hardwoods. Ground cover is provided by an understorey of scattered shrubs, ground ferns, matted ferns and tree ferns (Scott *et al.* 1986). The birds' main controlling factor on Kauai seems to be predation by feral Cats *Felis catus* and Pigs *Sus scrofa* (see Lever 1985).

In 1963 Red Jungle Fowl were imported from game-farms on the United States mainland and were released on Kauai and Hawaii; on the latter they apparently disappeared, but Bond (1979), Pratt *et al.* (1987) and the AOU (1998) confirm the species' survival on Kauai (including at Kokee) and, following a more recent introduction, at Waimea Falls Park on Oahu.

Polynesia; Micronesia; Melanesia

From archaeological evidence in the Marquesas and Society Islands it is known that Red Jungle Fowl were introduced to islands in the South Pacific from eastern Asia (mainly Malaysia) by early Polynesian voyagers some 3,000 years ago (Ball 1933). Escaped or deliberately released birds eventually succeeded in establishing feral populations on virtually every inhabited island throughout Polynesia and the East Indies (AOU 1998), where, however, 'now these populations are declining drastically' (Pratt *et al.* 1987: 121).

Kalij Pheasant
Lophura leucomelanos

Natural Range: From W Himalayas of N Pakistan and WC Nepal through Sikkim, Bhutan, Assam, and Burma to Xizang.

Naturalised Range: South America: Argentina. Pacific Ocean: Hawaiian Is.

Argentina

In about 1920 Aarón Anchorena introduced four species of pheasant (*L. leucomelanos melanota* (eastern Nepal, Sikkim, and western Bhutan), *L. nycthemera*, *Chrysolophus pictus* and *C. amherstiae*, *q.v.*) to Victoria Island in the Nahuel Huapi National Park in southwestern Argentina, where they became established and where in 1962 the population was estimated to number some 2,000. According to Navas (1987), Kalij and Silver Pheasants are very numerous on Victoria Island, where they have freely interbred and have produced hybrids that are now the most abundant birds on the island. Navas (1987) believed that a possible cause of hybridisation was a disparity in the ratio between the sexes. See also Narosky & Yzurieta (2000) and Mazar Barnett & Pearman (2001).

Impact: All four species of pheasants on Victoria Island consume large quantities of seeds, fruits, and insects, which has resulted in considerable changes in the ecosystem. They also compete to the detriment of many species of native fauna on the island (Navas 1987).

Hawaiian Islands

The population of Kalij Pheasants on the island of Hawaii is descended from the release in 1962 of 67 birds on the Puu Waawaa Ranch by L. S. Dillingham and W. Carlsmith (Lewin 1971). The birds were subsequently identified by Lewin & Lewin (1984) as an intergrade between *L. l. hamiltonii* of the western Himalayas and the nominate *L. l. leucomelanos* of central Nepal.

After their release, the birds established a breeding colony in dense stands of exotic Silk Oak *Grevillea robusta* woodland, where they remained for the next five years. Thereafter they spread at an average rate of some eight km a year, and within 14 years most of the mid-elevation forests on the island had been colonised. By the early 1980s, Kalij Pheasants were fairly common to abundant in most forested localities, especially in areas of extensive woodland on the slopes of Mauna Kea and Mauna Loa and in mid-elevation Ohia *Metrosideros collina* forest (such as the Honaunau Forest Reserve) on the leeward side of the island. Although the birds occur from sea-level to 2,450m, 95% are found between 450m and 2,150m; Lewin & Lewin (1984) estimated that the birds occupied a range of about 3,500 sq km – one third of Hawaii's total area. According to Pratt *et al.* (1987: 120), Kalij Pheasants were '… spreading explosively throughout the island in suitable habitat'. The AOU (1998: 117) says the species is '… now in the North Kona district and on the slopes of Mauna Loa and Mauna Kea'.

'The successful colonisation of Hawaii by Kalij Pheasants', wrote Lewin & Lewin (1984: 644), 'can be thought of as a symptom of a degraded ecosystem, because the birds are in large measure dependent on both exotic plants and animals for food and cover'. The species' success on Hawaii can be attributed to the ability of this shy woodland bird to colonise rainforest areas and other densely vegetated mesic habitats (Scott *et al.* 1986).

Impact: Of the Kalij Pheasants examined by Lewin & Lewin (1984), 82% contained the seeds of the exotic and aggressive vine Banana Poka *Passiflora mollissima* (one of the worst floral pests in Hawaii) and 36% contained those of another pest species, the Thimbleberry *Rubus rosaefolius*, both of which the birds help to spread. (See also Stone & Anderson 1988, Pratt 1994).

Silver Pheasant
Lophura nycthemera

Natural Range: S China, Burma, N Laos, southwestern Kampuchea, North Vietnam, C South Vietnam, Thailand, and Hainan.

Naturalised Range: Europe: ?Germany. South America: Argentina.

Germany

According to Niethammer (1963) and Heinzel *et al.* (1976), Silver Pheasants were then established in woodlands in unspecified parts of Germany. The species is not recorded in *The EBCC Atlas of European Breeding Birds* (1997).

Argentina

See under *L. leucomelanos.*

Reeves's Pheasant
Syrmaticus reevesii

Natural Range: From NE Sichuan, Hubei and Anhui to EC Nei Mongol and Hebei.
Naturalised Range: Europe: Czech Republic; France.

Czech Republic
Reeves's Pheasants have been successfully introduced for sporting purposes to temperate lowland forests of Hornomoravsky uval, especially in the regions of Litovel, Olomouc, Chropyne and Kromeriz (Kokes 1977).

The present breeding range of Reeves's Pheasants in the Czech Republic is concentrated in northern and central Moravia, mostly close to game-farms from which regularly released birds continually augment the wild population. Štastný (1997) regarded the species as a potential game bird in non-flooded forests up to 400m above sea level, and estimated the wild population at 200–400 individuals.

France and Central Europe
Serious attempts to naturalise Reeves's Pheasants in France started between 1970 and 1975 (Yeatman 1976). By 1987 the birds occurred in 16 separate forested regions in apparently self-sustaining populations, and had survived for at least a decade in northern and central France (Roobrouck 1994). Štastný (1997) estimated the 1985–89 population to number between 1,000 and 1,500 breeding pairs. Langley (2004) recorded the species as occurring in Ile-de-France, Fôret de Fontainbleu, Normandie, Picardie, Pas-de-Calais and on Porquereau Island in Var.

Reeves's Pheasants have also bred in the wild in forested parts of Austria, Germany, and Hungary, but stable populations have again failed to establish (Lever 1987).

Common Pheasant
Phasianus colchicus

Natural Range: S Palaearctic and NE Oriental regions: in eastern Europe in parts of the Caucasus Mountains; in Asia from N Asia Minor E to Korea, China and Taiwan.
Naturalised Range: Europe: British Isles; Continental Europe. Asia: Japan. North America: Canada; Mexico; USA; West Indies. South America: ?Chile. Australasia: Australia; New Zealand. Atlantic Ocean: St Helena I. Indian Ocean: Mascarene Is. Pacific Ocean: French Polynesia; Hawaiian Is.

British Isles
The earliest documentary evidence of Common Pheasants in Britain is found in a manuscript of about 1177 which gives details of the rations specified for the canons' household at the monastery of Waltham Abbey in Essex in 1058–59. Evidence that the birds occurred in the wild appears in a charter of

Reeves's Pheasants

1089 in which the monks of Rochester in Kent are assigned 16 Pheasants from four separate manors, and two years later the Abbot of Malmesbury in Wiltshire was licensed to kill wild Pheasants. Exactly when the Pheasant became naturalised in England is uncertain, but from the twelfth century the species appeared with increasing frequency in English literature, and by at least 1320 the birds were regarded as game (Fitter 1959).

The earliest mention of Pheasants in Scotland seems to be that made by John Leslie, the Bishop of Ross, in his *De Origine Moribus et Rebus Gestis Scotorum* (1578), quoted by Gladstone (1926). Pheasants were first introduced to Ireland before the late 1580s (O'Gorman 1970), when some were exported from that country to Pembrokeshire in Wales (Matheson 1963), where, however, they did not become common until the second half of the nineteenth century.

The early introductions of Pheasants to Britain were of the nominate *P. c. colchicus* (Transcaucasia and Azerbaijan), but at least five other forms have subsequently been imported, principally *torquatus* (the Ring-necked Pheasant: eastern China) first in 1768, but also *principalis* (southern Turkestan and Afghanistan) and *mongolicus* (Kirgizskaya and Turkestan) in 1898; *pallasi* (Siberia and Manchuria) before 1930; and *satscheuensis* (Kansu) in 1942. All these races have interbred, and the white neck-ring of *torquatus* is now a feature of the majority of British and Irish cocks. The population is annually augmented by birds released for sporting purposes.

Summing up the status and abundance of Pheasants in Britain, Bijlsma & Hill (1997: 219) say the country:

> has the highest population (though not necessarily the highest densities) of any European country as a consequence of the interest in game-shooting and the release of probably 15m[illion] pheasants each year for shooting (Hill & Robertson 1988).

Impact: Dunning (1974) found that Pheasants in East Anglia (Norfolk and Suffolk, England) eat the seedlings of commercially valuable sugar beet.

Continental Europe

Common Pheasants were traditionally first imported to mainland Europe around 1300 BC, when Jason and the Argonauts brought some back from Colchis (on the east coast of the Black Sea) to Greece. From Greece the species was introduced to Italy, and thence by the Romans to southern France and Germany. As in Britain, other races were subsequently imported, and the European population is now almost entirely composed of hybrids.

Niethammer (1963) suggested these dates for the arrival of Pheasants (*colchicus*) in Europe: Germany and Czechoslovakia (eleventh century); Austria (1414); Hungary (fifteenth/sixteenth century); northern France (1530); Corsica (sixteenth century); Calabria and Romania (seventeenth century); Switzerland (?1642); Sicily, Belgium, and Norway (eighteenth century); Sweden (1740); and Finland (1901–03). Bijlsma & Hill (1997) say that Pheasants were first released in Transcaucasia around 1890. *Ph. c. torquatus* and *mongolicus* arrived on Isla Procida off Naples in 1759, and were introduced elsewhere in Italy by 1775.

In modern times, Pheasants of the race *formosanus* (Taiwan) were introduced to northern France after 1850 and were followed around 1900 by *mongolicus* (Etchécopar 1955). Michelot (1991) says there are today five viable populations of Pheasants in the region of the Rhone–Alps.

In Norway, *P. c. torquatus* was first released at Baerum near Oslo in 1875–76; Pheasants are currently established only in Ostfold, Akershus, and Vestfold in the southeast (Myrberget 1976).

Elsewhere in Europe, data on Pheasants are scarce: according to Lensink (1996, 1998a) the breeding population in The Netherlands in 1973–77 amounted to 50,000–75,000 breeding pairs and in 1992–94 to 25,000. The fall in the population is a result of intensified agriculture and the curtailing of Pheasant-rearing and releasing in Holland (Bijlsma 1990).

Gebhardt (1996: 206) lists *P. colchicus* as having been introduced to Germany '*ca* AD. 0' and says that it is 'established', but provides no further details.

According to Costa *et al.* (1997: 562–563), in Portugal 'there are small localised populations in the provinces of Estremadura, Alentejo and Algarve. ... In the Sada Estuary, the favoured habitat consists of open woodland areas, mainly Cork Oak *Quercus suber* and Umbrella or Stone Pine *Pinus pinea*'.

Common Pheasants are locally abundant in southern Spain where large numbers are regularly released for shooting, and populations also occur in the north, in Catalonia and around Madrid (E. F. J. Garcia pers. comm. 2005). Martí & del Moral (2003) estimate the 'wild' population at fewer than 500 individuals.

Nummi & Pienmunne (1998) quote Jensen (1982) and Ebenhard (1988) who say that *P. colchicus* is also established in Denmark and Sweden respectively.

Summing up the present status and distribution of the Pheasant in continental Europe, Bijlsma & Hill (1997: 219) wrote:

> Its distribution and abundance patterns follow that associated with relatively low-lying country and the slopes of hills. It becomes sparse in many Mediterranean areas although Italy has become populated since 1980. It is less common in Greece, the Italian Alps, parts of the S-C and E French highlands, and is almost totally absent from Portugal and Spain [but see above]. Numbers and range decline in northern Scotland, Norway and Sweden, though there has been a significant numerical and range increase in Finland since the 1950s (Koskimies 1989) ... The six countries holding the largest Pheasant populations – Britain, Hungary, France, Germany, Denmark and Romania – together possess 88% of the mean European population. The Romanian population has undergone very significant increases in abundance and range from 1970 to 1990. Declines of at least 50% are reported in The Netherlands and Sweden .... The species is extending its range into Spain....'

Impact: Very little ecological or economic damage by Pheasants has been reported in Europe where shooting brings considerable economic benefit. Gebhardt (1996) indicates that some ecological damage has occurred in Germany, but provides no details.

Japan

According to Kuroda (1922) Pheasants were introduced in the Middle Ages (*c.* 500–1500 AD) to Tsushima and the Urishima Islands in the Korea Strait. In 1919, 1923 or 1924 (accounts differ) Korean Pheasants (*karpowi*) were released near Tsushima west of Nagoya on Honshu, and also on Kyushu, where they hybridised with the native Green Pheasant *P. versicolor*. In 1930, further birds from Korea were liberated on Oshamambe and Hidaka on Hokkaido (where *versicolor* does not occur) and have thrived in regions with mild winters (Kaburaki 1934, 1940). In 1965 or 1966, Korean Pheasants were released on Hachijo Jima and Miyake Jima in the Izu Shotō archipelago south of Tokyo (OSJ 1981). Eguchi & Amano (1999) confirm that in Japan *P. c. karpowi* has been intentionally and systematically released as game for shooting and has established long-term self-sustaining populations, which Brazil (1991) and the OSJ (2000) say occur principally on Tsushima and in Hokkaido.

Canada

Table 4 lists early introductions of Common and Ring-necked Pheasants into Canada.

Pheasants in Canada favour the same habitats as in the United States (see below). The AOU (1998) describes them as occurring from southern British Columbia (including Vancouver Island) through central Alberta, central Saskatchewan, southwestern Manitoba, southern Ontario, southwestern Quebec, New Brunswick and Prince Edward Island to Nova Scotia. The subspecies introduced to Canada are believed to be *colchicus*, *torquatus*, and *mongolicus*.

Mexico

From Imperial Valley in southern California Pheasants have spread into (or have been

TABLE 4 Introductions of Common Pheasants *P. c. colchicus* and Ring-necked Pheasants *P. c. torquatus* to Canada, 1882–1950s.

Date	*Province*	*Source*	*Result*
1882	British Columbia (Victoria, Vancouver I.)	C. W. R. Thompson via Lord Ernest Hamilton, England	Failed
1883	British Columbia (Esquimalt)	C. W. R. Thompson (from China)	Successful
1886	British Columbia (Saltspring I.)	Edward Musgrave (from China)	Successful
1890	British Columbia (Prevost I.)	Edward Musgrave (from China)	Successful
1890	British Columbia (Point Grey)	Mainland Protective Association	Successful
1890–1900	British Columbia (including Pender I.)	?	Successful
Before 1892	Ontario	?	Successful
Before 1893	Nova Scotia	?	Failed
1893	British Columbia (Ladner, near mouth of Fraser R.)	Mainland Protective Association	Successful
1909	British Columbia (Chilliwack)	British Columbia Game Commission (from China)	Successful
Before 1925	New Brunswick; Prince Edward I.; ? Quebec	?	Failed
Mid-1920s	Manitoba	?	Failed
1927	Ontario (Pelee I., L. Erie)	?	Successful
Until 1954	British Columbia (S & N interior; Queen Charlotte Is.)	British Columbia Game Commission	Successful
Late 1950s	Newfoundland (St John's)	?	Successful until at least 1968

Source: Allen 1956. For full list of references see Lever 1987, p. 174.

introduced to) northern Baja California (AOU 1998), where they are established in the Mexicali Valley east of Lake Salada (Peterson & Chalif 1973).

United States

Table 5 lists early introductions of Common and Ring-necked Pheasants into the United States.

Birds from most of the successful introductions listed spread rapidly from their points of release, and soon became established. Today, the AOU (1998), which says that the majority of North American populations are of *torquatus* stock, describes Pheasants as established in central Minnesota, central Wisconsin, central Michigan; south, at least locally, to southern interior California, Utah, southern New Mexico, northern and southeastern Texas, northwestern Oklahoma, Kansas, northern Missouri, central Illinois, central Indiana, southern Ohio, Pennsylvania, northern Maryland, New Jersey, central Virginia, Ohio, and North Carolina (Outer Banks). See also Vuilleumier (1991: California), Small (1994: California), Robbins (1995), Johnston & Garrett (1994: western states), Sibley (2000) and Dinsmore (2001: Iowa).

In northwestern states, Pheasants occur from sea-level to over 1,500m in areas with an annual rainfall of between 13cm and over 300cm. In California, they range from 60m

TABLE 5 Introductions of Common Pheasants *Phasianus c. colchicus* and Ring-necked Pheasants *P. c. torquatus* into the USA, 1733–1939.

Date	*State*	*Source*	*Result*
1733	New York	Governor, Colonel John Montgomerie	Failed
1786	New York	President George Washington via Marquis de Lafayette	Failed
1790	New Jersey	Richard Bache (son-in-law of Benjamin Franklin)	Failed
Early 1800s	Virginia	William Upshire; Governor Wentworth	Failed
1870s/80s	California	?	Failed
1872	New Mexico	Private landowners	Failed
1875	Colorado	Private landowners	Failed
1877; 1886–91	New York	?	Failed
c. 1880	New Jersey	Pierre Lorillard	Failed
1881	Oregon	A. H. Morgan via Judge Owen Nickerson Denny, Shanghai	Failed
1882	Oregon	John Denny via brother, Judge Denny	Successful
1883 or 1885	Washington	Via Judge Denny	?
1885–94	Colorado	?	Successful
1887	New Jersey	Rutherford Stuyvesant	Successful
1889–98	California	Board of Fish Commissioners	Successful
c. 1890	Utah	Hon M. H. Walker	Successful
1891	South Dakota	N. L. Witcher	Failed
1892–95	Pennsylvania	Private landowners	Successful
1893–95	New Hampshire	Private landowners and Fish & Game Commission	?
1890s	Massachusetts	?	? Successful
1894	Rhode I.	Private landowners	?
Mid-1890s	Michigan	A. G. Baumgartel	Failed
Late-1890s	Ohio	?	Failed
1898–1903	South Dakota	Dr A. Zetlitz	Successful
Late 1890s–1915	New Jersey	Private landowners	? Successful
1900 or 1901	Iowa	William Benton	Successful
Early 1900s	New York	?	Successful
1903	Ohio	?	Successful
1904–33	Missouri	?	Successful
c. 1905	Minnesota	State Conservation Department	Successful
Since 1906	Virginia; North & South Dakota; Georgia; Tennessee; Alabama	?	Largely unsuccessful
1908	Indiana	State Conservation Department	Successful
1909	Oklahoma	?	Failed
1910	Illinois	State Conservation Department	Successful
1910–1930s	North Dakota	?	Successful
1912	Arizona	?	Failed
1916	New Mexico	?	Failed
Before 1917	Nevada	?	Failed
1917–25	Michigan	State Conservation Department	Successful
1919	Ohio	State Conservation Department	Successful
Before 1925	Kansas	?	Failed
1926–27	Nebraska	?	Successful
1929	Wisconsin	State Conservation Department	Successful
1932	New Mexico	?	Successful
1934–1942	Alaska	?	Failed
1939	Texas	?	Failed

Source: Allen 1956. For full list of references see Lever 1987: 174.

below sea level (in the Imperial Valley) to over 1,200m above sea level in the Great Basin, with a yearly rainfall of 150mm to 500mm. On the coastal belt, which is only lightly populated, Pheasants occur in areas with an annual precipitation of 25cm to 130cm. In the southwest, thriving populations occur only in eastern Colorado up to an altitude of 2,300m. In general, Pheasants in the United States fare best in northern agricultural areas; in the south and west, Pheasant populations are governed by the availability of water, and except in parts of Washington and Oregon few occur in arid regions; in the south, high temperatures during incubation are known to reduce the hatching success rate. Few of the northeastern populations are in general comparable to those in the irrigated valleys of the west.

Scribner *et al.* (1989) considered that a high degree of spatial differentiation between different Pheasant populations in the Texas panhandle could be a result of limited dispersal, accentuated by a variety of release sites.

Since the 1960s several other races of *P. colchicus* (*talischensis*, *persicus*, *karpowi*, *bianchii*) have been introduced to the United States, in general with encouraging results.

Impact: In some areas where they are especially numerous (e.g. Iowa and Wisconsin) Pheasants have been accused of having an inhibiting effect on native Northern Bobwhites *Colinus virginianus* and (e.g. in Iowa, Illinois and South Dakota) on Greater Prairie Chickens *Tympanuchus cupido*, in whose nests they sometimes lay their own eggs (Vance & Westemeier 1979, Westemeier 1988, Robbins 1995, Dinsmore 2001). As in Europe, the relatively small amount of agricultural and horticultural damage caused by Pheasants in the United States, where growing corn (maize), grains, potatoes, melons, tomatoes and strawberries are sometimes locally affected, is far outweighed by the birds' economic value.

West Indies

In the 1950s *P. c. torquatus* was introduced to the Dominican Republic on Hispaniola by Ramfis Trujillo, where despite overshooting some may survive in the hills near Cabo Rojo.

Brudenell-Bruce (1975) says that Ring-necked Pheasants were introduced before 1959 at Hatchet Bay on Eleuthera in the Bahamas, where the AOU (1998: 117) says they are 'probably' established. Raffaele *et al.* (1998) record the species as common on Eleuthera and locally common in northern Isle of Youth, Cuba.

Chile

Common Pheasants were imported from England by C. J. Lambert in 1886 or 1887 as the founder stock of an avicultural collection. Two pairs released in a park at La Compañia had by 1897 increased in numbers and dispersed up to 25km inland, but the population subsequently died out. A second shipment, from Germany, in 1914 became established locally in the provinces of Valdivia and Cautin, where Johnson (1965) estimated the population at about 1,000. Blake (1977) said that the birds still survived on Pichi Colcuman Island in Lago de Ranco in the Andean foothills of Valdivia, and also on a *hacienda* (ranch) at Allipen in Cautin.

Australia

Table 6 lists early introductions of Common Pheasants into Australia.

Pizzey (1980) recorded Pheasants on Rottnest, King and Flinders Islands, in Tasmania, in the southern tablelands of New South Wales, possibly in the Australian Capital Territory (Canberra) and in the Mount Lofty Ranges of South Australia.

Blakers *et al.* (1984) show them as established in Western Australia (both on the mainland and on Rottnest Island), in Victoria, in southern and western New South Wales, on King and Flinders Islands, and in Tasmania. Barrett *et al.* (2003) record Common Pheasants as having bred in parts of Western Australia and on Tasmania.

New Zealand

Table 7 lists introductions from abroad of *P. c. torquatus* to New Zealand between 1842 and 1875. In addition to these importations, since 1864 there have been innumerable translocations and transfers of both subspecies, and

TABLE 6 Introductions of Common Pheasants *Phasianus colchicus* into Australia, *c.* 1855–1960s.

Date	*State*	*Source*	*Result*
In or before 1855	Victoria (including Philip & Churchill Is.) & Sandstone	?	Temporarily successful
1858–59	Victoria	?	?
1864/70/71/72/73	Victoria	Victoria Zoological & Acclimatis- sation Society; private landowners	Temporarily successful
1882	Tasmania	?	Failed
1897–1912	Western Australia (including Rottnest I.)	Acclimatisation Committee	?
c. 1910	King I., Bass Strait	Tasmanian Game Protection & Acclimatisation Society	?
1928	Western Australia (Rottnest I.)	H A Pearse	?
? 1944	New South Wales (Hawkesbury)	?	?
Mid-1940s & early 1960s	Tasmania	?	Successful
c. 1959 & 1960s	Western Australia (Rottnest I.) Flinders I.; Bass Strait	Tasmanian Game Protection & Acclimatisation Society	?
1961	South Australia (Mt Lofty Ranges)	Upland Game Association	? Successful
1960s	South Australia (near Adelaide)	Upland Game Association	? Successful

Sources: Tarr 1950; Jenkins 1959; Balmford 1978.

TABLE 7 Introductions of Common Pheasants *P. c. colchicus* and Ring-necked Pheasants *P. c. torquatus* into New Zealand, 1842–1910.

Date	*Province*	*Source*	*Race/Result*
1842	?	'Mrs Wills' (from England)	*colchicus*/Failed
1843	?	'Mr Petre'	*colchicus*/Failed
1845	Northland (Mongonui)	Walter Brodie	*colchicus*/Successful
c. 1850–69	Northland (Tauronga, Tologo Bay, Raglan, Kawau, Bay of Is., Napier)	?	*colchicus*/?
1850	Canterbury (Bank's Peninsula)	'Messrs Smith and C H Robinson'	*colchicus*/Successful
1851	Auckland (Waitakere)	Thomas Henderson (from China)	*torquatus*/Successful
1853	Nelson	Sir Edwin Dashwood	*colchicus*/Successful
1856	Auckland (Waitakere)	Thomas Henderson (from China)	*torquatus*/Successful
1865–70 & 1874/77	Otago	Otago Acclimatisation Society (A.S.)	*colchicus*/Successful
1865	Christchurch	Prime Minister, Sir Frederick Weld (from England)	*colchicus*/Successful
1867/68/71	Canterbury	Canterbury A.S.	*colchicus*/Successful
1867/68/69	Auckland	Auckland A.S.; 'Mr Wentworth'	*colchicus*/?
1874/75	Wellington	Wellington A.S.	*torquatus*/Successful
1895–1910	Stewart I.	Southland A.S.	?/Failed

Source: Thomson 1922.

since 1923 of *mongolicus* (southeast Kazakhstan and northern Kyrgyzstan), between the various acclimatisation societies (see Lever 1992), in particular in the 1890s after the population suffered a decline during the previous decade. This decrease has been attributed to a variety of factors: the enormous increase in Rabbits *Oryctolagus cuniculus*, which had been introduced from England some 30 years earlier (Lever 1985), led to the use of phosphorus-impregnated grain (which was equally accessible to birds) as a controlling agent; small insectivorous songbirds – especially starlings *Sturnus vulgaris* – imported in the late 1860s rapidly increased and became serious competitors for food; the importation of mustelids around 1882 (Lever 1985) introduced a new threat to the hitherto predator-free environment; the introduction in 1892 of the insectivorous European Hedgehog *Erinaceus europaeus* (Lever 1985) provided the beleaguered Pheasants with another competitor for food; finally, in some localities poaching was rife. Competition for food in winter not only caused the death of large numbers of Pheasants through starvation but also rendered the survivors unfit for spring reproduction; the chicks of those birds that did manage to breed successfully found a shortage of insects on which to feed and succumbed to starvation.

As in the British Isles and in North America, Pheasants in New Zealand today are mostly *colchicus* x *torquatus* crosses. Although in many places populations are fully self-maintaining, elsewhere they are augmented by annual releases. Today, Pheasants in New Zealand are widely if irregularly distributed and fairly common in North Island, especially in the north and west: in South Island they are sparse, with small numbers only in Nelson, Canterbury, and Otago. The national population is around 250,000, and is reinforced by frequent releases (Heather & Robertson 1997).

Impact: Although Thomson (1922) reported considerable damage to such crops as young grass, sprouting maize, potatoes, carrots, beans, peas, barley, wheat and many varieties of fruit, this was more than offset by Pheasants' consumption of vast numbers of injurious insects. Today, only minor localized damage sometimes occurs in market gardens and young maize crops. Oliver (1955) suggested that infections imported to New Zealand by Pheasants may have contributed to the extinction around 1875 of the endemic New Zealand Quail *Coturnix novaezeelandiae*.

St Helena Island

The introduction and history of Pheasants in St Helena has been described by Rowlands *et al.* (1998).

According to Brooke (1808, quoted by Gladstone 1923), Pheasants were probably first introduced to St Helena by Fernando Lopez (Fernão Lopes), the first permanent resident on the island, in 1513, although they may not have been imported until Lopes' second sojourn on St Helena from around 1531 (Correa 1860, quoted by Clifford 1903). Pheasants were subsequently recorded by many sixteenth- and seventeenth century visitors to St Helena, where they were reported to be extremely common. In or before 1775 more birds were introduced by Governor J. Skottowe (Anon 1805), and according to Lesson & Garnot (1826), a further shipment was imported from Bombay and released in 1788. In the early nineteenth century, Pheasants on St Helena were reserved, for sporting purposes, 'for the hospitalities to strangers' (Barnes 1817: 107). Between the nineteenth and mid-twentieth century, Pheasants remained common on St Helena, but by 1952 the population had declined to some 75 pairs (Haydock 1954). A small but apparently stable population remains established on the island (McCulloch 2004).

Impact: According to Green (1956), Pheasants were then regarded as a pest of agricultural crops and gardens throughout the island.

Mascarene Islands

Hawkins & Safford (in prep.) list *P. colchicus* as a recent introduction to Réunion, probably from Europe.

French Polynesia

According to Pratt *et al.* (1987: 122) Pheasants have also been 'reported in French Polynesia, but status and distribution there unknown'.

Hawaiian Islands

According to Walker (1967), *P. c. mongolicus* was first introduced to the Hawaiian Islands in 1865, *P. c. torquatus* in about 1875, *P. c. colchicus* in 1959, and melanistic mutants (so-called '*tenebrosus*') in 1960. *P. c. torquatus* was planted on all the main islands, and was subsequently augmented by further releases, including 44 on the Puu Waawaa Ranch on Hawaii between 1959 and 1960, when 119 *colchicus* and 73 '*tenebrosus*' were also imported from the mainland.

Schwartz & Schwartz (1949) recorded Pheasants on Molokai, Hawaii, Lanai, Maui, Kauai and Oahu, and estimated the total population to number 70,340 individuals. Although Pratt *et al.* (1987) recorded the presence of Pheasants on all the main islands, the AOU (1998) lists them as surviving only locally on Hawaii, with smaller numbers occurring on Kauai, Lanai and possibly Maui.

Scott *et al.* (1986) found that Pheasants occurred in almost every type of habitat on Hawaii and Maui, but were most common in dry areas with scattered trees with little natural shrub cover, few matted ferns, and large numbers of introduced herbs; the highest densities tend to occur where introduced shrubs reach high cover values because of disturbance by grazing or feral stock. In the Hawaiian Islands, Pheasants range from sea-level to over 3,000m, and in places with an average annual rainfall of between 25cm and 760cm. Only areas with an excessively high precipitation associated with dense rainforests, barren and dry regions devoid of vegetation at low elevations, and high mountain tops, have not been colonised.

Impact: Schwartz & Schwartz (1949: 26) reported some localized damage to such crops as sweet potatoes (yams), tomatoes, and young corn (maize), but said the species was 'the most important game bird in the Hawaiian Islands because of its wide distribution ....' Although Stone *et al.* (1988) say that Pheasants distribute seeds of such alien plants as the Banana Poka *Passiflora mollissima* in Hawaii's natural areas, Cole *et al.* (1995a, b) considered that the role played by Pheasants in facilitating the dispersal and germination of such indigenous plant species as *Vaccinium reticulatum*, *Styphelia tameiameiae*, *Coprosma* spp. and *Geranium cuneatum* (Cuddihy & Stone 1990) helps to restore degraded ecosystems on Maui; the birds' impact on native terrestrial invertebrates is negligible, and they are not significant competitors with the endemic Nene or Hawaiian Goose *Branta sandvicensis.*

Green Pheasant
Phasianus versicolor

Natural Range: Japan.
Naturalised Range: Europe: British Isles; France. North America: Canada; USA. Pacific Ocean: Hawaiian Is.

Because *P. versicolor* is sometimes treated as conspecific with *P. colchicus* (see e.g. AOU 1998, OSJ 2000) there are relatively few specific references to it in the ornithological literature, but many of the anonymous introductions of Pheasants around the world may have been of the former species. Here, the treatment by Dickinson (2003) of *P. versicolor* as a full species is followed.

Everywhere that *P. versicolor* has been introduced with *P. colchicus* the two species have hybridised, and not many pure-bred introduced populations of either species survive. The following are the few specific references to *P. versicolor* that have been traced by the author.

British Isles

Green Pheasants were first imported to England by the Earl of Derby for his menagerie at Knowsley in Cheshire around 1840 (Fitter 1959). The most recent introduction, in 1999 or 2000, took place in the Ingham/Stalham/ Sutton area of Norfolk (Ogilvie & RBBP 2002).

France

According to Etchécopar (1955), Green Pheasants were first introduced to France around the middle of the nineteenth century.

Canada

According to Carl & Guiguet (1972), five Green Pheasants were included among Common Pheasants released at an apparently unrecorded date on Jedidiah Island, British Columbia.

United States

Green Pheasants were first introduced, unsuccessfully, by the Colorado State Sportsmen's Association in about 1882 and by Judge Owen Nickerson Denny in 1885 on Protection Island in Puget Sound, Washington (Phillips 1928). Between 1960 and 1975 a total of 47,741 Green Pheasants were liberated in Virginia, Tennessee, Louisiana, Washington, Idaho, Kentucky, New York and Maryland, and by 1963 the birds had become established in at least Virginia and Tennessee. Sibley (2000) says that *P., versicolor* has also been introduced locally in Delaware.

Hawaiian Islands

Walker (1967) says that Green Pheasants were first introduced to the Hawaiian Islands before the turn of the nineteenth century. Pratt *et al.* (1987) state that Green Pheasants are largely restricted to the windward slopes of Mauna Kea and Mauna Loa on Hawaii, and that they occur in wetter habitats and at higher elevations than *P. colchicus*, with which they freely hybridise.

Golden Pheasant
Chrysolophus pictus

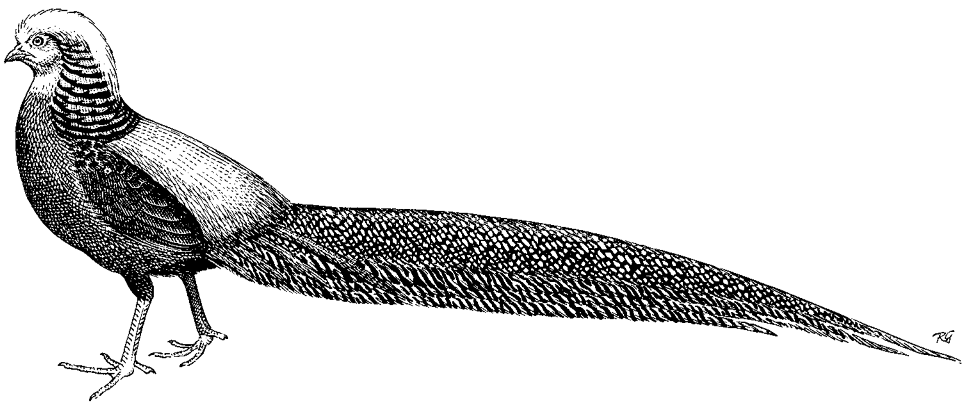
Natural Range: From N Guangxi and N Guangdong to S Gansu and S Shaanxi.

Naturalised Range: Europe: British Isles. South America: Argentina.

British Isles

Table 8 lists the main releases of Golden Pheasants in the British Isles from the 1880s to the 1990s.

The principle strongholds of the species in the British Isles today are the triangle formed by Kirroughtree Forest, Penninghame and Creetown in Wigtownshire and Kirkcudbrightshire, in southwest Scotland, and the Brecklands of southwest Norfolk and northwest Suffolk, England – especially between Thetford and Brandon and in Thetford Chase (Forest). Smaller populations have been established on Tresco in the Isles of Scilly; on Anglesey, North Wales; in Cardrona Forest, Peeblesshire; and in the



Golden Pheasant

TABLE 8 Releases of the Golden Pheasant *Chrysolophus pictus* in the British Isles, 1880s to 1990s.

Date	*Locality*	*Source*
1880s	Gigha I. & elsewhere in Scotland	?
c. 1895	Cairnsmore, Nr Newton Stewart, Wigtownshire	Duke of Bedford
1895	Mount Stewart, I. of Bute	Marquess of Bute
1890s	Tortworth, Gloucestershire	?
1902	Monreith, Wigtownshire	Sir Herbert Maxwell, Bt.
1925	Beaulieu Manor, Hampshire	Lord Montagu of Beaulieu
Before 1942	Sevenoaks, Kent	?
Before 1949	Elveden Hall, Suffolk	Earl of Iveagh
Since 1949	Whipsnade, Bedfordshire	?
?	Isle of Anglesey, Wales	Sir Richard Williams-Bulkeley, Bt.
1975	Tresco, Isles of Scilly	Dorrien-Smith family
?	Exbury, Hampshire	Edmund de Rothschild
?	Stockley Wood, New Forest, Hampshire	?

Sources: Harvie-Brown & Buckley 1892; Maxwell 1905; Fitter 1959; Cannings 1999.

Sandringham–Wolferton area of northwest Norfolk. Minor populations are also said to occur on the South Downs in Hampshire and West Sussex (Rehfisch 1997).

In 1996, several pairs bred on Tresco, and Golden Pheasants were also reported from Norfolk, Suffolk, Argyllshire (the island of Mull), and Dumfries & Galloway (Ogilvie & RBBP 1999). In 1999 a small population was recorded in the Lytham area of Lancashire, where an introduction was made in 1993.

There seems to be no firm evidence of a general decline in Britain, where the birds favour coniferous woodlands and mixed coniferous/deciduous forest and where the population is believed to number between 500 and 1,000 breeding pairs. Due to the species' skulking habits, population estimates should be treated with caution (Rehfisch 1997). However, anecdotal evidence suggests some decline in one of the species' strongholds, Thetford Chase. This decline may result from a combination of the abandonment in the 1950s of major releases, inbreeding, hybridisation with *C. amherstiae*, and increased predation as gamekeepers become fewer in number (Rehfisch 1997). D. Goodwin (1987 and pers. comm. 2004) believes that predation by Northern Goshawks *Accipiter gentilis* (which, except for occasional escapes from falconers, were virtually absent from the British Isles when Golden Pheasants were being introduced) or other raptors may be an important factor in the species' status in Britain where, because of its rarity in China, the population is of considerable conservation importance (Trollope 1995, Balmer *et al.* 1996).

Argentina

In about 1920 Aaron Anchorena introduced four pheasant species (*Lophura nyctemera*, *L. leucomelanos, C. pictus* and *C. amherstiae*) to Victoria Island in the Nahuel Huapi National Park in southwestern Argentina, where they became established and where in 1962 the population was estimated to number around 2,000. According to Navas (1987), although not so numerous as the two *Lophura* species, Golden and Lady Amherst's Pheasants are established on Victoria Island where, like the *Lophura* species, they freely interbreed. Navas (1993) believed that a possible cause of hybridisation was a disparity in the ratio between the sexes. See also Narosky & Yzurieta (2000) and Mazar Barnett & Pearman (2001).

Impact: See under *Lophura leucomelanos.*

Lady Amherst's Pheasant
Chrysolophus amherstiae

Natural Range: From N and NE Burma and N Yunnan to W Sichuan and W Guizhou.
Naturalised Range: Europe: British Isles. South America: Argentina.

British Isles

Although Lady Amherst's Pheasants were first imported to avicultural collections in England as early as 1828, the earliest releases in the wild were not made until around 1895, when some were freed by the Marquess of Bute at Mount Stewart on the Isle of Bute and by the Duke of Bedford (with *amherstiae* x *C. pictus* hybrids) at Cairnsmore in Wigtownshire and, with pure *amherstiae*, at Woburn Abbey in Bedfordshire. Later, Lady Amherst's Pheasants were liberated in the Beaulieu Manor woods in Hampshire by Lord Montagu of Beaulieu in 1925 and again in 1958; in Richmond Park, Surrey, between 1928 and 1932; in Whipsnade Park, Bedfordshire, in the 1930s; by the Earl of Iveagh at Elveden Hall, Suffolk, in 1950 (Fitter 1959, Lever 1977); on the Exbury estate in Hampshire by Edmund de Rothschild; in Stockley Wood in the New Forest, Hampshire; and at Halkyn Churchyard, Clwyd (Wales) (Cannings 1999).

In Cairnsmore, on Bute, at Beaulieu Manor, and at Elveden, hybridisation with *C. pictus* soon rendered pure *amherstiae* birds rare. At Woburn and Whipsnade, however, Lady Amherst's Pheasants flourished and spread along the greensand ridge, and this small area of south Bedfordshire and Buckinghamshire became the birds' British stronghold, with smaller populations around Exbury since the 1950s, and in parts of Norfolk after the early 1970s.

In Bedfordshire and Buckinghamshire, Lady Amherst's Pheasants favour deciduous and coniferous woodland with a dense understorey of Bramble *Rubus fruticosus* and Rhododendron *Rhododendron ponticum*. In Bedfordshire, the species is believed to have declined from 250 birds in the late 1970s to 100–200 in the early 1990s (Trodd & Kramer 1991): according to Cannings (1999), six *amherstiae* were released in mid-Bedfordshire in 1997, where the population has remained pure due to the absence of *C. pictus*. The much smaller Buckinghamshire population seems similarly to have contracted since the 1960s, with no recent records from two previously occupied localities (Lack & Ferguson 1993), although as McGowan & Rehfisch (1997) indicate, population estimates of this secretive species should be treated with caution.

By 1996 the Bedfordshire population, which only five years earlier had been estimated at between 100 and 200 individuals, had fallen to only 60, and in 1997 only 46 birds were reported in the county. Lady Amherst's Pheasants bred in two places in Buckinghamshire in 1996, when the population in the county was about ten pairs, and in at least one place in Bedfordshire, but the species was said by Ogilvie & RBBP (1999) to be declining. In 2001 the population in Backwood and Wavendon Woods in Buckinghamshire still survived (Ogilvie & RBBP 2003).

D. Goodwin (1987 and pers. comm. 2004) believes that predation by Northern Goshawks *Accipter gentilis* (which apart from the occasional occurrence of birds that had escaped from falconers were seldom seen in Britain when Lady Amherst's Pheasants were being introduced) or other raptors, may be an important factor in the species' decline in Britain where, because its status in the Far East is uncertain, the introduced population of *C. amherstiae* in Britain is of considerable conservation significance (Trollope 1995). It is also of value because not only does it provide quantitative data currently lacking in China but also supplies Chinese ornithologists with an opportunity to receive technical training on a native species (McGowan & Rehfisch 1997).

Argentina

See under *Chrysolophus pictus.*

Impact: See under *Lophura leucomelanos.*

Indian Peafowl
Pavo cristatus

Natural Range: From NE Pakistan E through India and Nepal to Assam and S to Sri Lanka.

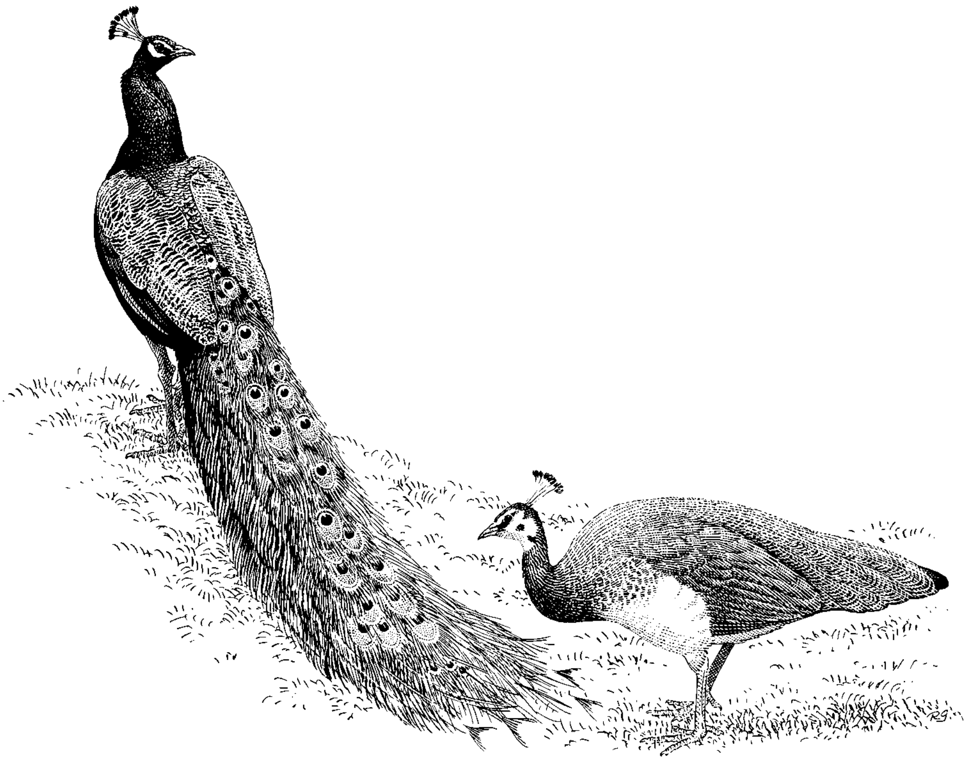
Naturalised Range: North America: USA; ?West Indies. Australasia: Australia; New Zealand. Indian Ocean: ?Andaman Is. Pacific Ocean: Hawaiian Is.

United States
A small population of Indian Peafowl established in the vicinity of Palos Verdes Estates, Rolling Hills and Portuguese Bend in southern California, is believed to be derived from birds that escaped or were released from captivity at an unrecorded date, having originally been imported in the 1920s. Hardy (1973: 507) described this population as 'thoroughly wild and completely independent of man for food', while Small (1994: 284) said it is 'scattered through the residential and semi-wild areas there'.

According to Small (1994), the two largest colonies of Peafowl in California occur in the western San Gabriel Valley in the vicinity of the Los Angeles County Arboretum near Arcadia, in San Marino, near Santa Anita Race Track, and in the Huntington Gardens. Other smaller colonies are scattered locally through the coastal slopes of southern California.

Summing up the status of Peafowl in southern California, Small (1994: 284) wrote that they occur in:

> semi-wild land at the edges of cities, suburban gardens, parks, botanical gardens, arboreta, and farms and ranches in the lowlands. ... They have increased so well in some suburban areas, and are so noisy, [that] some residents have demanded some sort of control program .... They



Indian Peafowl

have not spread beyond small areas of introduction.

James (1997) includes *P. cristatus* in his list of alien birds in Florida that did not have well-established breeding populations in 1991, when they occurred from Brevard County south to the Keys. Vuilleumier (1991), Johnston & Garrett (1994), AOU (1998), and Sibley (2000) confirm the species' survival in the United States.

West Indies

Indian Peafowl were introduced to Little Exuma Island in the Bahamas in the 1950s, where they are now fairly common but are seldom seen (Raffaele *et al.* 1998, AOU 1998).

Australia

Peafowl were first released in Victoria in Gembrook Reserve, in the bush near Melbourne, and at Cape Liptrap in 1870–72 (Ryan 1906). Young birds reared in the zoo at South Perth were freed in various parts of Western Australia – especially at Gingin and Pinjarra – before 1912, but by 1959 a small number survived only near the latter (Jenkins 1959). Around 1912, and probably again in 1915 or 1917, some were landed on Rottnest Island, where in 1965 between 50 and 100 were established (Storr 1965). Prior to the 1950s, Peafowl were said to occur near Onslow and perhaps elsewhere in the state (Serventy 1948).

In 1950, Peafowl were reported on East and West Sister Islands and on Prime Seal Island in the Furneaux group in the Bass Strait; in Tasmania; in the Blackall and Gladstone districts of Queensland; and on the headwaters of the Snowy River in New South Wales. In 1974, birds were recorded at Murray's Lagoon on Kangaroo Island (McGarvie & Templeton 1974), and a year later were said to be breeding on Heron Island off the coast of Queensland (Kikkawa & Boles 1976). Indian Peafowl today may occur on islands in the Furneaux group and on King Island in the Bass Strait, and perhaps also on Rottnest, Heron and Kangaroo Islands. They are recorded by Barrett *et al.* (2003) in Queensland, South Australia, Western Australia and especially on Tasmania.

New Zealand

The first Indian Peafowl in New Zealand were some imported from England by the Hon. Henry W. Petre in 1842, several of which became established at Hawke's Bay, Gisborne, and Wanganui. In 1867, the Otago Acclimatisation Society (see Lever 1992) introduced a pair, and at around the same time private individuals and dealers brought in others, some of which escaped or were released into the bush where, particularly in parts of North Island, they became established. Oliver (1930, 1955) recorded that in 1862 Peafowl were successfully introduced to Waimarama, Hawke's Bay. In the late 1860s Sir George Grey, Governor of New Zealand, introduced some Peafowl to Kawau Island in the Hauraki Gulf where, with various other exotic species, they became established. Thomson (1922) attributed the Peafowl's subsequent decline to competition for food, principally insects, with introduced songbirds.

Wild populations of Peafowl survive today in rough hill country and farmland in many drier and warmer localities in North Island, and in northwestern Nelson and on the west coast of South Island (Heather & Robertson 1997).

Andaman Islands

According to Abdulali (1964, 1967), Indian Peafowl were introduced to Ross Island in about 1868, where Hume (1873) reported them to be doing well, although introductions to South Andaman had failed. The invading Japanese destroyed the birds on Ross Island in 1940, but after the war more were imported there and some are believed to survive.

Hawaiian Islands

Indian Peafowl were first introduced to the Hawaiian Islands by Frances Sinclair in 1860 (Caum 1933). Fisher (1951) says they were liberated on Hawaii in the 1860s and on Niihau in the 1890s (another account claims in about 1860), from where some were later translocated to the Kalalau Valley on Kauai, and thence by Charles Grey to Lanai. In 1909 a pair was released on the Puu Waawaa Ranch on Hawaii, where they bred successfully and became quite common.

In 1936 Peafowl were reported to be plentiful on Kauai and in the early 1940s also on Niihau; Schwartz & Schwartz (1949) estimated the population on Oahu, Maui, Molokai, Kauai and Hawaii to total 530 individuals. According to Pratt *et al.* (1987), the Indian Peafowl 'has never done particularly well in the wild in Hawaii but persists in scattered localities on Hawaii (Hualalai above Puu Waawaa), Oahu (N end of Waianae Range), Niihau, and the W slope of Haleakala, Maui'. The AOU (1998) records Peafowl as occurring on Oahu, Maui and Hawaii. The birds are found from sea level to 1,500m in areas with annual rainfall of between 50 and 100cm. At sea level they occur in the *algaroba* (Mesquite *Prosopis juliflora*) flats, near sea level in the Guava *Psidium guajava* – Java Plum *Eugenia cumini* association, and at higher elevations in Mamane *Sophora chrysophylla* forests. Dense undergrowth and Passion Flower *Passiflora* sp. vines provide abundant cover. The principal controlling factor of Peafowl in the Hawaiian Islands seems to be predation of eggs and chicks by introduced Feral Pigs *Sus scrofa* and the Small Indian Mongoose *Herpestes javanicus* (see Lever 1985).

Impact: Indian Peafowl in the Hawaiian Islands are implicated in the dispersal of a pervasive and aggressive exotic vine, the Banana Poka *Passiflora mollissima* (Lewin 1971).

ANATIDAE (DUCKS, GEESE AND SWANS)

Bar-headed Goose
Anser indicus

Natural Range: Mountainous regions of C Asia, Mongolia, and China (at between 4,500 and 5,000m asl), wintering in N India and N Burma.

Naturalised Range: Europe: British Isles; ?Finland; Germany; ?Italy; The Netherlands; ?Ukraine.

British Isles

Delany (1993) recorded a national total of 85 free-flying Bar-headed Geese in 1991, although the only report of successful breeding was from Stratfield Saye, Hampshire, where a flock of 19 included nine juveniles in three broods. Other records in 1991 were a flock of 11 from Highfield Lake, South Yorkshire, and flocks of six at each of Abberton Reservoir, Essex; The Otter Trust, Bungay, Suffolk; and Castle Loch, Dumfries & Galloway. Other Scottish records were from South Ronaldsay, Orkney; Loch Tummel, Tayside; and Tyninghame, Lothian. In northern England there were reports from Cheshire, Greater Manchester, South Yorkshire and Shropshire, and in eastern England from Bedfordshire, Greater London, Essex and Kent. Further west, there were records from Oxfordshire, Berkshire, Gloucestershire and Avon, and in the south from the Isle of Wight.

Between 1996 and 2001, Ogilvie & RBBP (1999–2003) received reports of successful breeding of Bar-headed Geese in Avon, Derbyshire, Greater London, Greater Manchester, Hampshire, Somerset, Surrey, Sussex, and West Midlands, although some were cases of hybridisation with Canada Goose *Branta canadensis*, Lesser White-fronted Goose *Anser erythropus*, and Greylag Goose *A. anser*. From a current population of more than 100 birds in around 30 locations at least five pairs of Bar-headed Geese breed successfully in most years, and their numbers and range in Britain have been slowly increasing since the 1960s (Blair *et al.* 2000). Rowell *et al.* (2004) recorded a total of 52 in 2000.

Finland

First recorded in 1982, up to two breeding pairs from a population of about 25 birds succeed in raising young in a good year (Blair *et al.* 2000).

Germany

Escaped birds have occurred in the wild in Schleswig-Holstein since 1968. Although an irregular breeder, out of a total population of 100–200 individuals (of which 50–80 occur in Schleswig-Holstein) between five and ten pairs breed successfully in most years. The numbers and distribution of this under-recorded species seem to be slowly increasing, and hybridisation (e.g. with Greylag Geese *Anser anser* and Canada Geese *Branta canadensis*) is not uncommon (Blair *et al.* 2000).

Italy

First recorded in 1969, ten sub-populations have occurred in ten provinces, in three of which successful breeding has been recorded (Blair *et al.* 2000).

The Netherlands

From a single breeding pair in 1973–77 the number had risen by 1992–94 to between six and 11, and Lensink (1998a) includes the species among those expected to become definitely established in the near future. The population is unknown, but seems to be slowly increasing in the floodplains and marshes.

Ukraine

Bar-headed Geese have existed for several decades in the Ascania-Nova Reserve, where they breed occasionally (Blair *et al.* 2000).

Future trends: Blair *et al.* (2000: 32) predict that 'if it can assemble several flocks or semi-colonies large enough to stimulate breeding behaviour, then [the] Bar-headed Goose will begin to emulate [the] Canada Goose in Europe'.

Snow Goose
Anser caerulescens

Natural Range: NE Siberia, N Alaska and NW Canada, wintering in S USA, N Mexico, and Japan. Also NE Canada and NW Greenland, wintering in NE USA.

Naturalised Range: Europe: British Isles.

British Isles

According to Blair *et al.* (2000: 62), Britain has over 250 'very under recorded' Snow Geese living in the wild, of which around ten pairs breed annually, 'mostly among a small but probably self-sustaining population'. For the last 20 years or so this breeding population of 30–50 birds, derived from a former avicultural collection, has existed in northwestern Mull and on the neighbouring island of Coll, Argyll, in the Inner Hebrides of western Scotland (M. A. Ogilvie, pers. comm. 2004).

In 1991, Delany (1993) estimated the British population of Snow Geese to number 182, of which 40 occurred at Haunn on Mull, where six were blue morphs of the smaller nominate subspecies. A flock of 32 was established at the Linch Hill Leisure Park in Oxfordshire and another, of 22 adults of the larger *atlanticus* form, at Slimbridge in Gloucestershire. The only other report of *atlanticus* (six) came from Tankerness on Orkney, Scotland. In Norfolk there was a flock of 23 *caerulescens* on the Babingley River.

In addition to those on Mull, blue morphs were reported from Avon, the Isle of Wight, Greater London, Norfolk and Kent. Snow Geese of unspecified race were observed in Leicestershire, Bedfordshire, Cumbria, Anglesey, Dorset, Dumfries & Galloway, Kent, Norfolk, Oxfordshire and Hampshire. Delany (1993) reported successful breeding only at Haunn on Mull (where 14 out of the 40 birds seen were juveniles); on the Babingley River in Norfolk; at Radwell gravel-pit in Bedfordshire; and at Stratfield Saye in Hampshire.

Fifty Snow Geese were seen in Sandringham Park, Norfolk, in the spring of 1996 but no breeding was recorded; breeding was only reported on Coll (Ogilvie & RBBP 1999). In 1997 at least 49 Snow Geese were counted on Coll, where there '… appears to be an apparently self-sustaining flock which has remained remarkably stable for the last 30 years or more [while] other introduced geese have managed steady increases' (Ogilvie & RBBP 1999: 474). In 1999 and 2000 breeding occurred in Hampshire and also on Coll and Mull, where up to 30 were seen in 1999 and 30–40 in 2000 (Ogilvie & RBBP 2001, 2002). Rowell *et al.* (2004) recorded a total of 86 Snow Geese in 2000, principally on Thamesmead Lakes in Greater London (22), at Eversley in Hampshire (13), on the University of York Lake in North Yorkshire (10), at Blenheim Park in Oxfordshire (9) and at Stratfield Saye (9).

Impact: 'This species can be aggressive when feeding or breeding as a group and has hybridised quite widely (with 11 Anatidae) among other geese. It is, therefore, potentially a local threat to indigenous waterbirds' (Blair *et al.* 2000: 62).

Swan Goose
Anser cygnoides

Natural Range: C Asia to SE Siberia and Mongolia; winters S to China.
Naturalised Range: Europe: ?Germany.

GERMANY
Gebhardt (1996) records the presence locally of a few breeding pairs which he says cause some ecological damage, but provides no further information.

Canada Goose
Branta canadensis

Natural Range: Breeds in the Bering, N Kuril, and Aleutian Is., and in much of mainland N America, wintering in Japan, SW Canada, and the USA S to Texas, and Mexico.
Naturalised Range: Europe: ?Austria; Belgium; British Isles; ?Bulgaria; Denmark; Finland; France; Germany; ?Italy; The Netherlands; Norway; ?Russia; Sweden; ?Ukraine. Australasia: New Zealand.

AUSTRIA
First recorded in 1979, the number of Canada Geese in Austria, most of which occur on reservoirs, has been estimated at around 50 individuals, with between two and five successful breeding pairs annually (Blair *et al.* 2000).

BELGIUM
Since the 1970s, when Symens (1988), quoted by Madsen & Andersson (1990), said the total population was 120 with only 15–18 breeding pairs, the number of Canada Geese in Belgium has increased to over 300 breeding pairs, with up to 2,000 wintering individuals. They are descended from birds that dispersed from Scandinavia, augmented by some that escaped from a waterfowl collection at Essen in Antwerpen. Introductions, mainly for sporting purposes, continue (Anselin & Geers 1994).

Impact: Hybridisation with Barnacle Geese *B. leucopsis*, Greater White-fronted Geese *Anser albifrons*, and Mallard *Anas platyrhynchos* has been recorded (Blair *et al.* 2000).

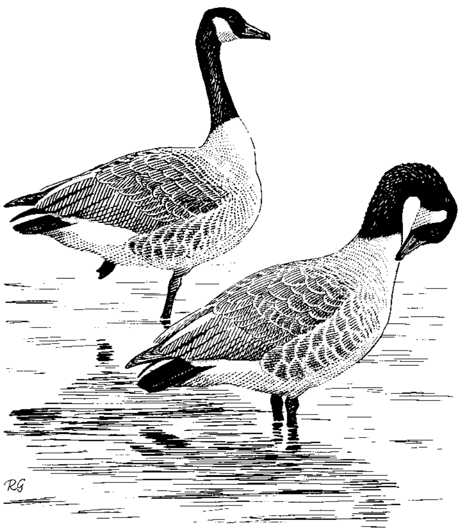
BRITISH ISLES
The earliest recorded reference to Canada Geese in Britain, by the diarist John Evelyn in 1665, describes birds in the collection of Charles II in St James's Park, London, where they were also noted before 1672 by Willughby and Ray in their *Ornithologia.* Kirby & Sjöberg (1997: 75) assert that introductions were made 'from *c.* 1650 …', but provide no evidence for this claim.

By the nineteenth century, Canada Geese were widely distributed on private estates throughout much of England and in parts of southern Scotland. Further introductions were made in England, Wales, and Ireland (Merne 1970) during the twentieth century, but it was not until the late 1930s that the species began to live predominantly in the wild.

In the 1950s and 1960s Canada Geese began increasingly to come into conflict with farmers, as a result of which the removal of birds to hitherto unoccupied areas was undertaken as a misguided form of control. This redistribution almost invariably resulted in the formation of new sub-populations, and the donor colonies soon resumed their former numbers. This policy of translocations was largely responsible for the general increase in numbers and distribution during the 1970s and 1980s, and Canada Geese became widely established in England (where they were most numerous), Scotland, Wales, and parts of Ireland.

According to Blair *et al.* (2000), Canada Geese were first introduced to Northern Ireland in the early 1800s, from when they later spread south into the Republic, although most of the 23 current breeding sites are in Northern Ireland. The increase in numbers and distribution is slower than in Great Britain, though stocking continues for sporting purposes. Over 530 of the total population of 970 birds occur on only eight sites.

Between 1953 and 1969 the Canada Goose population in Britain rose from between 2,200 and 4,000 to 10,500; by 1976 the total had nearly doubled to 19,400 (Ogilvie 1977), and by around 1990 had reached over 59,000. Delany (1993) recorded the summer 1991 post-breeding population at 63,581; by the late 1990s the population was estimated by Kirby & Sjöberg at 30,000 breeding pairs, while Blair *et al.* (2000) gave a figure of 20,000 breeding pairs with a post-breeding total of 80,000 birds. The 2000 total given by Rowell *et al.* (2004) was 54,587.



Canada Geese

The principal reasons for the successful naturalisation of the Canada Goose in Britain are the existence of a near-vacant ecological niche for a large aquatic bird that breeds on waters in open woodland and parks (where its only competitor is the Mute Swan *Cygnus olor*), the availability of new habitats and the birds' abandonment of the instinct to migrate. Since 1947, however, a moult migration of some 500km to the Beauly Firth in Scotland, similar to those that occur in parts of North America, has evolved among non-breeding adults of central Yorkshire (Dennis 1964).

The principal form introduced to the British Isles (and continental Europe) is believed to be the nominate *B. c. canadensis*, which occurs naturally in eastern North America.

Impact: The ecological impact of *B. canadensis* in Britain has been considerable. In cities and towns large numbers of birds on small park ponds cause water pollution, eutrophication, and the soiling of areas open to the public; thus causing a health hazard. The pollution of reservoirs, the fouling of golf courses and posing a danger to air traffic have been recorded (Allan *et al.* 1995, Watola *et al.* 1996, Rehfisch *et al.* 2002). Because the birds feed largely on agricultural land, increasing crop damage is being reported; the birds graze and trample growing cereals, other crops, and pastures intended for domestic stock, and cause erosion and soil compaction. In late summer they can have a serious impact on unharvested crops. In natural habitats, such as reed-beds, damage can be caused by grazing and trampling (Madsen & Andersson 1990).

Although possible competition between *B. canadensis* and such native species as Greylag Geese *Anser anser* and Mute Swan *Cygnus olor* is of concern, there appears to be no evidence of a serious impact on any indigenous species. As in Belgium, hybridisation with Barnacle, Greylag, and semi-domesticated 'Chinese' Geese has been recorded, but is infrequent (Lever 1977), though in Ireland there have been more than 25 cases of hybridisation with *A. anser* (Blair *et al.* 2000). Some small waterbirds are occasionally killed or driven away, but the geese also give such birds early warning of potential predators, and by uprooting deeply submerged aquatic vegetation provide small dabbling ducks with an additional source of food (Blair *et al.* 2000).

There are indications that Canada Geese may be damaging sites of conservation importance by their destruction of bankside vegetation, the consequent reduction of nesting cover for other species, and the increasing eutrophication of waterbodies through deposition of excrement. The birds have also been reported to eat the young shoots and submerged rhizomes of the Common Reed *Phragmites australis*.

Various methods of control have been attempted, including shooting, the pricking or removal of eggs and their substitution with dummy eggs, electric fencing, bird-scarers, translocation, and the alteration of habitats to render them inimical to geese (Kirby *et al.* 1998), but none has been successful.

Bulgaria

Gabuzov (1990) says that a project is being considered for the introduction of Canada Geese to Bulgaria.

Denmark

Canada Geese from Scandinavia have for many years regularly wintered in Denmark, where in the 1930s unsuccessful attempts were made to establish them in the wild. However, Nummi & Pienmunne (1998) say that the species has since been successfully introduced to Denmark.

Finland

In the summer of 1960, 1963, 1964 or 1967 (accounts differ) goslings were imported from Sweden to Viksberg Manor, 50km east of Helsinki, where successful breeding on Lake Viksberg took place in 1966 (Nummi 1985, 1988). In the following year some juveniles migrated south, and in most years some have returned to Porvoo, east of Helsinki (Korhonen 1972). Since the 1960s, large numbers of Canada Geese have been introduced for sporting purposes to southern Finland (Vikberg & Moilanen 1985), from where the birds have spread north, most crossing the Baltic to winter in southern Fennoscandia (Madsen & Andersson 1990), where they also breed on coastal islands and on lakes (Heggberget 1991). In the late 1980s the number of breeding pairs was estimated by Madsen & Andersson (1990) at between 500 and 1,000 out of a total population of 2,000–3,000. Kirby & Sjöberg (1997) gave a population of up to 1,000 breeding pairs.

France

Delacour (1954) said that Canada Geese occurred in France only in semi-captivity or as occasional vagrants from Scandinavia. Blair *et al.* (2000), however, recorded a core population in northern France of some 20 breeding pairs plus more than 350 non-breeders, and said that since the 1970s increasing numbers are founding new sub-populations and that the species is regularly stocked for sporting purposes. Several hundred birds, mostly from Fennoscandia, arrive to winter among the resident population.

Germany

Recorded since the early 1900s and breeding since around 1955 (Niethammer 1963), the total population of Canada Geese in Germany has been estimated at a maximum of 1,000 breeding pairs (Kirby & Sjöberg 1997) and a further 3,000 non-breeders (Gebhardt 1996, Blair *et al.* 2000), of which 100 pairs and 400 other birds, plus 300 post-breeding juveniles, occur in Schleswig-Holstein. The birds' population and range is said to be increasing, assisted by irregular stocking for sporting purposes. Up to 30,000 birds, largely from Fennoscandia, winter in Germany (Blair *et al.* 2000).

Impact: Much hybridisation with other Anatidae has been recorded in parts of Germany (Gebhardt 1996; Simberloff 1996) including 500 instances with Greylag Geese. Gebhardt (1996) refers to economic damage to agricultural, vinicultural, horticultural and arboricultural crops, urban parks and landlocked waters.

Italy

Canada Geese have been recorded in Italy almost every year since 1969, mostly as vagrants, and there is now a small but apparently stable colony of about ten birds from which one pair regularly breeds successfully (Baccetti *et al.* 1997, Blair *et al.* 2000). The AOU (1998) claims that Canada Geese are also established in Sardinia.

The Netherlands

According to Lensink (1996), the Canada Goose has been breeding in The Netherlands since the 1950s (Blair *et al.* (2000) record the earliest occasion as in 1951), but until 1970 no viable population became established; in that year a few birds dispersed from a nearby site in Belgium and began breeding in south Holland, where in 1976 they were all shot. Since 1981, however, breeding flocks have become established in several localities (Lensink 1996). Although Lensink (1998) recorded only two to five breeding pairs between 1973 and 1977 and 68–108 pairs in 1992–94, Blair *et al.* (2000) say that by 1999 the number of breeding pairs had increased to at least 140, and that in winter the population, augmented by migrants from Fennoscandia, rises to at least 1,800 individuals.

Norway

The first Canada Geese in Norway were imported from North America, and perhaps also from Sweden, in 1936 by T. Røer, who released 11 at Nesodden, Oslo. These birds failed to become established. Between 1958 and 1972 a total of 112 were liberated in various localities (Lund 1963, Tangen 1974), as a result of which viable populations were established around Oslo and Trondheim. Subsequently, further releases were made in other localities (Myrberget 1976), and by 1984 the total number of breeding pairs was estimated at between 700 and 900 (Madsen & Andersson 1990), with a post-breeding population of 5,000–7,000 individuals (Nummi 1988). Most birds winter near their breeding grounds, though a few migrate to Sweden and Denmark (Myrberget 1976). The current Norwegian population is about 10,000, of which some 2,000 pairs breed annually (Blair *et al.* 2000).

Russia

The first major introduction of Canada Geese to Russia, for sporting purposes, took place in the 1980s, when a total of 70 birds (including 20 breeding pairs) were released in the Sea of Azov in Krasnodar Krai (Gabuzov *et al.* 1988, Gabuzov 1990). By 1989 many birds were breeding, and by the following year the total population was nearly 300, augmented by dispersers from Sweden (Medvedev 1992). Gabuzov (1990) reported plans for further introductions in Krasnodar and Stavropol Krais, in Rostov Oblast, in Lake Issyk-Kul (Kirgizia) and Kelifski Uzboi (Turkmenia). [See also under Ukraine].

Sweden

Canada Geese were first imported to Sweden from North America by Bengt Berg in 1930. Three years later Berg released some birds that had been bred in captivity at Kalmarsund in Blekinge, where they first nested in the wild; within a few years, helped by various translocations, they had colonised much of southern and central-southern Sweden, migrating in winter south to Denmark, Germany, France, The Netherlands, and Belgium. The Swedish population increased dramatically from 150 breeding pairs in 1960 to some 2,000 in 1970, with a total population of nearly 10,000 (Fabricius 1970; Tangen 1974). Fabricius (1983a, b) estimated the population to number around 50,000, with 5,000 breeding pairs. The late 1980s figures given by Madsen & Andersson (1990) were 3,000+ breeding pairs and a total population of 30,000–50,000 individuals. Kirby & Sjöberg (1997) give a figure of 5,000–10,000 breeding pairs, while Blair *et al.* (2000) give the same totals as Fabricius (1983a, b).

The Canada Goose's success in Sweden is attributed to the existence of a vacant ecological niche and to a favourable habitat and climate – the weather and the boreal forests of its native Laurentian shield in eastern Canada are very similar to those of the Fennoscandian shield in Scandinavia.

Impact: According to Blair *et al.* (2000), there have been occasions when Mute Swans *Cygnus* *olor* in Sweden have been intimidated by large numbers of Canada Geese into abandoning nesting sites as soon as their cygnets have hatched, and some hybridisation with Greylag Geese *Anser anser* and interspecific competition for nest sites has been reported.

Ukraine

Gabuzov (1990) said there were plans to introduce Canada Geese to the Ukraine, where Blair *et al.* (2000) state that for several decades they are said to have been breeding in the wild in the Ascania-Nova Reserve. The latter authors predict that by 2010 the Ukrainians (and perhaps also the Russians and Belarusians) may have succeeded in establishing fully naturalised populations which could spread eastward during the next 20 years to occupy similar habitats to those in the birds' native range: migrant populations might then winter on the Black and Caspian Seas, perhaps putting pressure on wintering Red-breasted Geese *B. ruficollis.*

Iceland

The AOU (1998) claims that Canada Geese have been introduced to, and are established in, Iceland.

Overall European Impact: The success of *B. canadensis* in Europe has been ascribed by Madsen & Andersson (1990) to a combination of factors: the introduction projects have been widespread and persistent; the birds have initially an exceptionally high rate of recruitment; and a vacant ecological niche exists in the form of cultivated lowland habitats with good nesting sites and an abundance of food. Studies in several countries show that the impact of *B. canadensis* on other waterbirds is mixed (Blair *et al.* 2000). The species is undoubtedly very aggressive to other birds of its own size or smaller during incubation and when the goslings are young. Canada Geese have been known to kill adult ducks and ducklings, Moorhens *Gallinula chloropus* and Common Coots *Fulica atra*, and their aggressive behaviour inhibits smaller waterfowl from seeking nesting sites. Huge aggregations of *B. canadensis* may prevent other waterbirds from using a large potential breeding area. On the other hand, the species' uprooting of submerged vegetation provides an additional source of food for dabbling ducks. When nesting in isolated pairs, Canada Geese goslings may be killed by Mute Swans *Cygnus olor*, that tend to be more hostile to goose than duck neighbours.

The main concern in Europe, however, is that the sheer size of the expanding *B. canadensis* population will not only affect autochthonous waterbirds but will also have a detrimental effect on wintering-grounds utilised by migrants, where eutrophication caused by the geese is changing the balance of plant and invertebrate communities, although the evidence so far is largely circumstantial (Allan *et al.* 1995).

Looking to the future, Blair *et al.* (2000) anticipate open shooting seasons being declared in many countries, and that research will probably show significant local economic and amenity damage, and some quantified human health risk. The Canada Goose may eventually extend its breeding range still further into central and southern Europe, where its likely impact could be very considerable.

New Zealand

In 1876 and 1879 the Wellington Acclimatisation Society (see Lever 1992) unsuccessfully released a total of 18 Canada Geese (Thomson 1922). In 1905, the New Zealand Government imported about 50 (believed to be *B. c. maxima*: south-central Canada) as potential game birds, which they distributed among the Southland, Otago, Canterbury, and Wellington Acclimatisation Societies, by whom they were released in various localities. Although by around 1915 Canada Geese were reported by Thomson (1922) to be established in several districts, in 1920 the Canterbury Society imported a further ten birds (probably *B. c. taverneri*: north-eastern Alaska and northern Canada). A decade later Canada Geese had apparently disappeared from North Island but were well established in Otago and Canterbury in South Island.

In 1950, Canada Geese of the nominate form were released near Canterbury (Oliver

1955), where the population of *maxima*, *taverneri* and possibly *moffitti* (southwestern Canada and northwestern USA) was already flourishing, and the national flock is now likely to be crosses of these races.

According to Heather & Robertson (1997: 261), Canada Geese are abundant '… in the eastern South Island from Marlborough to North Otago (especially on Lake Ellesmere) and common in drier tussock country of eastern Fiordland'. Since the 1970s, Canada Geese have become well established on North Island '… in the Waikato, Taupo-Ohakune area, northern Hawke's Bay, coastal Manawatu, and especially near Lake Wairarapa'. In the later 1980s the population was around 20,000; Heather & Robertson (1997) estimated the post-shooting population at about 50,000, of which 40,000 occurred in South Island; 10,000–15,000 winter on Lake Ellesmere. Heather & Robertson (1997) say that although in South Island most birds nest near high-country rivers and lakes, many adults and juveniles from the Marlborough interior to the MacKenzie Basin migrate to Lake Ellesmere and other coastal lakes and estuaries between November and February for the autumn moult, remaining for the winter until early September. In recent years, more birds have tended to remain in high-country lakes throughout the year, moulting on inland lakes, and some breed on such coastal lakes as Ellesmere and Forsyth. In North Island, most birds are resident on coastal lakes such as Whakaki Lagoons (near Wairoa) and Wairarapa. Vagrants have been reported from the Kermadec, Chatham, and Auckland Islands.

Impact: Canada Geese in New Zealand mainly eat grass (which domestic stock are then reluctant to use), clover, lucerne and brassicas, but they also sometimes feed on stubble or standing crops of grain and peas, when they can cause considerable damage. Control measures include sport shooting (up to 30,000 are shot annually), the shooting of flightless moulting birds and egg-destruction (Heather & Robertson 1997).

Barnacle Goose
Branta leucopsis

Natural Range: NE Greenland, S Varlbard, NW Russia and the Baltic region, wintering in NW Europe.

Naturalised Range: Europe: ?Austria; Belgium; British Isles; Finland; Germany; The Netherlands; Norway; Sweden.

Deliberate introductions of Barnacle Geese have been relatively few in number. Most of the following breeding populations may be derived from accidental releases or escapes.

Austria

Although the earliest record was in 1981, a small breeding population of between one and three pairs out of a total population of about 15 birds has been established only since 1997 (Blair *et al.* 2000).

Belgium

The first records of escaped birds date from 1983, and there are currently at least 50 breeding pairs in a total population of a minimum of 300 individuals (Blair *et al.* 2000).

Impact: Successful hybridisation has been recorded with Canada Geese *B. canadensis*, Greater White-fronted Geese *Anser albifrons* and Mallard *Anas platyrhynchos* (Blair *et al.* 2000).

British Isles

By the 1980s breeding pairs in Britain were 'already in high double figures' (Blair *et al.* 2000: 37). The current record of 30 breeding pairs at 17 localities (ponds, pools, flooded gravel pits) from over 900 resident birds at over 90 localities is an underestimate. Rowell *et al.* (2004) recorded a countrywide total in 2000 of 693, including 212 in Cumbria, 113 in Hampshire, 56 in Essex, 50 in Gloucestershire and 46 in Lancashire.

Finland

The slow rate of increase from 1980 to around

32 breeding pairs in 1998 is now showing signs of speeding up, as is happening elsewhere in Europe (Blair *et al.* 2000).

Germany

The best current assessment is of between 20 and 50 breeding pairs from a national population of around 500 birds, of which 25 pairs and a total population of about 50 individuals occur in Schleswig-Holstein. These birds are believed to be derived from deliberate releases and possibly from some natural dispersal from Gotland, Sweden (Blair *et al.* 2000).

Impact: Some hybridisation with Greylag Geese *Anser anser* has been recorded (Blair *et al.* 2000).

The Netherlands

With a breeding population between 1992 and 1994 of 40–81 pairs, Lensink (1996, 1998a: 7) lists *B. leucopsis* as one of the exotic species 'established definitely' in The Netherlands. According to Blair *et al.* (2000), the earliest recorded escape took place in 1987, and the current population numbers about 300 individuals.

Norway; Sweden

Although in Norway there have been numerous records of escapes from captivity since the 1940s, in 1998 only 35 breeding pairs were recorded (Blair *et al.* 2000). Nummi & Pienmunne (1998) list *B. leucopsis* as also successfully introduced to Sweden.

Summary: The slow increase in numbers of naturalised Barnacle Geese in Europe will probably continue until a critical population size and density are reached, perhaps by 2015, when the birds may spread to other countries. Although *B. leucopsis* could develop into a pest species and will probably contribute to the eutrophication of small waterbodies, thus indirectly affecting other waterbirds, it is unlikely, except locally, to impact directly on other waterbird species (Blair *et al.* 2000).

Black Swan
Cygnus atratus

Natural Range: S Australia and Tasmania.
Naturalised Range: Europe: ?British Isles; ?Germany; ?Italy; ?The Netherlands; ?Spain. Australasia: New Zealand.

British Isles

Black Swans were first introduced to England in 1791, though the earliest record for successful breeding in the wild was not until 1902, since when breeding has been intermittent (Blair *et al.* 2000). Allard (1999), however, records the presence of a recently established population in the Broadlands of east Norfolk (where they were first recorded before 1980), centred on Salthouse Broad and the River Bure at Wroxham, and to a lesser extent on the Trinity Broads. A pair bred at Walcott in 1989, when at least one pair was nesting regularly, though not always successfully, at Salthouse Broad. By 1994 there were at least three breeding pairs in the Salthouse–Wroxham area, and a further pair raised five cygnets at Waxham. Since then the birds have been slowly expanding their range and numbers: they were estimated to total 20–40 individuals in 1998 (Allard 1999).

Ogilvie & RBBP (1999–2003) received reports of successful breeding from Cleveland, Devon, Essex, Greater Manchester, Northamptonshire, Sussex and Wiltshire in England, and from Lothian, Orkney and northeastern Scotland. Ogilvie & RBBP (2000: 429) say that in Essex, Lothian, Northamptonshire and Wiltshire, 'all four breeding records refer to well-established pairs'. The greatest number of breeding pairs was nine in 2001.

Germany

Black Swans have been known in the wild in Germany since 1963 (Gebhardt 1996) or 1969 (Blair *et al.* 2000), where the former says (p.206) there are 'locally [a] few breeding pairs'. The latter say the population and successful breeding rate fluctuate, partially depending on the harshness of the weather in winter; the present population is between 50 and 200 birds, but there are only from five to

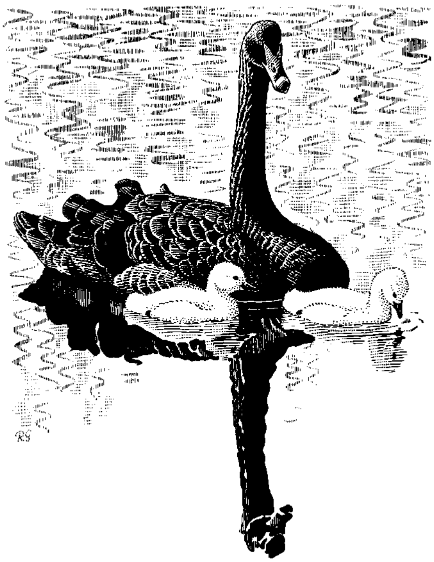
15 breeding pairs, mostly associated with parkland or urban wetlands.

Italy

Black Swans have been recorded in the wild in Italy since 1979, where in a good year up to five pairs breed successfully (Demartis & Murru 1995, Baccetti *et al.* 1997, Blair *et al.* 2000). Those that nest in natural wetlands tend to have a poor rate of success because they breed in winter (Blair *et al.* 2000).

The Netherlands

Black Swans have had a poor record of breeding in The Netherlands since they were first reported in 1978, with 25 pairs being the upper limit; the population and distribution appear to have been slowly increasing since 1988 (Lensink 1996), at least partially due to recruitment from numerous escapes in 1994 (Blair *et al.* 2000). According to Lensink (1996), the birds currently breed mainly in southwestern Holland and along central rivers. Lensink (1998) gives the 1992–94 number of breeding pairs as between 14 and 26, and lists the species as among those expected soon to become established.



Black Swan and chicks

Spain

J. Clavell (in Martí & del Moral 2003) reports that birds bred in the wild at two sites in northern Spain in 2002.

Potential European Impact: Blair *et al.* (2000) attribute the poor rate of successful breeding among Black Swans in the northern hemisphere to their inability to escape from the austral breeding cycle. Because in New Zealand breeding success seems dependent on flocks reaching a certain size, should that be achieved by European populations and should the birds relax their austral breeding cycle, Black Swans could soon become widely naturalised in Europe, where they could well displace many native waterbird species and would probably become an agricultural pest.

New Zealand

Although Blair *et al.* (2000: 25) claim that 'the New Zealand introductions started probably in the 18th century …', the earliest documented importation took place shortly before 1864 when seven birds were acquired by the Nelson Acclimatisation Society (see Lever 1992). In that year the Governor of New Zealand, Sir George Grey, presented four birds to the Canterbury Acclimatisation Society, and in 1865 13 pairs were obtained by the Christchurch City Council, which released them in the Avon River to clear the beds of alien Watercress *Nasturtium officinale* which were clogging up the river. The numbers of Black Swans increased dramatically, and in 1867 many birds dispersed to Lake Ellesmere, Marlborough, Otago and the west coast. (According to Heather & Robertson 1997: 260, '… it is likely that some also arrived naturally in 1867 …'). By 1880, up to 500 individuals were established on the Rivers Avon, Halswell and Heathcote, and within 15 years several thousand had colonised the estuary of the Opawa River in Marlborough.

Between 1866 and 1870 the Otago Acclimatisation Society released a total of 61 birds, and in 1869 half-a-dozen were released by the Southland Society. These liberations proved so successful that the birds soon spread throughout South Island from Stewart Island and the west coast sounds to Cook Strait.

Black Swans were first introduced to North Island in 1864 (Buller 1872) or 1867 (Thomson 1922), when the Auckland Society released four; by around 1912 their progress was said to be abundant on the Kaipara River and Kaipara Flats. Drummond (1906) said that Black Swans then occurred in thousands in many parts of New Zealand from the far north to the extreme south: they were abundant on the Chatham Islands before 1920 (Thomson 1922) and by the following decade they were widely distributed on both the main islands.

The largest and most important breeding site for Black Swans in New Zealand is Lake Ellesmere, southwest of Christchurch. From the early 1950s to the mid-1960s, when the national flock numbered around 100,000 birds (Heather & Robertson 1997), between 40,000 and 80,000 birds lived on Lake Ellesmere. Thereafter, for a variety of reasons, the population declined, and by 1968 had reached a nadir of only some 10,000. Since then it has recovered; Scott (1972) estimated the country-wide population at around 200,000, while Heather & Robertson (1997) judged it in 1981 to be 63,000, of which 3,000 were on Chatham Island. Druett (1983: 185) claimed that 'Today Lake Ellesmere has a black swan population in excess of seventy thousand birds' – the approximate total two decades previously.

Heather & Robertson (1997: 260) say that today the largest numbers of Black Swans in New Zealand occur '… on large lowland or coastal lakes and lagoons and on some estuaries, especially Kaipara Harbour, the lower Waikato valley, Hawke's Bay, Lake Wairarapa, Farewell Spit, Lake Ellesmere, coastal Otago and Southland, and Te Whanga Lagoon (Chatham Island). Good numbers are also found on some inland lakes such as those in the Rotorua district, Lake Taupo and Ashburton Lakes'.

Williams (1979) attributed the success of *Cygnus atratus* in New Zealand at least partially to the presence of an ecological niche left vacant after the extinction several centuries previously of the native New Zealand Swan *C. sumnerensis*.

Impact: Buller (1872), Drummond (1906), and Oliver (1930, 1955) were agreed that aggressive Black Swans were having a negative impact on native Pacific Ducks *Anas superciliosa* by harrying them and competing with them for food: Oliver (1930, 1955) adds that Black Swans harass the native Purple Swamphen *Porphyrio porphyrio*. They were, however, at least partially successful in reducing watercress beds in the Avon River.

In the early twentieth century Black Swans were a considerable agricultural pest, grazing and fouling grass and clover pastures and eating arable crops such as peas and grain (Heather & Robertson 1996). On the other hand, the population on Lake Ellesmere has been a commercially important natural resource, providing both food and sport.

Black Swans in New Zealand have been controlled mainly by shooting (especially of flightless moulting birds) and by pricking their eggs.

Mute Swan
Cygnus olor

Natural Range: From temperate Europe to C Asia, wintering in N Africa and India.

Naturalised Range: Europe: British Isles; continental Europe. Asia: Japan. Africa: ?South Africa. North America: Canada; USA. Australasia: Australia; New Zealand.

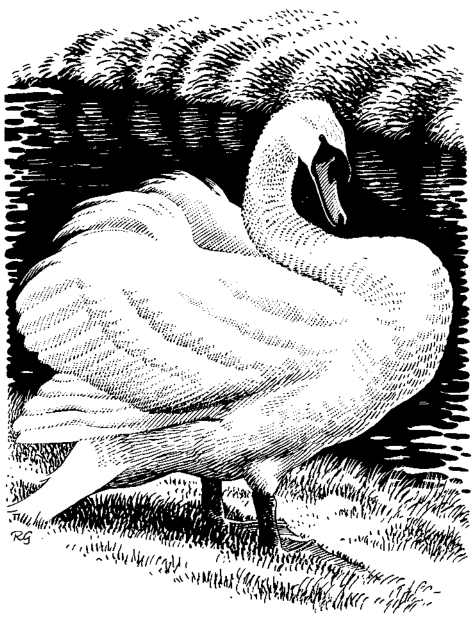
British Isles
The precise status of the Mute Swan in the British Isles (and in continental Europe) is equivocal. In England, where it was a native of parts of East Anglia (Cambridgeshire, Huntingdonshire, Lincolnshire, Norfolk and Suffolk) it became semi-domesticated before AD 1186, but began to revert to the wild again during the seventeenth or eighteenth centuries. Mute Swans are now widespread throughout the British Isles; the population numbers around 25,750 (Blair *et al.* 2000).

Continental Europe

To a lesser extent, Mute Swans also became semi-domesticated in continental Europe, where according to Madge & Burn (1988: 157), 'all populations [are] now more or less of domestic origin'. In Austria, for example, the present population of 140–320 breeding pairs, which is increasing, originates partially from reversions to the wild of the 1890s. The small but increasing population in Croatia is believed to be derived from the natural spread of birds from Hungary. In Finland, Mute Swans reverted to the wild in the Åland Islands in 1937 (Jensen 1982). In France, where the current population numbers 7,000, of which 2,000 are breeding pairs, feral Mute Swans were established around Paris as early as the late seventeenth century. In Germany, twentieth- century reversions and natural spread account for a breeding population of over 4,000 pairs (Blair *et al.* 2000). In Greece, where Mute Swans are said by Madge & Burn (1988) to have been domesticated in ancient times, the current small population derives from more recent reversions. The population of around 800 in northern Italy (e.g. Piemonte), where Mute Swans are said to have been originally domesticated by the Romans (Madge & Burn 1988), is descended from reversions mainly since the 1970s, and is slowly spreading south (Baccetti *et al.* 1997, Bertolino 1999). First reversions in Latvia, where the population is currently 4,000 in winter, with 500 breeding pairs, took place in 1935. Reversions in Luxembourg occurred prior to 1974 and the present stable breeding population is around 12–20 breeding pairs with 150 birds in winter. Reversions in Switzerland took place before 1895, and Mute Swans have since colonised all suitable waters, where between 450 and 600 pairs now breed annually, and where in winter the population reaches some 4,000 birds (Blair *et al.* 2000). Williamson (1970) records the successful importation in about 1940 of Mute Swans to Tørshavn and Vágur on Sudurey in the Danish Faeroe Islands. Nummi (1988) and Nummi & Pienmunne (1998) record the successful importation of Mute Swans to Norway and Sweden. Mute Swans have occurred in the Rhone–Alps region since the nineteenth century, when they were introduced for ornamental reasons (Michelot 1991). Mute Swans released in Almeria in 1993 have probably been responsible for records across southern Spain; others breed mainly in eastern Spain (J. Clavell in Martí & del Moral 2003, E. F. J. Garcia pers. comm. 2005).

Impact: In the British Isles and in mainland Europe Mute Swans kill adult and young waterbirds (especially geese), but by uprooting deeply submerged vegetation they provide an additional source of food for dabbling ducks. Through nesting close to Mute Swans, Great Crested Grebes *Podiceps cristatus* and Common Coots *Fulica atra* gain protection against potential predators from their strongly territorial neighbours. The only reported hybridisation in the wild by Mute Swans has been with Whooper Swans *C. cygnus* in Sweden. In France, habitat damage and eutrophication caused by Mute Swans adversely affects breeding colonies of Black Terns *Chlidonias niger* (Blair *et al.* 2000).

In the British Isles and in Europe, some damage is caused by Mute Swans overgrazing



Mute Swan

water-meadows and trampling and grazing new-sown leys and winter wheat.

Japan

In 1977, seven Mute Swans escaped from Onuma Park on southwestern Hokkaido, and in the following year began breeding at Utonai-ko, where by 1987 a population of 90 birds, including 15 breeding pairs, had become established. The species seems to be continuing to expand slowly on Hokkaido, where it has been recorded at Miya-numa, Taiki in Tokachi district and Ibaraki-ken. Elsewhere, around 50 Mute Swans breed on Koya-ike, Itami, near Osaka on Honshu, and pairs with cygnets are frequently recorded at Yunoko, Nikko in Tochigi-ken. The dispersal of cygnets from such breeding sites may account for the large populations on Ibaraki-ken and Osaka. Pairs have also been widely introduced on Honshu (Brazil 1991).

Today, Mute Swans occur on marshes and rivers in southwestern and southern Hokkaido, and on moats and lakes in major cities on Honshu and on lakes in Ibaraki-ken and Osaka. The total population numbers around 200 birds (Brazil 1984, 1991).

According to Blair *et al.* (2000), the population may be augmented by vagrants from Mongolia or Ussuri.

Impact: Mute Swans in Japan have been accused of overgrazing vegetation and of competing for food with native Whooper Swans *C. cygnus* and Tundra (or Bewick's) Swans *C. columbianus bewickii*, but the evidence is scant.

South Africa

From the 1950s to the 1980s a herd of between 40 and 60 Mute Swans was established near Humansdorp at the mouth of the Krom River (Siegfried 1962), but eventually died out. In 1966, some escaped birds formed a small population at Marina da Gamba in Western Province (Blair *et al.* 2000), where some are believed to survive.

Canada

Mute Swans that presumably dispersed from the United States breed locally in Canada in southern British Columbia and southern Ontario, and formerly in southern Saskatchewan (AOU 1998).

United States

Mute Swans were first released in the United States, in the state of New York, in the late nineteenth century. In 1910 and 1912 a total of 544 birds was imported from Europe, and by 1920 a number had escaped from captivity and had become established on the Lower Hudson River and on Long Island, New York. In 1941 some birds were released at Oakdale on Long Island, where by 1967 the population numbered around 700.

A herd near Akron, Ohio, which was wing-clipped annually from 1911 to 1934, was allowed to fly free in the latter year. By 1940 Mute Swans had established themselves along much of the northern coast of New Jersey, where by 1957 the population had increased to 118. On Rhode Island, Mute Swans were well established by the early 1950s (Allin *et al.* 1987).

From the above states Mute Swans soon dispersed to much of the eastern United States. The AOU (1998: 62) lists the species as breeding locally '… from northern Minnesota, northern Wisconsin, northern Michigan … central and south-eastern New York, and southern New England (east to Cape Cod), south to central Missouri, central Illinois, northern Indiana, northwestern Ohio and Virginia, also in southern Alabama'. This range includes Maine, Maryland, and Connecticut (Conover & Kania 1999). Johnston & Garrett (1999) claim that *C. olor* was successfully introduced to Oregon on the west coast where, however, it would seem it no longer occurs. Robbins (1995) indicates that wherever it is found the species is increasing.

Impact: Expanding populations of Mute Swans can have a detrimental effect on native biota. Their consumption of large quantities of aquatic vegetation such as *Potamogeton* and its associated macro-invertebrate community and their aggression towards other waterfowl is of major concern (Allin *et al.* 1987, Conover

& Kania 1994, 1999). The latter include wintering Trumpeter Swans *C. buccinator* and Tundra (or Bewick's) Swans *C. columbianus.*

Australia

The earliest recorded introduction of Mute Swans to Australia was in 1853, when four were acquired by the Melbourne Botanical Gardens, which a decade later placed a pair of their offspring on Phillip Island. In 1897 three pairs were landed at Perth in Western Australia, and were the ancestors of the small breeding population that became established at Northam on the Avon River. Semi-wild populations have occurred since before 1912 on a number of ornamental waters and on some rivers in the extreme south-west of Western Australia. Elsewhere, Mute Swans have occurred in the wild in southeastern Queensland, near Sydney in New South Wales, and in Tasmania (Tarr 1950), but they are at best only tenuously established in Australia and show no signs of spreading (Blair *et al.* 2000). Barrett *et al.* (2003) list a single recent record in Western Australia.

Impact: Wherever the two species come into contact in Western Australia, Mute Swans are said to compete with native Black Swans *C. atratus*, to the latter's disadvantage.

New Zealand

The first Mute Swans in New Zealand were a pair imported by the Canterbury Acclimatisation Society (see Lever 1992) in 1866 and some landed at Christchurch in the same year. These were followed by introductions between 1867 and 1871 to Auckland, Dunedin and Otago. Although Thomson (1922) found Mute Swans to be abundant in New Zealand, Oliver (1950) reported only a few small scattered populations. Falla *et al.* (1979) found a well-established breeding population of 50–70 on Lake Ellesmere, Canterbury, and between 12 and 20 on Lake Poukawa, Wanstead Lagoon, and other waters in central and southern Hawke's Bay. Heather & Robertson (1997: 259) say the species 'maintains a tenuous hold in the wild on wetlands in Hawke's Bay, North Canterbury and Lake Ellesmere. Some live in a semi-feral state in many town parks, such as Virginia Lake, Wanganui … *c.* 100 in the wild in the 1990s, *c.* 20 in Hawke's Bay, the rest in Canterbury'.

Egyptian Goose
Alopochen aegyptiaca

Natural Range: Sub-Saharan Africa. Formerly SE Europe.
Naturalised Range: Europe: Belgium; British Isles; ?France; Germany; Italy; The Netherlands; ?Romania. Asia: ?Israel; UAE.

Europe

Until the late seventeenth century (Venema 1997) or early eighteenth century (Blair *et al.* 2000) the Egyptian Goose was a regular breeder in the Danube Valley from southern Hungary downriver through Voyvodina to Romania.

Belgium

In 1975 some Egyptian Geese escaped from the Royal Gardens near Brussels (Devillers 1988), and within 20 years a population numbering between 100 and 150 pairs had become established, principally in the vicinity of Brussels and central Flanders (Anselin & Devos 1992). The present population of around 630 birds (excluding Wallonia, which comprises southern and eastern Belgium and neighbouring parts of France) includes at least 150 breeding pairs (only ten of which are in Wallonia). Although there is plenty of apparently suitable riverine habitat, flooded gravel pits are the most favoured nesting sites (Blair *et al.* 2000).

British Isles

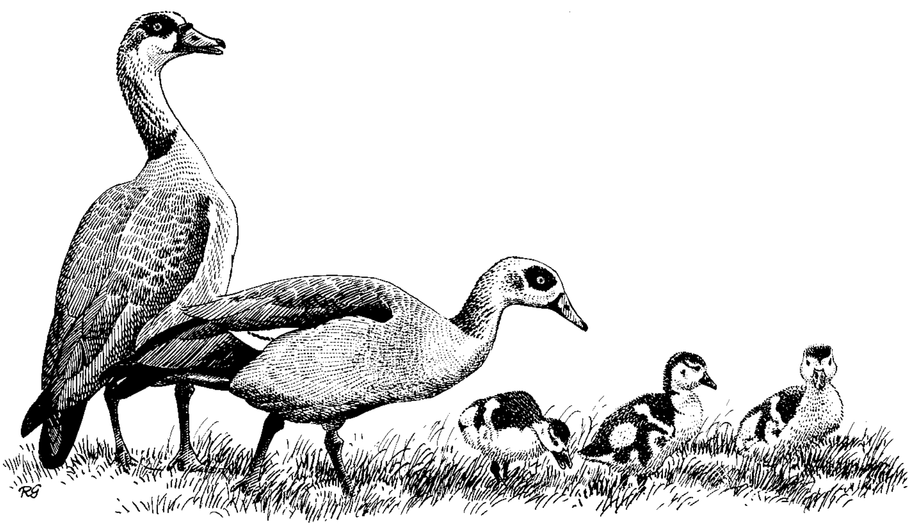
Egyptian Geese, some of which were imported from Africa (Venema 1997), were first introduced to England in the late seventeenth century, when they were in the collection of Charles II in St James's Park in London. During the nineteenth century full-winged birds became increasingly common on private estates, mostly in southern and eastern

England (mainly Norfolk), from where some dispersed to establish other colonies elsewhere (Fitter 1959). Northwest Norfolk, especially between Holkham and Beeston, and to a lesser extent the Bure Valley and the Broadland area of northeast Norfolk, are today the species' principal strongholds in England. Egyptian Geese are, however, spreading slowly south and west through the Breckland region of Suffolk, and breeding in Essex was first recorded in 1979, in Somerset in 1982, and in Cambridgeshire in 1988 (Venema 1997).

Sutherland & Allport (1991) estimated the British population in 1988 to number 400 adults. Within three years the figure had more than doubled to 906 (Delany 1993), 91% of which were in Norfolk, with the balance occurring in Berkshire, Cambridgeshire, Cleveland, Gloucestershire, Greater London, Hampshire, Leicestershire and Somerset, although away from Norfolk breeding was only recorded on Rutland Water in Leicestershire and at Lower Basildon on the Thames in Berkshire. Between 1996 and 2000 Ogilvie & RBBP (1999–2003) received reports of breeding Egyptian Geese in Berkshire, Buckinghamshire, Essex, Greater Manchester, Hertfordshire, Leicestershire, Norfolk, Northumberland, Nottinghamshire, Suffolk and Surrey.

Blair *et al.* (2000) estimated the population of Egyptian Geese in (southern) England to number 950 adults, while Rowell *et al.* (2004) in the same year (2000) found a total of only 575 at 43 sites, 16 of which were in Norfolk where 444 birds (77% of the total) were counted. In Suffolk 64 were found at seven sites. The species has bred successfully in both counties and on the River Thames in Berkshire. Elsewhere, Rowell *et al.* (2004) recorded Egyptian Geese in Buckinghamshire, Surrey, Greater London, Greater Manchester, Hampshire, Merseyside, Essex, Nottinghamshire, North Yorkshire and Cornwall. Estimates of the number of breeding pairs also varies widely: Ogilvie & RBBP (2000–2002) received reports of at least 85 pairs in 1999, 127 (2000), and 147 (2001), whereas Blair *et al.* (2000) give a total of some 300 breeding pairs.

The failure of Egyptian Geese to spread more rapidly in England suggests that climatic conditions may be merging on marginal; in The Netherlands, where range expansion has been much quicker, spring and summer temperatures are on average some 2°C higher than in eastern England (Blair *et al.* 2000). Goslings, which usually hatch in early spring when the weather can be cold and wet, are preyed on in Britain



Egyptian Geese

by Carrion Crows *Corvus corone* and other predators.

France

Blair *et al.* (2000) refer to a population of Egyptian Geese in northeast France where, however, they say (p.39) that the species 'is classed as a rare breeder'.

Germany

Although Gebhardt (1996) claims that Egyptian Geese were first introduced to Germany in the eighteenth century, Blair *et al.* (2000) say the first birds crossed the border from Holland along the Rivers Rhine and Eems (Lensink 1999) into Nordhein-Westfalen in the 1950s, when the core population comprised perhaps 150 breeding pairs. The present total German population is between 1,000 and 3,000 birds, including 200–400 breeding pairs spread thinly over six Länder (provinces), which suggests that the population has been augmented by more recent escapes or releases. Blair *et al.* (2000) believe it is only a matter of time before birds reach southern Germany and the upper Danube, which from Ulm eastwards has extensive patches of apparently suitable habitat.

Italy

Some migrant Egyptian Geese appear to winter in parts of Italy (Blair *et al.* 2000).

The Netherlands

Naturalised Egyptian Geese in The Netherlands date from about 1967, when six birds escaped from a park at Rijswijk: at about the same time a pair escaped from the Wassenaar Zoo, and these birds were the origin of the population that became established between Den Haag and Leiden, where breeding began in 1971. Other birds probably escaped elsewhere in Zuid Holland, and those in Gelderland, Noord Holland and Friesland are also likely to be descended from escaped birds (Eikhoudt 1973), as are birds occurring since 1981 in Drenthe (Lensink 1996).

Lensink (1988a) estimated the number of breeding pairs in 1973–77 at between 15 and 50, and by 1992 at 750–1,350 after the colonisation of many new localities (Lensink 1998b). Blair *et al.* (2000) said the total Dutch winter population was believed to exceed 6,000 individuals, with perhaps 1,400 breeding pairs.

The population of Egyptian Geese in The Netherlands is expanding rapidly, due at least in part to the vast network of drainage channels, many of which are bordered by trees and scrub which provide shelter and cover.

Romania

'There are a few records … but with low coverage and ample ideal habitat, it would scarcely be surprising if [the Egyptian Goose] has not already recolonised part of its original European range' (Blair *et al.* 2000: 40).

European Impact: The Egyptian Goose is not yet sufficiently numerous in its naturalised British or European range for any possible ecological impact to be assessed. In parts of its natural African range it is regarded as a considerable pest of arable crops. It shares the same habitat preferences with Mallards *Anas platyrhynchos* and Common Coots *Fulica atra*, with which it might compete. In South Africa and Namibia it has hybridised with native South African Shelducks *Tadorna cana*, though whether the offspring are viable is unknown (Blair *et al.* 2000). E. F. J. Garcia (pers. comm. 2005) has seen hybrids with Canada Geese *Branta canadensis* at Rutland Water, England.

Blair *et al.* (2000) consider that Egyptian Geese will probably have expanded their European range, especially in Germany and France, by 2015, when the population will probably exceed 20,000. If, say by 2010, populations have become established in Austria, Hungary, and Switzerland, the apparently migrant wintering population in Italy could rapidly increase, and the likelihood of a spread to its former natural range along the Danube and into the side valleys south of Hungary (e.g. in Croatia) seems probable.

Israel

'Wild-living birds have been seen near zoological centres and at fishponds from 1994 onwards. Breeding is suspected' (Blair *et al.* 2000: 38).

United Arab Emirates

A slowly increasing population of Egyptian Geese was established from 1976 to at least 1991 in at least three localities (Al Ain, Abu Abyad Island and Sir Bani Yas Island wetlands (Ain Al Fayda and adjacent islands)) and may still occur in some numbers on fish ponds, drainage pits and tidal mudflats (Blair *et al.* 2000). Richardson (1992) said that a census in 1989 revealed the presence of around 200 birds, while Blair *et al.* (2000) estimated an upper limit of 50 breeding pairs from a total population of 300. Richardson (1992) said that Egyptian Geese are seen regularly at Abu Dhabi's Western Road Lagoons, where they are probably now self-maintaining.

Ruddy Shelduck
Tadorna ferruginea

Natural Range: SE Europe, NW and NE Africa and SW and C Asia; winters in S Europe, N Africa, S and E Asia.

Naturalised Range: Europe: ?Austria; Belarus; ?Belgium; ?British Isles; ?Czech Republic; ?France; Germany; The Netherlands; ?Poland; Switzerland; ?Ukraine. Asia: ?Israel. North America: Canada; USA.

Free-living Ruddy Shelducks occurring in the wild in the following (and possibly other) European countries are mostly escapes from captivity (Madge & Burn 1988).

Austria

Those recorded on the River Inn are believed to be natural immigrants (Blair *et al.* 2000).

Belarus

The first record of breeding in the wild by escaped captive birds dates from 1997, but given the paucity of reporting breeding may well have occurred earlier (Blair *et al.* 2000).

Belgium

Present since the 1980s, the species reached a maximum population of around 20 birds but has since declined to about eight; occasional breeding is believed to have occurred (Blair *et al.* 2000).

British Isles

Since the 1950s there have been over 100 records, with occasional breeding of one to two pairs (Blair *et al.* 2000) including in Ireland (Hallman *et al.* 1997).

Czech Republic

Since the 1950s there have been intermittent records, but recently a small but apparently stable population seems to have become established near Prague zoo, possibly augmented by periodic escapes. Successful breeding has yet to be confirmed (Blair *et al.* 2000).

France

The earliest record dates from the 1980s, and breeding has subsequently been recorded in the national population of 20–30 birds. Recruitment from escapes is probably necessary to maintain numbers (Blair *et al.* 2000).

Germany

Records of escapes date from the 1950s; between eight and ten pairs breed in most years, and the population and range seems to be slightly increasing. Schleswig-Holstein has a sub-population of around 15 birds, including between one and three breeding pairs (Hallmann *et al.* 1997, Blair *et al.* 2000).

The Netherlands

In most years between seven and ten pairs (Hallmann *et al.* (1997: 82) say seven pairs in 1992 'with poor success') breed on marshes and small still waters, but given that winter counts have recorded up to 150 individuals in the Dutch Delta the number of breeders may well be higher (Blair *et al.* 2000).

Poland

Between 1981 and 1990 Wroclaw Zoo deliberately released a number of captive-reared broods which formed a small population from which at least one pair bred successfully from 1988 to 1990. This population appears no longer to exist, though some individuals may have dispersed to settle elsewhere (Blair *et al.* 2000).

Switzerland

The existence of fragmented areas of open montane forest may explain why Switzerland, where the species was first recorded as breeding in 1989, supports a population of 50–80 birds, of which between two and six pairs breed annually (Blair *et al.* 2000).

Impact: On at least one occasion hybridisation in the wild with alien South African Shelducks *T. cana* has been reported (Blair *et al.* 2000).

Ukraine

Ruddy Shelducks of captive origin have probably bred successfully in the wild on several occasions in the Ascania-Nova Reserve, where they have been present for several decades (Blair *et al.* 2000).

European Summary: 'The European total number [of breeding pairs] among escapes is significant in conservation terms .... Provided captive rearing has not robbed it of its migratory instinct, it should be able to ... avoid persistent harsh weather in winter, ... [and] there is a reasonable chance that the species will establish itself in the wild in Europe by 2015' (Blair *et al.* 2000: 42). This could be of some significance, given the decline in western wild populations (Madge & Burn 1988).

Israel

Since 1994 a number of birds of probably captive origin have been established on man-made waters near the Tel-Aviv zoo, where breeding has probably occurred on at least one occasion (Blair *et al.* 2000).

Canada; United States

Free-living escaped Ruddy Shelducks have been recorded in the wild in California, Iowa, Indiana, Ohio, Pennsylvania, Quebec, Rhode Island and Vermont, and from New Jersey south to Florida, but breeding has so far not been recorded (AOU 1998).

Muscovy Duck
Cairina moschata

Natural Range: From S Mexico to Peru and N Argentina.

Naturalised Range: Europe: ?Austria; British Isles; ?Germany; ?The Netherlands; ?Spain. Africa: ?Mauritania; ?Senegal; ?South Africa. North America: USA; West Indies. South America: ?Chile. Atlantic Ocean: ?Azores; Canary Is. Indian Ocean: ?Madagascar.

Muscovy Ducks were domesticated long before the New World became known to Europeans, and in common with many long-term domesticated birds the plumage of the *forma domestica* is predominantly white. It seems quite likely that the *forma domestica* was the first bird from the Americas to be introduced to Europe, perhaps by the early sixteenth century. Since then the species has been introduced as a domesticated bird virtually worldwide, but has been largely ignored in the wild by ornithologists, perhaps because it is generally regarded as 'farmyard poultry'. Some feral populations are, however, believed to be of long standing, since the Muscovy is both hardy and adaptable. Because of the apparent prejudice against it, there has been little study of feral Muscovy Ducks, and it is possible that the *forma domestica* is the most widely distributed of the world's exotic waterbirds (Blair *et al.* 2000). The paucity of the following records (all taken from Blair *et al.* 2000 except where indicated) reflects the lack of interest in the species by most ornithologists. Most figures are likely to be gross underestimates.

Austria

Muscovy Ducks have occurred in the wild since at least 1979. There are at present 14–20 breeding pairs from a population of over 100 individuals.

British Isles
From at least the early 1980s a colony of up to 50 Muscovy Ducks survived in the wild near Ely in Cambridgeshire. Between 1996 and 2001, Ogilvie & RBBP (1999–2003) recorded successful breeding in Bedfordshire, Cambridgeshire, Cheshire, Derbyshire, Devon, Dorset, Greater Manchester, Norfolk, Northumberland, Nottinghamshire, Suffolk and Surrey. In 1996 flocks of up to 75 birds were reported, and in the following year 99 were counted on Lothing Lake and Oulton Broad in Norfolk; 24 individuals were present at Ely in 1999 and up to 30 in 2001. In 1999, Muscovy Ducks occurred in the wild on shallow lakes, drainage channels, village ponds and reservoirs over much of northeastern, east-central, and southeastern England, where around 15 pairs bred annually from a total population of about 130 (Blair *et al.* 2000). Hybridisation with Mallard *Anas platyrhynchos* and feral *A. p. forma domestica* is not uncommon. Ogilvie & RBBP rightly say that Muscovy Ducks are not simply farmyard ducks and stress the need for full reporting.

Germany
The feral population, mostly from urban localities in Schleswig-Holstein, is believed to be between 50 and 100, of which there are perhaps one to ten breeding pairs.

The Netherlands
Muscovy Ducks have occurred in the wild since at least 1992; Blair *et al.* (2000) believe the number of breeding pairs exceeds the five to ten given by Lensink (1998a).

Spain
J. Clavell (In Martí & del Moral 2003) records Muscovy Ducks in the wild in Catalonia.

Mauritania
For several decades feral Muscovy Ducks have been present in Mauritania, but successful breeding in the wild is unconfirmed.

Senegal
A few birds have lived in the wild from time to time, but breeding has not been confirmed.

South Africa
It is believed that small numbers occur in the wild and that the population may be slowly increasing.

United States
At an apparently unrecorded date 101 Muscovy Ducks from Venezuela and Paraguay were released in various parts of Florida, where most, if not all, are believed to have fallen prey to Raccoons *Procyon lotor* (Bolen 1971). Domestic birds are locally common on ponds in Florida (Robbins 1995), where they hybridise freely with *forma domestica* Mallards *Anas platyrhyncos* (Robertson & Woolfenden 1992) and white farmyard 'Pekin' ducks, and also occur in the wild in natural wetlands or remote coastal areas (Stevenson & Anderson 1994). Muscovy Ducks have recently been declining in Dade County (James 1997). They also occur as feral or vagrant birds on the Rio Grande in Texas (Hidalgo, Starr, and Zapata Counties) (AOU 1998), where breeding was recorded in 1994 (Texas Ornithological Society 1995) and in San Patricio and Live Oak Counties of Texas, in the lower Rio Grande Valley. Individual feral birds are found widely throughout much of North America (AOU 1998, Sibley 2000), especially in other Gulf Coast localities.

West Indies
Muscovy Ducks are '… established from feral stock in Cuba' (AOU 1998: 65).

Chile
'Since this duck is frequently kept in captivity in Chile the Chilean records [in Talca and Curico] may represent feral individuals or populations that have originated from escapees, though deliberate introduction(s) cannot be ruled out' (Vuilleumier 1991: 335).

Azores
'Quite common as a farmyard duck, it is thought to live ferally on occasion' (Blair *et al.* 2000: 44).

Canary Islands
J. Clavell (in Martí & del Moral 2003) reports

the presence of Muscovy Ducks in the wild on most islands and occasional breeding.

MADAGASCAR
Since the 1890s Muscovy Ducks have lived ferally or at least in only loose association with man in Madagascar, where they have hybridised freely with feral/hybrid domesticated Mallard types *Anas platyrhynchos forma domestica*.

Impact: Concern has been expressed that Muscovy Ducks and *forma domestica* Mallards will soon hybridise, if they have not already done so, with the rare endemic Meller's Duck *A.melleri* in Madagascar.

Summary: Summing up the global status of feral Muscovy Ducks, Blair *et al.* (2000: 44) said: 'The Muscovy Duck occurs almost everywhere, but is seemingly invisible during wildfowl counts!'

Blair *et al.* (2000) surmised that in the African-Eurasian Waterbird Agreement area alone the population of feral Muscovy Ducks may exceed 10,000, and appealed for studies to be made of their biology and behaviour lest they eventually emerge as a pest species: their aggressive nature and bulk could enable them to dominate other waterbird species if large numbers were ever to become established.

Mandarin Duck
Aix galericulata

Natural Range: SE Siberia, Korea, E China and Japan: winters south of 40°N.
Naturalised Range: Europe: Austria; Belgium; British Isles; ?France; Germany; ?Italy; ?Luxembourg; The Netherlands; Poland; ?Romania; Sweden; Switzerland; ?Ukraine. North America: United States. Atlantic Ocean: ?Azores.

AUSTRIA
Present since at least 1981, Mandarins in Austria had by 1999 reached a population of 10–20 breeding pairs plus 50 other individuals (Blair *et al.* 2000).

BELGIUM
The earliest record of Mandarins in Belgium probably dates from before 1987. Estimates of the current population vary considerably; a national reckoning of only perhaps ten scattered individuals does not match up with another estimate of a stable 15 breeding pairs in the Brussels area alone (Blair *et al.* 2000).

BRITISH ISLES
The earliest record of a Mandarin Duck in Britain dates from before 1745. In the nineteenth and early twentieth century several attempts were made to establish the species in the wild in Britain, but the most successful were only of short duration. In 1928, however, Jean Delacour obtained a consignment of Mandarins from Hong Kong, from which he selected four or five pairs for his friend Alfred Ezra, who released them on his estate at Foxwarren Park near Cobham, Surrey; here the birds bred successfully and dispersed northwards into south Buckinghamshire and southwestern Middlesex, and east and west to northern Surrey and central Berkshire. Their success is attributed primarily to the fact that they were released into a near-ideal habitat with, importantly, a profusion of nut-bearing trees to provide an abundance of winter feeding.

The largest and most important population of free-flying Mandarins in Britain, which is believed to be largely descended from Ezra's birds, is centred on Virginia Water in Windsor Great Park on the Surrey/Berkshire border, from where by 1932 Mandarin were spreading to other waters both within and outside the park.

In 1935, Ronald and Noel Stevens successfully established a colony of free-flying Mandarins at Walcot Hall in Shropshire, and since the Second World War other populations have succeeded in becoming established in numerous places in England (especially in the southeast, south-centre and parts of the Midland counties), and also in Scotland; on the River Tay in Perthshire (where the 1984 post-breeding population numbered about 100), and since the 1970s on the Eye Water in Berwickshire. In 1996 up to six pairs bred at two places in the Loch Eck area of Argyll, and three pairs in Strathnairn in the Highland District. Since 1987 a population of between 20 and 30 Mandarins has been established on the Shimna River in County Down, Northern Ireland (Ogilvie & RBBP 1999).

In 1972 the British population was estimated to number over 250 pairs; by the mid-1970s Sharrock (1976) judged that it had risen to 300–400 pairs; by the middle of the following decade it may have been as high as 1,000 pairs (Davies 1985) and by the early 1990s it is believed to have exceeded 7,000 individuals. By the mid-1990s Mandarins were beginning to establish themselves in parts of Wales (Lever 2002). Because of their secretive nature it is likely that Mandarin populations are considerably under-recorded.

Bones discovered in Cromerian forest beds in Norfolk, England, seem to refer to *A. galericulata*, which indicates its presence in the Middle Pleistocene when there is evidence of the existence of suitable temperate oak woodland. For fuller details see Harrison (1988: 14–15).

Mandarin Ducks

France

The earliest record of Mandarin in the wild dates from 1977, but little is known about the current population. One public garden supports some 30 full-winged birds, yet the national population is said to number only 40–45 individuals, of which about ten pairs breed successfully (Blair *et al.* 2000).

Germany

The earliest records of free-flying Mandarin Ducks in Germany date from around 1900 (Gebhardt 1996) or 1968 (Blair *et al.* 2000). The principal source was Berlin, where O. Heinroth supervised releases in the 1920s in the central park (Großer Tiergarten) near the zoo (Witt 2003), where the present population of over 100 birds is self-maintaining (Blair *et al.* 2000). During the Second World War this project was abandoned, but by the 1950s the Großer Tiergarten was recolonised, and from here in the 1980s Mandarins started to disperse southwestwards, arriving in Potsdam around 1990 (Witt 2003).

Recent estimates suggest that not only is the Berlin population increasing, but that from a total of 500–1,500 birds between 100 and 200 pairs breed successfully (Blair *et al.* 2000), although Witt (2003) says that in winter the population is a minimum of only 400. The declining Schleswig-Holstein population comprises only 20–40 birds, but it seems possible that the extensive areas of apparently suitable habitat between Berlin and the Polish border will be more to the Mandarins' liking (Blair *et al.* 2000). Geissen (2001) refers to the occurrence of Mandarin Ducks in Koblenz. Reports from other parts of Germany suggest a national total of 250–370 breeding pairs.

Impact: Although Gebhardt (1996) lists the Mandarin as among those exotics that cause ecological damage in Germany, Witt (2003) says that it does not compete with other species and that steps to reduce the population would not be justified.

Italy
Although first reported as long ago as the 1940s and since recorded in 12 provinces, the present population is only a minimum of ten individuals (mostly in winter) (Blair *et al.* 2000), and breeding has not been confirmed. *Aix galericulata* is not mentioned by Bertolino (1999), and Baccetti *et al.* (1997) confirms its failure so far to become naturalised.

Luxembourg
About a dozen birds occur in spring in Luxembourg, and as-yet unconfirmed breeding has probably taken place (Blair *et al.* 2000).

The Netherlands
Present since 1964 (Blair *et al.* 2000), Mandarin Ducks first bred in The Netherlands, in coastal sand-dunes (an atypical habitat) near the Hague, in the early 1960s (Lensink 1996). In 1967 a pair nested along the eastern border of the Veluwe, where subsequently a significant population became established; small numbers of breeding birds are reported from a few other localities (Lensink 1996). Lensink (1998a) gave the 1973–77 population at three to eight breeding pairs, and that in 1992–94 at 48–61 pairs. Blair *et al.* (2000) say the current breeding population, which is increasing, amounts to around 80 pairs.

Poland
According to Langley (2004), there is a developing colony of Mandarins in Lazincki Park in Warsaw.

Romania
There are several records, but breeding is as yet unconfirmed, though the species is poorly recorded (Blair *et al.* 2000).

Sweden
Despite 23 records since 1992 there is so far no proof of breeding (Blair *et al.* 2000).

Switzerland
The earliest record of free-flying Mandarins in Switzerland dates from 1969; the present population of about 100, from which 10–15 pairs breed, is believed to be increasing (Blair *et al.* 2000).

Ukraine
Whether the small population established for the past two decades on the Ascania-Nova Reserve breeds successfully is unknown (Blair *et al.* 2000).

European Summary: Mandarin Ducks in Britain and Europe have lost the instinct to migrate, and have thus been able to become established in the wild without the distraction of the need for migration. This loss of the migratory instinct has, however, been a factor in inhibiting the species' spread in Britain and Europe, although in Britain and perhaps elsewhere there is a tendency to some seasonal dispersal in autumn (Lever 2002).

In recent years there does seem to have been a decline in the Mandarin population in parts of their British range; on Virginia Water in Windsor Great Park in England, for example, where a few years ago flocks of 40 Mandarin in winter were not uncommon, now flocks seldom exceed 10–15 birds (pers. obs.). This decline, if permanent and widespread, could be of serious conservation significance, since the British population alone still probably exceeds that in the whole of the Far East outside Japan. Fortunately, recent information suggests that numbers in Europe are considerably higher than previously recorded, and ringing would reveal if, as suspected, part of this scattered population has reacquired the instinct to migrate, and 'by 2010 a truly vigorous and self-sustaining population may become evident in several new locations in Europe' (Blair *et al.* 2000).

United States
Before 1972, when breeding was first recorded, a free-flying colony of Mandarin Ducks was established by Lawton L Shurtleff and Richard A. Cuneo at Vineburg and Walnut Creek on Indian Meadow Ranch in Sonoma County, north of San Francisco, California. Here, within six kilometres of

Calistoga, they share with the closely related and native Wood Duck *A. sponsa* an area of rough, rolling hills, heavily wooded with a variety of oaks, Madrone *Arbutus menziesii*, alders (*Alnus* spp.), willows (*Salix* spp.) and other species. Since the Mandarins are given supplementary feeding throughout the year they cannot be regarded as fully naturalised (AOU 1998), and without such artificial feeding might not survive. In 1987 the population of Mandarins in Sonoma County was estimated at around 550 birds (L. L. Shurtleff and R. A. Cuneo pers. comm. 1985, Small 1994, Shurtleff & Savage 1996). The birds continue to survive in the Calistoga area today (AOU 1998, Berner *et al.* 2003, L. L. Shurtleff and R. A. Cuneo pers. comm. 2004). Their principal predator is the Largemouth Bass *Micropterus salmoides*, a translocated game-fish (see Lever 1996a), which has taken a heavy toll of ducklings.

Azores

Free-flying Mandarins may exist in the Azores, although survival is difficult because of the absence of suitable waters (Blair *et al.* 2000).

Mallard

Anas platyrhynchos

Natural Range: An Holarctic species, ranging through Europe, Asia and N America; winters S to N Africa, India, and Mexico. Also Greenland and highlands of N and C Mexico.

Naturalised Range: Asia: ?Saudi Arabia. Africa: ?Mali; ?Namibia; South Africa. North America: West Indies. Australasia: Australia; New Zealand. Atlantic Ocean: Bermuda; ?Falkland Is. Indian Ocean: Madagascar; Mascarene Is. Pacific Ocean: Hawaiian Is; ?Lord Howe I; ?Macquarie I; ?Norfolk I.

Saudi Arabia

A colony of Mallard on sewage farm ponds near Riyadh since 1955 is believed to be descended from escaped or released captive stock (Blair *et al.* 2000).

Mali

In the 1990s a shifting population of fluctuating size of feral or semi-feral domestic type Mallard has been reported in Mali (Blair *et al.* 2000).

Namibia

Since 1996 up to ten breeding pairs of feral hybrid-type Mallard have nested in the Oanob artificial water storage dam in the semi-desert area of central Namibia (Blair *et al.* 2000).

South Africa

According to Siegfried (1970: 89), 'No definite information exists concerning the status of the Mallard in Southern Africa. It is known, however, that an increasing number of waterfowl fanciers are keeping exotic waterfowl on open waters and that at present live Mallards are being freely offered for sale by dealers. It may well be that the species has already succeeded in obtaining a foothold in the wild'. Blair *et al.* (2000: 49) say that from the original escapes 'probably before 1979' a population of perhaps 1,000 breeding pairs has become established in various localities; up to 200 breeding pairs of feral hybrid type Mallard have been recorded. Richardson *et al.* (2000: 330), quoting Cohen (1997), say that Mallard are 'apparently increasing locally in abundance in South Africa'.

Impact: According to J. Vincent (pers. comm. 1981), 'This is a species which is starting to be of some concern in a few isolated localities. … it has cross-bred with the indigenous African Yellowbill (*Anas undulata*) … the offspring are fertile'. Hybridisation has also occurred between Mallard and African Black Ducks *A. sparsa*.

Mallard in South Africa are controlled by shooting and the use of chloral hydrate baits (the latter allow the freeing of non-target species) and in some localities, such as the Ramsar site on the Orange River, Mallard have been almost eradicated (Blair *et al.* 2000).

West Indies

The AOU (1998: 68) says that Mallard are

'Introduced and established in the Virgin Islands', but provides no further details. Raffaele *et al.* (1998) say that Mallard occur in the Virgin Islands (St Croix) only as vagrants, but that in 1983 a flock was introduced to Grand Cayman.

Australia

The first Mallard introduced to Australia were six that were released on Phillip Island, Victoria, in 1866. In 1871–72 120 Mallard were placed on a lake in the Melbourne Botanical Gardens, Victoria, where they hybridised with the Pacific Black Duck *Anas superciliosa* (formerly the Australian Black Duck), before all but disappearing around the turn of the century.

Before 1912 Mallard were breeding in, and spreading from, ornamental waters around Perth in Western Australia, and eight years later they were established in several parks in the Metropolitan area.

Semi-domesticated Mallard now occur in numerous urban parks and gardens (especially in Sydney, New South Wales) and on some farm dams and swamps, particularly in southeastern Australia. In the wild, small numbers are found in southeastern South Australia, in southern New South Wales north to southern Queensland, and in Tasmania (Barrett *et al.* 2003).

Impact: In Australia naturalised *A. platyrhynchos* x native *A. superciliosa* hybrids are common, the dominant genes of the former soon obliterating the characteristics of the latter. Mallard in Australia have lost their instinct to migrate, and hybrids may not survive as well as the native species which disperses in times of drought. Hybridisation also occurs when semi-domesticated Mallard-type birds are introduced to farm dams and swamps occupied by *A. superciliosa* (Scott 1967, Weller 1969).

New Zealand

Table 9 lists introductions by acclimatisation societies of Mallard to New Zealand between 1867 and 1939. Although most, if not all, of the early importations were made with European stock, between about 1920 and 1940 many North American birds were imported and large scale breeding and release programmes took place. By the mid-1960s, Mallard were widespread and common on both North and South Islands and on Stewart Island, and occurred in small numbers on the Chatham Islands; they are also occasional vagrants on some more distant offshore islands, and may be breeding on Macquarie Island where they were first recorded in 1949 (Gwynn 1953). Since then, Mallard have colonised the Chatham, Antipodes, Snares, Auckland and Campbell Islands (Heather & Robertson 1997). The population, which disperses widely, was estimated in 1981 to number about five million and continued to grow until 1985, but has since declined to around three million (Heather & Robertson 1997) In most settled districts and on all lowland farms Mallard are the dominant New Zealand duck; only in the undeveloped back country, where no Mallard were ever released, is the indigenous Pacific Black Duck *A. s. superciliosa* more abundant.

Impact: As in Australia, Mallard and Pacific Black Ducks in New Zealand hybridise freely, the dominant genes of the former soon obliterating the latter's characteristics to such an extent that in some areas the alien appears to be replacing the native species (Sage 1958, Rhymer *et al.* 1994). Mallard graze on newly sown leys, and also eat grain, peas and beans, and cause considerable damage by trampling growing crops (Heather & Robertson 1997).

Hawaiian Islands

The status of Mallard in the Hawaiian Islands is equivocal. The AOU (1998: 68) says they are 'Introduced and established in the … Hawaiian Islands', whereas Pratt *et al.* (1987: 98) say they 'winter S to … occasionally the main Hawaiian Is. … some of these breed in a semiferal state on Kauai and Oahu'.

Impact: In the Hawaiian Islands hybridisation with *A. platyrhynchos* threatens the survival of the endemic Hawaiian Duck *A. wyvilliana* (Griffin *et al.* 1989), classified as Vulnerable by the World Conservation Union.

Macquarie, Lord Howe and Norfolk Islands

Mallard have been recorded on Macquarie, Lord Howe and Norfolk Islands (Barrett *et al.* 2003).

Madagascar

In the 1890s, and probably in the first few decades of the twentieth century, Mallard were introduced to Madagascar by French colonists, as also were domestic Mallard-type ducks, and it seems likely that today there is a shifting mixed population of feral and semi-feral birds (Blair *et al.* 2000).

Impact: Concern has been expressed that Mallard on Lake Alaotra may eventually hybridise, if they have not already done so, with the endemic and threatened Meller's Duck *A. melleri* (Blair *et al.* 2000).

Mascarene Islands

In 1979 37 Mallard were introduced to the Tamarind Falls reservoir on Mauritius (Staub 1993), where by 1995 the population had increased to around 50 and was beginning to spread to other reservoirs and to lakes and marshland on the plateau (Jones 1996).

Impact: Staub (1993) reported that Mallard had displaced the introduced Meller's Ducks *A. melleri* on the Tamarind Falls reservoir, although in captivity the two species do not readily hybridise (Jones 1996).

Bermuda

Free-flying Mallard in Bermuda are descended from domestic breeding stock imported in the 1950s and 1960s from the UnitedStates. Locally bred captive birds escaped or were released, and colonised such waters as Spittal and Warwick Ponds, and considerable numbers began breeding in the wild (D. B. Wingate 1973 and pers. comm. 1981, AOU 1998). The species also occurs as an uncommon vagrant (Raine 2003).

Falkland Islands

Since the 1930s semi-domesticated Mallard have occurred in small numbers in the Falkland Islands (Navas 1987).

Impact Worldwide: Summing up the ecological impact of Mallard around the world, Callaghan & Kirby (1996) and Simberloff (1996) said that they will eventually reduce or even eradicate the genotypes of Pacific Black Duck *A. s. superciliosa*, American Black Duck *A. rubripes* and Hawaiian Duck *A. wyvilliana*; in the longer term the Mexican Duck *A. p. diazi* and the Mottled Duck *A. fulvigula* may suffer the same fate. In addition to hybridising, Mallard compete for food and nesting sites with native species, cause eutrophication of water bodies and spread diseases.

TABLE 9 Introductions by acclimatisation societies of Mallard *Anas platyrhynchos* in New Zealand, 1867–1939.

Date	*Society*	*Locality*	*Number*
1867–96	Otago	Kakanui, Riverton, etc.	44+
1896	Southland	?	10
1870, 1886	Auckland	The Domain	6
1873, 1897	Canterbury	Botanic Gardens	12
1893	Wellington	Masterton, Wairarapa	19
1896–1916	Wellington	Manawatu, Rangitikei, Wairarapa	Several hundred
1898	Taranaki	?	?
After 1906	Taranaki	Lake Okareka	Flock of 200 became established
1910–18	Southland	?	1,350
1920–40	?	?	Large numbers from the USA
1939	Wellington	Manawatu, Rangitikei, etc.	500 eggs and large numbers of birds

Sources: Thomson 1922; Oliver 1930, 1955.

Meller's Duck
Anas melleri

Natural Range: E Madagascar.
Naturalised Range: Indian Ocean: Mascarene Is.

Mascarene Islands
In about 1850 Meller's Duck was introduced to Mauritius where it is restricted to Pinton du Milieu and Valetta Lakes and rivers on the high plateau, although in Madagascar it occurs in fast-flowing streams down to low elevations. On a number of occasions in the 1980s this population of up to 50 birds has been reinforced by others reared in captivity. It may well be at long-term risk through possible hybridisation with domestic variants of Mallards *A. platyrhynchos* and Muscovy Ducks *Cairina moschata* (Blair *et al.* 2000).

Since this is the only wild population of *A. melleri* outside Madagascar, it is of considerable conservation significance (Jones 1996). It is classified by the World Conservation Union as 'Lower Risk, near threatened'.

Northern Shoveler
Anas clypeata

Natural Range: Europe, Asia, and N America. Winters in N and E Africa, India, China, and Mexico.
Naturalised Range: Asia: Saudi Arabia.

Saudi Arabia
Possibly since the 1990s a small breeding population, believed to be derived from escapes, has been established on a sewage farm pond near Riyadh (Blair *et al.* 2000).

Red-crested Pochard
Netta rufina

Natural Range: C and S Europe, SW and C Asia, wintering in S Europe, N and NE Africa, and S Asia. In Europe the range is discontinuous.
Naturalised Range: Europe: British Isles; The Netherlands.

British Isles
'It was first recorded as an escape in 1900, and as breeding in the wild [in Lincolnshire] in 1937. Sporadic breeding probably became annual most years fairly soon after, and although around seven breeding pairs are recorded most years, the total is very probably higher, simply because of the species' peripatetic nature and the low level of interest in introduced birds. Over 150 individuals occur in winter counts' (Blair *et al.* 2000).

Between 1997 and 2001, Ogilvie & RBBP (1999–2003) received reports of successful breeding by Red-crested Pochards in Essex, Gloucestershire, Greater Manchester, Lincolnshire, Middlesex, Norfolk, Nottinghamshire, Oxfordshire, Surrey, Sussex and Wiltshire; the highest numbers of breeding pairs were six in 1998 and 2001, and seven in 1999. 'British nesting records probably all concern a population originating from escapes, although continental birds are known to visit' (Berndt 1997: 101).

The Netherlands
The status of *N. rufina* in The Netherlands as a native species or an exotic is uncertain, but the latter seems the more probable. The species was first recorded in 1973, and between that year and 1977 Lensink (1996, 1998a) estimated the breeding population to number 40–60 pairs. The current estimate of around 25 pairs (Lensink 1996, 1998a, Blair *et al.* 2000) represents a decline of some 50%, but this species is extremely secretive while nesting.

Ruddy Duck
Oxyura jamaicensis

Natural Range: Canada, the USA and the West Indies; winters S to N Mexico.
Naturalised Range: Europe: British Isles; ?Austria; ?Belgium; France; ?Iceland; ?Italy; ?The Netherlands; Spain; ?Sweden; ?Switzerland. Asia: ?Turkey. Africa: ?Morocco.

British Isles

Ruddy Ducks now established in the British Isles are the descendants of some that escaped from the then Wildfowl Trust's reserve at Slimbridge in Gloucestershire; the first two birds flew away in the winter of 1952–53, followed by about 20 more in 1957, and by 1963 a total of some 70 juveniles are believed to have escaped (Hudson 1976). Four juvenile males spent the winter of 1957–58 on Chew Valley Reservoir in Somerset, where in 1958– 59 they were joined by some females and where the first wild brood was observed in 1960 (King 1960).

In 1959 Ruddy Ducks began to appear on several waters in Staffordshire, where breeding on Gailey and Belvide Reservoirs took place in 1961, and from where the birds began to extend their range. Up to the mid-1980s, however, breeding numbers in Somerset and Gloucestershire remained low, the principal expansion in distribution and increase in numbers taking place in the west Midlands, where the birds spread to Shropshire (1965), Cheshire (1969–70), Worcestershire (1971), Leicestershire (1973), Warwickshire (1974) and Derbyshire (1975). In 1974 Ruddy Ducks bred for the first time in Northern Ireland (Lough Neagh), and in 1978 in Wales (Isle of Anglesey) and in Scotland. From three known breeding pairs countrywide in 1961 the number had increased to 35 by 1973. Hudson (1976) estimated the 1974 post-breeding population at a minimum of 250 individuals, including 45–50 breeding pairs; by the following year the totals had risen to 300–350 and 50–60 respectively; the total population increased to 380 (1976), 430–450 (1977), 770 (1978), and 1,570 (1981) (Vinicombe & Chandler 1982), an average annual rate of increase since 1978 of some 50%. An increase in mortality during the severe winter of 1981–82 was followed by a rapid recovery of the population to 1,800 by 1983–84; by 1991 some 570 pairs were breeding in Britain (Hughes & Grussu 1994). By 1997 the total population was around 3,600 birds (Hughes 1997).

In the early 1990s the stronghold of Ruddy Ducks in Britain remained in the Midland counties of England, but there were also major concentrations in Cheshire, Greater Manchester, Yorkshire and Anglesey; the species was also breeding regularly in Fife and on Tayside in Scotland, with perhaps 15–20 pairs nesting in Northern Ireland (Hughes 1997). The present Irish pre-breeding population in Ulster and Wexford (Langley 2004) numbers at least 130 individuals including 50–54 breeding pairs, and both range and population are increasing.

During the past 30–40 years the Ruddy Duck has shown one of the most explosive increases in population and distribution of any bird in Britain (Hughes 1993). This has been due largely to the availability of an abundance of suitable breeding habitats; little if any competition from native species; the fact that eggs and chicks have a high survival rate; brood parasitism by some females; and the ability to rear two broods per season (Hughes 1993). Flooding of nests and some predation seem to be the species' principal controlling factors.

A remarkable aspect of the Ruddy Duck's rapid colonisation of Britain has been the equally speedy development of a largely nocturnal and regular migration

Ruddy Duck

pattern, as in North America (cf. Canada Geese *Branta canadensis* and Mandarin Ducks *Aix galericulata*). Following the birds' late summer moult Ruddy Duck leave Cheshire, Shropshire and other major population centres, and disperse to lakes and reservoirs in Staffordshire and parts of Somerset (Avon). Unlike all other species of British wildfowl, Ruddy Ducks also have a complete pre-breeding moult in early spring (Vinicombe 1986).

Europe

Although many, if not most, records of Ruddy Duck in the Western Palaearctic are due to natural dispersal from the thriving British population, some are undoubtedly a result of local releases and/or escapes. As it is impossible to differentiate between the two, all are included in the following brief summary derived from Blair *et al.* (2000) and Hughes (2003).

Austria

Individuals have been recorded in the wild since the late 1990s.

Belgium

First reported in the 1980s, since when only about three birds are recorded annually.

France

Present in France since well before 1987. There is now a population of at least 50, including ten (perhaps many more) breeding pairs in the west on Lac Grand-Lieu (Langley 2004).

Iceland

First recorded in 1976. There are now some 10–15 individuals; breeding occurred for the first time in 1990.

Impact: Local persecution of Slavonian Grebes *Podiceps auritus* has been observed in Iceland.

Italy

First recorded in 1988; four individuals currently occur in two provinces.

The Netherlands

Present in small numbers since at least 1973; for 1973–77 and 1992–94 Lensink (1998a) records a maximum of two breeding pairs annually. However, around 80 birds winter in The Netherlands annually, with the majority dispersing – probably back to Britain – in spring.

Spain

The earliest occurrence of Ruddy Ducks in Spain was in 1973, and by the early 1990s more than 120 birds (excluding winter migrants but including *O. jamaicensis* x White-headed Duck *O. leucocephala* hybrids) were resident. A Onrubia and T Andrés (in Martí & del Moral 2003) record breeding by pure pairs and records from 21 provinces.

Sweden

Between 1976 and 1988 a total of 16 birds was recorded.

Switzerland

Between one and three birds are reported annually.

Turkey

First observed in the late 1980s; a hybrid with *O. leucocephala* was reported in 1988.

Morocco

Ruddy Ducks have occurred in small numbers (up to 17) in Morocco since 1992, where breeding was first recorded in 1994 and where Ruddy Duck x White-headed Duck *O. leucocephala* hybrids have been observed since 1999.

Impact: Ruddy Duck control in Morocco is complicated by the presence of a further two locally rare species (Red-knobbed Coot *Fulica cristata* and Marbled Teal *Marmaronetta angustirostris*) which necessitates great care when culling.

Impact Worldwide: Concern has been expressed about the potential impact on the native White-headed Duck (classified as Vulnerable by the World Conservation Union) through hybridisation with the naturalised Ruddy Duck in Spain and elsewhere. The former species breeds in small numbers in Europe in Spain, Romania, Hungary, Turkey and the former USSR; in Africa in Tunisia, Morocco, and perhaps Algeria; and in Asia in China. Some third-generation hybrids have been recorded; first- and second-generation hybrid back-crosses seem to be fertile and dominant but too few third-generation hybrids have been studied for meaningful results. The literature on whether or not to attempt to eradicate Ruddy Ducks in the Western Palaearctic (particularly in Britain, which is the source of most Palaearctic birds) in order to protect the local Spanish and other populations of White-headed Ducks is extensive, and the following references are only a selection from the past decade: Gantlett 1993, Green 1994, Department of the Environment, European Wildlife Division 1996, Hughes 1996, 2003, Perennou 1997, Persson & Urdiales 1997, Storkersen 1998, Hughes *et al.* 1999, Avery 2000, Goodwin 2000, Hughes *et al.* 2000, Lawson 2000, Walton 2001, Nummi 2002, Bear 2003, Smout 2003. The author considers such proposed eradication entirely unjustified (see e.g. Smout 2003).

PHOENICOPTERIDAE (FLAMINGOS)

Greater Flamingo
Phoenicopterus ruber

Natural Range: Caribbean coasts of C and S America and the West Indies; S Europe, C Asia, NW India, and N, E and S Africa.

Chilean Flamingo
Phoenicopterus chilensis

Natural Range: Peru and Uruguay to Tierra del Fuego.

Naturalised Range: Europe: Germany; The Netherlands. North America: USA.

Germany
Since the 1980s a mixed flock of escaped or released Greater Flamingos (some of which may be of the American subspecies *roseus*) and Chilean Flamingos have bred successfully at Zwillbrocker Venn near the Dutch border. Among about 160 birds some 10% are *ruber* with up to six breeding pairs: there are 10–20 breeding pairs of *chilensis*. When the weather is favourable breeding appears to be annual with occasional successful hybridisation. The role played by recruitment from further escapes in maintaining this apparently stable flock has not been ascertained (Gebhardt 1996, Blair *et al.* 2000).

The Netherlands
Flamingos (mainly *chilensis*) occur throughout the year, most, if not all, being wanderers from the German population. Winter counts of over 300 birds in the Dutch Delta and Ijsselmeer in some years suggest that the European population of both species may be much larger than realised (Blair *et al.* 2000). In 1992–94 Lensink (1998a) listed nine to 18 breeding pairs of *chilensis* and one or two pairs of *ruber*.

European Summary: Were the Chilean Flamingo, which is a hardier species than *P. ruber*, to become established in Europe in less marginal habitats and conditions than those in Germany and The Netherlands, it is likely to thrive when its numbers have reached the critical figure to stimulate successful reproduction, regardless of further recruitment (Blair *et al.* 2000).

United States
There are several deliberately released wild mixed flocks of *ruber* and *chilensis* Flamingos in the United States, the breeding status of which is uncertain. A flock of deliberately introduced *P. r. roseus*, dating perhaps from the 1950s, was established in the wild in Hialeah, Florida (Blake 1977), for some 30 years before apparently dispersing back to its normal Caribbean range (Blair *et al.* 2000).

THRESKIORNITHIDAE (IBISES AND SPOONBILLS)

Sacred Ibis
Threskiornis aethiopicus

Natural Range: Sub-Saharan Africa, Iraq, Aldabra I. and W Madagascar.
Naturalised Range: Europe: France; Italy; ?Spain. Asia: ?UAE. Atlantic Ocean: Canary Is.

France
Sacred Ibises were accidentally and/or deliberately introduced at Golfe de Morbihan on the coast of Brittany probably in the late 1970s or early 1980s. Initially the birds nested in occupied heronries, but as the number of Ibises grew the herons declined. For a time the Ibis colony apparently stabilised at around 40 breeding pairs, but after the establishment of a further colony at Lac Grand Lieu near Nantes the total population in 1993 was estimated at about 350 birds, and by 1999 the numbers had increased to over 1,000 individuals, with some 200 breeding pairs. New colonies continue to be formed, based on marshes, lake margins, and muddy coastal regions. The species is likely to continue to increase and spread in France (Blair *et al.* 2000). Langley (2004) recorded it in Morbihan in Loire-Atlantique, Briere, and Grandlieu.

Italy
Since 1989 or 1990 a small population containing around ten breeding pairs has been established at Lake Fiume Sesia in northwestern Italy, where breeding first occurred in 1994 and where in 1999 the population numbered 32. Sacred Ibises have been reported from five provinces and as probably nesting in most years in mixed heronries in two provinces in the northwest and northeast, where the population may be slowly increasing (Baccetti *et al.* 1997, Bertolino 1999, Blair *et al.* 2000).

Spain
J. Clavell (in Martí & del Moral 2003) records the presence of a wild colony in the grounds of Barcelona zoo since 1983.

Future Trends: Blair *et al.* (2000) considered that Sacred Ibises will probably attempt to establish colonies elsewhere in Europe (including possibly the British Isles) before 2015.

Potential Impact: If it becomes widely established in Europe, the Sacred Ibis may cause damage to seedlings of winter wheat. Its apparent dominance of heronries will have a local impact on Grey Herons *Ardea cinerea*, Little Egrets *Egretta garzetta*, and Night Herons *Nycticorax nycticorax* (Blair *et al.* 2000).

United Arab Emirates
Richardson (1992) recorded a free-flying population of around 300 based on al Ain zoo, with smaller numbers on Sir Bani Yas Island and perhaps elsewhere. Blair *et al.* (2000) said that between 1976 and 1991 up to ten pairs out of a population of 70 birds bred in wetlands at al Ain and on Sir Bani Yas Island (Ain al Fayda), but that the species' present status was unknown.

Canary Is.
J. Clavell (in Martí & del Moral 2003) says that breeding has occurred in the Canaries since 1997.

ARDEIDAE (HERONS, BITTERNS AND EGRETS)

Black-crowned Night Heron
Nycticorax nycticorax

Natural Range: C and S Europe (and N Africa) eastwards to E China and Japan, Taiwan, the Sunda Is. and the Philippines; winters in C Africa and SE Asia. Also from SE Canada to SW Peru, Chile, and SW Argentina, and the Hawaiian and Falkland Is.
Naturalised Range: Europe: British Isles.

British Isles
In 1950 some Black-crowned Night Herons of the North American race *hoactli* escaped from

Edinburgh zoo in Scotland, where five months later they were joined by the remainder of the captive colony which had been established since 1936. Dorward (1957) estimated the population in 1955 at 24, and by the early-1980s Young & Duffy (1984) judged it to be between 25 and 40. Since their escape the birds have regularly nested within the zoo grounds, where breeding has been recorded in every month except August and September when the adults are moulting. Insufficient food may account for the high (perhaps 50% or more) rate of fledgling mortality. Although the birds' main source of food has been from within the zoo grounds, some have flown up to 15–20km to feed on intertidal waters of the Firth of Forth and on the River Almond (H. G. Young and K. Duffy, pers. comm. 1983, 1985).

In 1997 Ogilvie & RBBP (1999) reported the presence of at least 30 birds in the zoo grounds, including five to ten breeding pairs; the total for the following year was estimated to be 35 individuals (Ogilvie & RBBP 2000). Ogilvie & RBBP (1999) were also informed that a free-flying colony of up to 30 Black-crowned Night Herons of the nominate European subspecies was established in Great Witchingham Park in Norfolk. The birds in Edinburgh zoo do not breed outside the zoo grounds, and both colonies are said to depend on supplementary feeding. Edinburgh zoo is apparently trying to reduce the number of its free-flying birds. According to Blair *et al.* (2000), both the above colonies seem to be stable or declining only slowly.

Cattle Egret
Bubulcus ibis

Natural Range: Originally only locally in SW Palaearctic, Ethiopian, and Oriental regions, including parts of N and tropical Africa, S Iberia, and SW Arabia sporadically E to S China and Japan, Taiwan and E Malaysia. Since the late 1870s (AOU 1998) the species has dramatically extended its range naturally in the Western Hemisphere (see Crosby 1972, Lever 1987).

Cattle Egret

Naturalised Range: Indian Ocean: Chagos Archipelago; ?Mascarene Is.; Seychelles Is. Pacific Ocean: Hawaiian Is.

Chagos Archipelago
In 1955 Captain Georges Lanier imported 12 Cattle Egrets from the Seychelles to the Chagos Archipelago to control insect pests (nine others may have been introduced two years previously), and by 1960 a colony of 27 nests had become established at Point Est on Diego Garcia (Bourne 1971).

Impact: If Cattle Egrets were to spread to other islands in the archipelago they might have a negative impact on colonially nesting seabirds.

Mascarene Islands
Cattle Egrets may have been successfully

introduced to the island of Rodrigues (Rountree *et al.* 1952).

Seychelles Islands

It is possible that Cattle Egrets were originally introduced to the Seychelles in the late nineteenth or early twentieth century. In 1960, some were released on Frégate and Praslin Islands to control insect pests, where they became well-established; they later spread to other islands in the group and also to the neighbouring Amirante Islands (Penny 1974).

Impact: On Frégate, Cattle Egrets prey on the eggs and chicks of White Terns *Gygis alba*, and may have affected the surviving population of the endemic Seychelles Magpie-robin *Copsychus sechellarum*, which is classified as Critically Endangered by the World Conservation Union. Other species, such as Sooty Terns *Sterna fuscata*, have been attacked on Bird Island (Feare 1979), and in the Amirantes Cattle Egrets preyed on nesting seabirds on Noeufs Island.

Hawaiian Islands

In 1959, 105 Cattle Egrets from Florida (Robbins 1995) were released on Kauai, Molokai, Maui, Oahu, and Hawaii where the first successful breeding occurred in the following year. In 1961 a further 48 Egrets were liberated on Oahu, where a year later the population was around 150 (Thistle 1962). Pratt *et al.* (1987: 89) said that Cattle Egrets were '… now abundant from Kauai to Hawaii. Rare visitor to NW Hawaiian Is. and Johnston Atoll, probably as strays from the main islands'. The AOU (1998: 44) records the species as '… established on most of the larger Hawaiian Islands, wandering to French Frigate Shoals and Midway'.

Impact: On Oahu, Cattle Egrets feed on Louisiana Red Crawfish *Procambarus clarkii*, whose burrows cause flooding by undermining embankments and irrigation ditches around taro and watercress paddies (Breese 1959). On Kauai, concern has been expressed that they might displace nesting Red-footed Boobies *Sula sula* in Kilanea Crater. Cattle Egrets were introduced to the Hawaiian Islands in an attempt to control flies that were damaging hides and causing lower weight gains in cattle (Breese 1959).

CATHARTIDAE (NEW WORLD VULTURES)

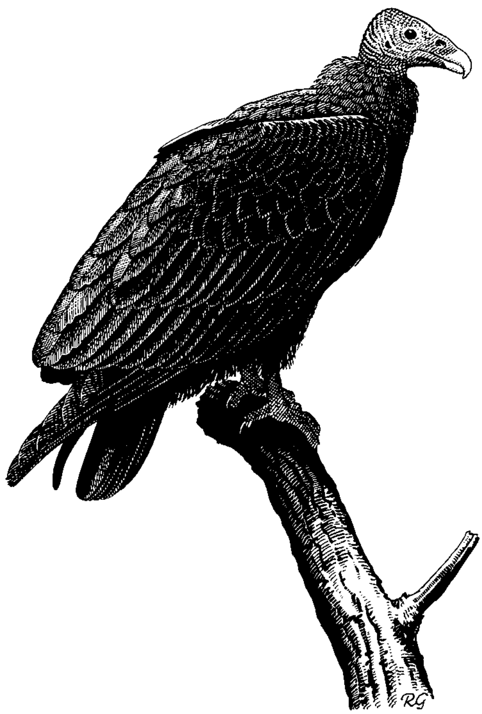
Turkey Vulture
Cathartes aura

Natural Range: From S Canada and the N USA, S through C America to Patagonia and the Falkland Is.

Naturalised Range: North America: West Indies.

West Indies

The status of the Turkey Vulture as a naturally occurring species or as an introduced exotic in



Turkey Vulture

parts of the West Indies is equivocal. According to Wetmore (1927), birds of the nominate subspecies (southern Canada to Costa Rica and Cuba) are said to have been introduced by Spanish government agencies from Cuba to Puerto Rico in about 1880, where they become established in the southwest, but increased only slowly. Wetmore (1927) estimated the population in 1912 at no more than 25; it had doubled a decade later. They occur mainly in open country and near large towns, probably as a result of the absence of Black Vultures *Coragyps atratus* which occupy these habitats on the mainland.

Turkey Vultures may also have been introduced to Hispaniola (after 1931) and, according to Blake (1975), to Grand Bahama.

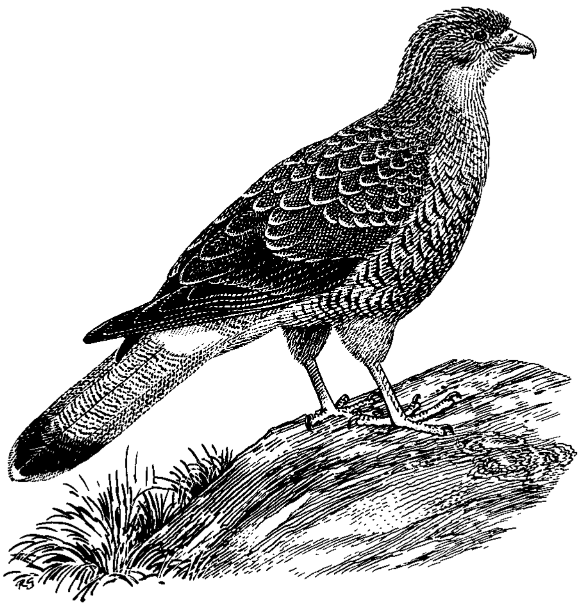
According to Bond (1979: 54) Turkey Vultures were 'introduced in Puerto Rico from Cuba (about 1880), and only recently established in Hispaniola, where now known from both the Dominican Republic and Haiti'. Raffaele *et al.* (1998: 248) say 'There is uncertainty as to whether or not Turkey Vulture was introduced to … Hispaniola and Puerto Rico or extended its range naturally'. The AOU (1998) lists the species as introduced to and established on Puerto Rico. All three authorities treat *C. aura* as a native or natural colonist elsewhere in the West Indies.

FALCONIDAE (FALCONS AND CARACARAS)

Chimango Caracara
Milvago chimango

Natural Range: From Paraguay and Uruguay to S Argentina, and from S Chile to Tierra del Fuego.
Naturalised Range: Pacific Ocean: Easter I.

Easter Island
In 1928 Chimango Caracaras (presumably of the form *C. m. temucoensis*) were introduced from mainland Chile to Easter Island in the South Pacific, where Harrison (1971) reported that although they numbered no more than about 50 they occurred over most of the island, where their presence was confirmed by Araya & Millie (1986).



Chimango Caracara

Impact: Harrison (1971) found that Chimango Caracaras were controlling the populations of two other alien species, the Chilean Tinamou *Nothoprocta perdicaria* which had been introduced in 1885, and the House Sparrow *Passer domesticus* which arrived from the Chilean mainland also in 1928. By preying on the young of colonially-nesting seabirds Caracaras have had a marked effect on such species as the Red-tailed Tropicbird *Phaethon rubricauda* and the Kermadec Petrel *Pterodroma neglecta*.

Chimango Caracaras also feed on insects associated with the faeces of domestic cattle *Bos 'taurus'* and domestic horses *Equus 'caballus'*. However, they also probe their hides for ticks, causing damage which not only injures the animals but also reduces the commercial value of the hides (Johnson *et al.* 1970). Caracaras are, however, efficient and useful scavengers.

ACCIPITRIDAE (SECRETARY BIRD, OSPREY, KITES, HAWKS AND EAGLES)

Western Marsh Harrier
Circus aeruginosus

Natural Range: Europe, NW Africa and the Middle East to C Asia, wintering in S Europe, Africa, and S Asia.
Naturalised Range: Pacific Ocean: Society Is. (with natural dispersal from Tahiti to other islands in Polynesia).

Society Islands

In 1883 or 1884 Western Marsh Harriers were introduced by the German Consul to control rats on Tahiti in the Society Islands. In the early 1900s the population was said to be low, but by the 1920s was apparently increasing and 50 years later the species was said to be abundant. On Tahiti, Marsh Harriers occur mainly in the mountains below 1,500m and on the plateau of the southwest coast, while on the neighbouring island of Moorea they frequent marshland near Papetoai and the central plateau. Throughout the Society Islands they hunt in a variety of habitats, including bracken-covered hills, montane forests, valleys, plantations, prairies, cultivated land around villages, and occasionally on beaches and rocky reefs (Holyoak 1974).

Holyoak and Thibault (1984) traced the natural dispersal of Western Marsh Harriers from Tahiti to other islands in Polynesia, where between the early 1920s and the early 1970s they became established on Bora-Bora, Huahine, Maupiti, Raiatea, Tahaa, Tetiaroa and Tupai. Pratt *et al.* (1987), who give the date of introduction to the Society Islands as 1885, say the species is common on Bora-Bora, Raiatea, Moorea, Tahiti and Tetiaroa.

Impact: Although rats and mice remain the main constituents of Marsh Harriers' diet in the Society Islands, their predation is believed to have at least contributed to the decline in Polynesia of the Grey-green Fruit Dove *Ptilinopus purpuratus*, the Pacific Imperial Pigeon *Ducula pacifica*, the Polynesian Imperial Pigeon *D. aurorae*, the White Tern *Gygis alba*, the Blue Lorikeet *Vini peruviana*, the Spot-billed Duck *Anas poecilorhyncha* and the

Western Marsh Harrier

Long-billed Reed Warbler *Acrocephalus caffer*. Seitre & Seitre (1992), however, considered that the possible extinction on Tahiti of *D. aurorae* could be due, at least in part, to hunting by man, while predation by Black Rats *Rattus rattus* (see Lever 1985) is more likely to be the principal cause of the decline of *V. peruviana* in the Society Islands and on Bora-Bora.

RALLIDAE (RAILS, WATER-HENS AND COOTS)

Weka
Gallirallus australis

Natural Range: New Zealand (North Is., South Is., Stewart Is.).

Naturalised Range: Pacific Ocean: Chatham Is., Macquarie I. Open Bay, Motunui, Jacky Lee, Big Solander, Codfish, Kapiti and Kawau Is.

Chatham Islands

According to Peters (1934), Wekas of the nominate subspecies (north and west South Island) were introduced to the Chatham group, but he provides no date. Atkinson & Bell (1973: 385), who say that two races formerly occurred on the islands, state that 'The Weka now on Chatham and Pitt Islands [south of Chatham] is the Buff Weka (*Gallirallus australis hectori*) of eastern South Island, which was introduced to the Chathams in 1905'. The birds have thrived in the Chatham Islands, where they became widely distributed.

Impact: Wekas, together with introduced feral Cats *Felis 'catus'* and Black Rats *Rattus rattus* (see Lever 1985) may be jeopardizing the survival of the endemic Chatham Island Magenta Petrel *Pterodroma magentae*, listed by the World Conservation Union as Critically Endangered.

Macquarie Island

According to Sir Walter Lowry Buller (quoted by Oliver 1955), Wekas may have been first introduced to Macquarie Island in 1830. The earliest documented importation, however, was made in 1867 by whalers and sealers who released Stewart Island Wekas *G. a. scotti* as a source of food. More, believed to have been of the nominate subspecies, were introduced between 1872 and 1879.

According to Brothers & Skira (1984), from whom much of the following is derived, most Wekas on Macquarie Island occurred in tussock grassland (*Poa foliosa* and *Stilbocarpa polaris*) on the coastal terraces, especially in the northwest, covering an area of some 50 sq km above sea level. A few birds were discovered in low coastal valleys up to 100m above sea level and one km inland, and a small number on the high plateau. Brothers & Skira (1984) estimated the population at up to 500.

Chick mortality of Wekas on the island appears to be high, the main predators being feral Cats *Felis catus* and Brown Skuas *Stercorarius antarcticus lonnbergi*, both of which also occasionally kill adult Wekas; some eggs may be taken by Black Rats. Although few introduced Rabbits *Oryctolagus cuniculus* are eaten by Wekas, introduced House Mice *Mus musculus* and Black Rats (see Lever 1985) may be important food items.

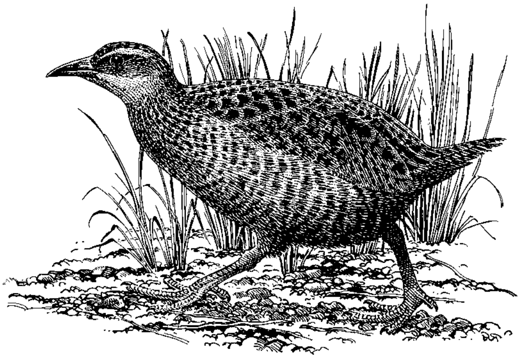
The comparative scarcity of Wekas on Macquarie until at least the 1880s has been attributed to a combination of their own low fecundity and predation by feral Cats. The population explosion that took place around 1890 is believed to have occurred following the introduction of Rabbits in 1870–80: the rapid increase and spread of Rabbits provided an alternative and easier source of food for Cats, and the Wekas' prospects were further enhanced by the abundance of burrow-nesting petrels and other birds as a readily available food source. The Weka population on Macquarie has tended to be highest when that of Rabbits is also greatest (both providing an easily accessible food for Cats) and in habitats inimical to both mammals. Thus, wherever there are few Rabbits, predation on Wekas by Cats is intensified. The introduction to Macquarie in 1978 of the European Rabbit Flea *Spilopsyllus cuniculi* as a vector of myxomatosis was followed by a decline in the Rabbit population and a corresponding increase in predation by Cats on Wekas, which Brothers & Skira (1984) reported to be then rare throughout the island.

Impact: Although Brothers & Skira (1984: 145) claim that 'the presence of Wekas on Macquarie Island for over a century has had a disastrous effect on the native fauna', it is hard to determine the individual roles played by Wekas, Rats and Cats in exterminating between 1880 and 1891 the endemic ground-nesting Red-fronted Parakeet *Cyanoramphus novaezeelandiae erythrotis* and, by 1894, the endemic race of the Buff-banded Rail *Gallirallus philippensis macquariensis*, and in extirpating from the main island such burrow-nesting species as the Blue Petrel *Halobaena caerulea*, Grey Petrel *Procellaria cinerea* and Common Diving Petrel *Pelecanoides urinatrix*, all of which breed on nearby terrestrial predator-free islets. Most reports tend to implicate Cats as the prime culprits, although Wekas do prey at times on Sooty Shearwaters *Puffinus griseus* and White-headed Petrels *Pterodroma lessoni*; Antarctic Prions *Pachyptila desolata* became restricted to the high plateau herbfield on Macquarie where Wekas are rare. (See also Cooper 1995).

Open Bay, Motunui, Jacky Lee, Big Solander, Codfish, Kapiti and Kawau Islands

In the early 1900s, Wekas from Stewart Island (*G. a. scotti*) were successfully introduced as a source of food for sealers and 'mutton-birders' (hunters of 'mutton birds': Short-tailed Shearwaters *Puffinus tenuirostris*) to all the above offshore islands of New Zealand (Atkinson & Bell 1973). Oliver records that *G. a. hectori* (eastern South Island) is believed to have been successfully introduced by Sir George Grey (then Governor of New Zealand) to Kawau Island in Hauraki Gulf in 1863.

Impact: On all these islands Wekas have been implicated in the predation of various burrow-nesting petrels, and also of the Buff-banded Rail, which is common on Weka-free



Weka

islands. By the late 1930s, Fairy Prions had considerably declined, allegedly due to predation of their chicks by Wekas, and Blackburn (1968) reported heavy Weka predation of Mottled Petrels *Pterodroma inexpectata* on Codfish Island, where they are presumed to have been responsible for the earlier eradication of a large colony of Cook's Petrels *P. cookii*. Miller (1999) says that the decline in numbers and distribution of the endemic Open Bay Islands Leech *Hirudobdella antipodum* may be due to predation by introduced Wekas.

Purple Swamphen
Porphyrio porphyrio

Natural Range: From SW Europe, NW Africa, and sub-Saharan Africa and Madagascar, eastwards to Thailand, Indochina and Yunnan. Also occurs on numerous Indonesian islands, the Philippines, New Guinea and its associated islands, Australia, New Zealand and many Pacific islands.
Naturalised Range: North America: USA.

United States

Pranty *et al.* (2000) have traced the origin, current status, and distribution of the Purple Swamphen in the United States. The species was first reported, at Pembroke Pines in south-central Broward County, Florida, in 1996 (Pranty & Schnitzius 1998). Successful breeding was recorded in 1997, and by early 1999 the population numbered at least 135 individuals. The birds are believed to be confined to five shallow artificial wetlands, in what was formerly a part of the Everglades, that have been planted with a variety of native trees and forbs. The population, which appears to be predominantly or solely *P. p. poliocephalus* (India to Yunnan and the Malay Peninsula), is believed to be derived from escapes from local aviculturists.

Potential Impact: Since Purple Swamphens in Pembroke Pines seem to breed throughout the year, and rear two or even three broods annually, it might be expected that they will soon begin to expand their range outside suburban Pembroke Pines; Pranty *et al.* (2000), however, considered that Swamphens were unlikely tocolonise native wetlands such as the Everglades, which are favoured by native Purple Gallinules *P. martinica*. On the other hand, in their native range Purple Swamphens have been known to disperse for up to 1,000km so they have the potential to colonise large parts of Florida.

Although mainly vegetarians, in their native range Swamphens also eat molluscs, fish, lizards, frogs, snakes, birds' eggs, nestlings and small adult birds; they also on occasion cause damage to grain and vegetable crops. No interaction with native species or economic damage has yet been reported in Florida.

PTEROCLIDIDAE (SANDGROUSE)

Chestnut-bellied Sandgrouse
Pterocles exustus

Natural Range: Africa: from Senegal, Gambia and Mauretania E to Sudan, Egypt (Nile Valley), Eritrea, Ethiopia, Somalia, Kenya and Tanzania. Also S and W Arabia, SE Iran, Pakistan, and India.
Naturalised Range: Pacific Ocean: Hawaiian Is.

Hawaiian Islands
Chestnut-bellied Sandgrouse of the Asian race *hindustan*, or according to Berger (1981) *erlangeri* from Saudi Arabia, were in 1961 released for sporting purposes on Hawaii, Molokai and Kauai, but only survived on Hawaii. These plantings of 395 birds were followed in 1962 by the liberation of a further 401 at Ahumoa, Puu Hualalai, Hale Laau and Pohakuloa on Hawaii (Paton *et al.* 1982), where Bump & Bohl (1964: 20) claimed the experiment was 'the most successful to date'. Between 1966 and the early 1980s various authors described the birds as having either disappeared or as being, at best, established but rare. A. J. Berger (pers. comm. 1985) wrote that 'a population estimated to be in the low hundreds [is] in the Waimea plains area of the island of Hawaii', where they occurred over an area of more than 250 sq km of pastures dominated by exotic herbs and grasses. Pratt *et al.* (1987: 188) said that Chestnut-bellied Sandgrouse were 'apparently established in the S Kohala District S and W of Waimea', where Pratt (1994) confirmed the birds' survival. The AOU (1998: 218) says the species is 'established … [in the] North Kona district of Hawaii'. The birds' principal limiting factor appears to be the generally lower temperatures of Waimea compared with those in their native range (Bump 1968).

COLUMBIDAE (DOVES AND PIGEONS)

Rock Dove (Feral Pigeon)
Columba livia

Natural Range: Originally confined to Palaearctic and Oriental regions, extending S into parts of the Ethiopian region.
Naturalised Range: The Rock Dove is the ancestor of the Feral Pigeon, which is now virtually cosmopolitan and whose distribution is confused by extensions of range through hybridisation with domestic stock. The following are the better documented

accounts of the species' introduction and present naturalised status throughout the world. (See also Johnston & Janiga 1995).

Europe: British Isles; European mainland. Asia. Africa. North America: Canada; Mexico; USA; West Indies. South America. Australasia: Australia; New Zealand. Atlantic Ocean: Bermuda; Cape Verde Is; St Helena I; South Georgia I. Indian Ocean: Andaman and Nicobar Is; Comoro Is; Madagascar; Mascarene Is; Seychelles Is. Pacific Ocean: Easter I; Galápagos Is; Hawaiian Is; Juan Fernandez I; Lord Howe I; Norfolk I; Polynesia.

British Isles

Feral Pigeons in the British Isles are the descendants of native Rock Doves that were probably first captured and domesticated by Neolithic man; some were subsequently released or escaped when meat became more readily available through improved methods of preservation and distribution. Exactly when this occurred is unknown but by the late fourteenth century Feral Pigeons were well established in London, and probably elsewhere.

Wherever Rock Doves and Feral Pigeons have come into contact they have tended to interbreed, and since the twentieth century they have occasionally been joined by lost racing pigeons. This interbreeding must have greatly influenced the genetic composition of many wild populations, and while urban and inland rural colonies of Feral Pigeons are entirely descended from released or escaped domesticated stock, many coastal communities are composed of hybrids, with few pure Rock Doves remaining (Fitter 1959).

Continental Europe

Rock Doves were domesticated in the eastern Mediterranean (perhaps first in Egypt) around 3000 BC. The history of their establishment on the European mainland is probably much the same as in the British Isles, starting perhaps in the eleventh century (Saari 1997). They are now widely distributed, mostly in urban inland localities, at least as far north as 70°N in Norway.

In Finland, Feral Pigeons are descended from courier birds introduced in the nineteenth century, which in the 1880s established wild populations in larger urban areas in the south (Saari 1997). In about 1900, Feral Pigeons were introduced to various parts of Finnish Lapland (Alapulli 1964), where they became permanently established only at Rovanimi – the northerly sites of Pelhosennimi, Sodentyta, Ivalo and Kemijarvi being occupied more briefly (the last-named until the First World War) – although stray courier or racing pigeons can be encountered almost anywhere in Finnish Lapland. Today, Feral Pigeons breed in all European countries, where large cities may support populations in excess of 100,000 birds and densities of 250 breeding pairs or more per square kilometre (Saari 1997).

Impact: Large numbers of Feral Pigeons in some European cities may well account for the recent urban increase of such predators as the Northern Goshawk *Accipiter gentilis* and Peregrine Falcon *Falco peregrinus* (Würfels 1994).

Asia

In Asia, Feral Pigeons occur to at least 90°E. They are common in much of southeast Asia, and are also found in Korea, Inner Mongolia, parts of China, Japan, Taiwan and Hainan. In Thailand, where they are believed to have been introduced many years ago from India, Feral Pigeons are widely established near human settlements. Populations in Korea, Manchuria and on Honshu (Japan) are probably descended almost exclusively from escaped or released domestic birds, while those elsewhere in China and in Mongolia may include a mixture of Rock Dove stock. In Malaysia, isolated populations occur in the Batu Caves north of Kuala Lumpur and in Selangor, and since about 1960 in Singapore (Goodwin 1970). In Japan, where the OSJ (2000) records the species in Hokkaido, Honshu, Sado, Shikoku, Kyushu and the Amami and Ryukyu Islands, Brazil (1991) says that as early as 1887 it ranged from Hokkaido to the Nansei Shoto.

Africa

Domesticated pigeons from Holland were first introduced to Cape Town, South Africa, in 1654 by the Governor, Jan van Riebeeck. Racing pigeons did not appear until the 1890s, when some were imported by the British for carrying despatches during the Boer War. From both of these sources birds must from time to time have escaped to the wild though, as elsewhere, when this took place is not recorded. Feral Pigeons are expanding both their population and range in South Africa (Brooke *et al.* 1986, Richardson *et al.* 2000).

In other countries in southern Africa, Brooke (1981) traced populations of Feral Pigeons in Angola, Mozambique, Zambia and Zimbabwe. Elsewhere on the continent, Feral Pigeons are found in northern Algeria, Morocco and Tunisia in northwest Africa; in most of Egypt and the northern Sudan (northeast Africa); and in west Africa in Benin, Chad, Ghana, Guinea, Niger, Nigeria, Sierra Leone and Togo.

Temperature appears unimportant in shaping the distribution of Feral Pigeons in Africa, where they occur in the warmest and coolest regions; nor are they apparently affected by the amount of precipitation or by drought. As commensals of man, their distribution seems to be almost entirely dependent only on the presence of human settlements that provide food, shelter and nesting-sites (Brooke 1997, Richardson *et al.* 2000).

Impact: *C. livia* is known to interbreed in captivity with the Speckled Pigeon *C. guinea.* Hybridisation and competition for food and nesting sites must be a possibility where the two species coexist in southern Africa.

Canada; Mexico; United States; West Indies

Domesticated pigeons were probably first imported to the United States by early settlers in 1621 (Schorger 1952), and their feral descendants are today widely established in close proximity to man throughout much of North and Central America from the central parts of the Canadian provinces southwards through Mexico, including Socorro Island (AOU 1998), into Central America.

In the West Indies, Bond (1979) recorded Feral Pigeons in Cuba, Jamaica, Puerto Rico, St Croix, Trinidad and Antigua (and probably elsewhere). Raffaele *et al.* (1998: 297) found *C. livia* in the West Indies to be 'common … in the northern Bahamas, Greater Antilles, the Virgin and Cayman Islands, and in most large towns in the Lesser Antilles. It is semi-feral and may be entirely feral, locally, on Puerto Rico and perhaps on other islands'.

In the western United States (e.g. in the Great Basin) and in high montane habitats the Feral Pigeon population is low, but the species is present throughout the year, albeit at low density, in central Utah, southwestern Wyoming, southeastern Colorado, and central montane New Mexico (Johnston & Garrett 1994). In the Channel Islands of California *C. livia* is only a transient visitor (Power 1994).

Schorger (1952) traced records of Feral Pigeons in Wisconsin and Illinois in the late 1700s, and Spiker (1933) recorded Rock Doves nesting in the wild in Iowa. In some parts of Colorado and Oregon, Feral Pigeons have reverted to living on cliffs away from man (James 1997).

In Canada, according to Marc Lescarbot, quoted by Saunders (1935), 'pigeons' were first introduced to New France by Poutrincourt in 1606; a few populations occur away from human settlements, e.g. in parts of the Okanagan Valley in British Columbia.

In Mexico, Feral Pigeons occur in many urban, and in some rural, habitats, but are scarce or absent in Yucatán and Campeche (Peterson & Chalif 1973).

In parts of North America many thousands of pigeons are still reared annually for homing and racing, and some of those birds that fail to 'home' supplement the feral population each year (Robbins 1995).

Impact: In the United States, Feral Pigeons in the Front Range in Colorado are a useful source of food to Peregrine Falcons *Falco peregrinus* that have been reintroduced to their former range (Johnston & Garrett 1994).

South America

Most large urban conurbations in South

America, especially those in the south, support colonies of Feral Pigeons (Goodwin 1970), whose range extends as far south as Tierra del Fuego in Chile and Argentina. Those in towns and villages of the Peruvian Andes, and on the coast, are said to be descended from birds imported by the Spanish conquistadors in the sixteenth century. The subspecies introduced to Argentina is the nominate *C. l. livia* from the western Mediterranean, central Europe and northern Africa.

In Chile, Feral Pigeons were not mentioned by Hellmayr (1932), though this may have been because of their semi-'domesticated' status. Philippi (1964) and Johnson (1967) both refer to the species' presence in the Juan Fernandez Islands but say nothing about its occurrence on the Chilean mainland. Araya & Millie (1968: 232), however, state that Feral Pigeons were then common 'in parks and gardens of our cities' but give no information on distribution other than to say that wild-type birds occur on Masatierra (Juan Fernandez Islands) and on the mainland at Vega del Chanaral. Sick (1968: 302) said that Feral Pigeons occurred 'in all towns' throughout South America (all quoted by Vuilleumier 1991).

Impact: In some Bolivian cities, *C. livia* is encroaching on the habitat of the native Eared Dove *Zenaida auriculata*, on which it may be having a negative impact.

Australia

Domestic pigeons were probably originally introduced to Australia by the First Fleet in 1788. The earliest recorded liberation was at Cape Liptrap in Victoria before 1873. Feral Pigeons are now established in many of the larger urban areas and in some suburban and rural ones over most of the continent (especially in the east and southeast), and according to Frith (1979) occasionally well away from human settlements – for example in the wheat-lands of Victoria.

Long (1981) traced the spread of Feral Pigeons in Western Australia, where they were probably introduced by the early settlers from Port Jackson, New South Wales, in 1825. They were sufficiently well-established on Rottnest Island by 1890 to be polluting the water supply. In 1951 they occurred in Perth and Fremantle, and a decade later were recorded on Garden Island and in various parts of the Perth metropolitan district.

Today, Feral Pigeons occur mainly in eastern Australia as far north as Queensland and south to Kangaroo Island, South Australia (where they were first recorded in 1967), southwestern Western Australia, and Tasmania (Barrett *et al.* 2003).

New Zealand

As in Australia, domestic pigeons were probably introduced to New Zealand by the early settlers, perhaps in the 1850s (Wodzicki 1965). By the mid-1950s Oliver (1955) found Feral Pigeons in most urban and rural districts throughout the country, and a decade later Wodzicki (1965) reported them to be common, though of restricted distribution, on both North and South Islands. Kinsky (1970) found Feral Pigeons to be most abundant in parts of Hawke's Bay, Marlborough, Canterbury, Otago and in all principal cities. In some places, Feral Pigeons have reverted to their Rock Dove ancestors' sea cliff habitat (Falla *et al.* 1979). Feral Pigeons in New Zealand are described by Heather & Robertson (1996: 259) as 'widespread and locally common'.

Bermuda

Domestic pigeons were first introduced to Bermuda in the early eighteenth century. Feral birds nest on some of the island's more precipitous coastal cliffs (Wingate 1973, pers. comm. 1991) and the species is now abundant in the islands (Raine 2003).

Impact: It is believed that the large numbers of Feral Pigeons breeding on Bermuda's cliffs have caused White-tailed Tropicbirds *Phaeton lepturus* to abandon some of their ancestral nesting sites (Raine 2003).

Cape Verde Islands

Escaped domestic pigeons are recorded as nesting on cliffs on São Nicolau and São Thiago before 1856 (Moseley 1879). The birds' survival is confirmed by Hazevoet (1995).

St Helena

The earliest report of domestic pigeons, introduced from Europe (Gosse 1938) and 'several parts of India' (D. F. Navarrete in Cummins 1962: 359), on the island of St Helena seems to have been by Odoardo Lopez in 1578 (Hartwell 1745). They were recorded again in 1599 by J. C. van Neck (Commelin 1646), and by various visitors to the island in the seventeenth and eighteenth centuries. By the early nineteenth century, Feral Pigeons were described as abundant on the island (Barnes 1817), and Mellis (1870) found them to be extremely common in both the wild and domestication. Carrier pigeons, kept by the military during the First World War, may have been released after the cessation of hostilities in 1918 (Haydock 1954).

Rowlands *et al.* (1998: 174–175), from whom the above references are derived, described Feral Pigeons on St Helena as:

> … common throughout the island apart from the most arid and most thickly wooded parts. Population at least 1000, with the largest numbers found on pastures, arable land and around settlements. A roost has existed for at least a century at Heart Shape Waterfall in James Valley and today contains 100s of birds … and 100s [roost] in the gorge leading to Prosperous Bay. … In 1997 abundant throughout the island.

South Georgia Island

Watson (1975) reported the presence of Feral Pigeons at the whaling station on South Georgia in 1968.

Andaman and Nicobar Islands

Kloss (1903) mentions an introduction of domestic pigeons in 1898 to Car Nicobar, where he saw numbers of them two years later. Abdulali (1967) says that Feral Pigeons were established around Nancowry on Camora Island in the Nicobars and also at Port Blair on South Andaman.

Comoro Islands

Hawkins & Safford (in prep) consider that *Columba livia* is not fully naturalised in the archipelago, but occurs on all four islands, with keepers in numerous villages and towns on Mayotte and Grand Comore; lesser numbers occur on Moheli and Anjouan (Louette 2004).

Madagascar

Feral Pigeons occur in settled localities throughout Madagascar (Morris & Hawkins 1998).

Mascarene Islands

Domesticated pigeons from Europe were probably first introduced to Mauritius in about 1715 by the French East India Company, and were originally restricted to the St Denis, Port Louis and Signal Mountain regions (Meinertzhagen 1912). They now occur mainly in parks, gardens, cultivated land and urban areas (Jones 1996), but also in montane areas and on sea cliffs, e.g. at Corps de Garde, Moka Range, Black River Gorges and Souillac (Hawkins & Safford in prep).

On Rodrigues, where Feral Pigeons were introduced sometime between 1874 and 1916, they are present in most urbanised areas and also nest on cliffs at Cascade Victoire and East Coast (Probst 1997, Showler 2002). In 1999, Showler (2002: 19) found them to be 'widespread but not common'.

Feral Pigeons were well established on Réunion by the 1860s (e.g. Maillard 1862), and today occur on sea cliffs and in inland ravines as well as in settled areas (Hawkins & Safford in prep).

Seychelles Islands

Feral Pigeons are found on the granitic islands of Mahé, Praslin, La Digue and Silhouette; their arrival may be fairly recent, since in the 1970s they were known only on Frégate. On Mahé the population greatly increased during the 1990s, from where if not controlled it is likely to spread (Skerrett *et al.* 2001).

Easter Island

Domesticated pigeons are believed to have been introduced to Easter Island in 1928, the same year as the Chimango Caracara *Milvago chimango* and House Sparrow *Passer domesticus.*

Galápagos Islands

Feral Pigeons were first recorded in the Galápagos Islands in 1972 or 1973 (Harmon *et al.* 1987). They have been reported on all the inhabited islands – Santa Cruz, Isabela, San Cristóbal and Floreana (C. A. Valle pers. comm. 1986). Although the species is not mentioned by Harris (1974), Swash & Still (2000: 86) say that Feral Pigeons are 'a fairly common, introduced resident occurring around human habitation'.

Impact: In the Galápagos Islands (and elsewhere) *C. livia* displays a high prevalence of *Trichomonas gallinae* and some evidence of cancer. The former is now found in the endemic Galápagos Dove *Zenaida galapagoensis* wherever Feral Pigeons occur (Harmon *et al.* 1987).

Hawaiian Islands

Domesticated pigeons were first introduced to the Hawaiian Islands in 1796 (Schwartz & Schwartz 1949). They were formerly abundant on all islands except Kauai but in the early twentieth century the population declined as a result of over-shooting, changing land-usage: which lessened their feeding range, and probably tapeworm infestation. Schwartz & Schwartz (1949) estimated the total population at around 2,550, of which 2,300 (90%) were on Hawaii, with about 100 each on Lanai and Molokai and 50 on Oahu. The birds roosted and nested throughout the year on sheltered coastal cliffs, in rocky gulches, and in collapsed lava tubes at up to 3,000m elevation on the slopes of Mauna Kea on Hawaii.

Peterson (1961) found Feral Pigeons locally on all the above islands and also on Midway, 2,000km to the northwest. The Hawaiian Audubon Society (1975) recorded the presence of Feral Pigeons also on Kauai and Maui, while Zeillemaker & Scott (1976) reported their occurrence on Oahu and Molokai (common); Kauai, Maui, and Hawaii (uncommon), and on Lanai (local and uncommon). Scott *et al.* (1986: 235) say that Feral Pigeons 'occur on all main islands and are well established in many urban areas'; this is confirmed by Pratt *et al.* (1987) and the AOU (1998).

Juan Fernandez Islands

Domestic pigeons were possibly introduced to the Juan Fernandez Islands by the first eponymous colonist in 1572. Philippi (1964: 96) said that Feral Pigeons occurred 'al estado completamente silvestre en la isla de Masatierra (Juan Fernandez)', and their presence is confirmed by Johnson (1967), Sick (1968: who says that only in Juan Fernandez in the South American region has *C. livia* reverted to its Rock Dove ancestors' wild habitat), Araya & Millie (1986) and Jaramillo *et al.* (2003).

Norfolk Island; Lord Howe Island

According to Smithers & Disney (1969), a few Feral Pigeons were established around buildings and in coastal caves on Norfolk Island. They have also been observed on Lord Howe Island (Barrett *et al.* 2003).

Polynesia

In eastern Polynesia, Feral Pigeons are established in the Cook, Society, Tubuai, Tuamotu, Gambier and Marquesas groups and have been on Tahiti since the early nineteenth century (Holyoak & Thibault 1984). In western Polynesia, the Feral Pigeon 'is not a recent arrival, for it was certainly present soon after the turn of the [twentieth] century and there is evidence that it may have first arrived with missionaries as early as the 1840s' (Watling 1982: 78). In Fiji, Feral Pigeons became locally common on all the larger islands; they were first noted in Samoa on Savaii in 1872.

As elsewhere, Feral Pigeons in Polynesia are centred on towns and villages, especially in Fiji, though some, e.g. in the Marquesas, have reverted to nesting on coastal cliffs. Populations that seem to be least dependent on man occur in the Gambier archipelago and the Marquesas (Holyoak & Thibault 1984).

Pratt *et al.* (1987: 189) say of Feral Pigeons in Polynesia that they 'can be expected almost anywhere in the Pacific, and have often been overlooked in the literature. Reported from Hawaii, Fiji, French Polynesia, Samoa, and Micronesia'.

Impact: Where the two species occur together in Polynesia, Holyoak & Thibault (1984) believed that Feral Pigeons may compete for nesting-sites with the native Blue Noddy *Procelsterna cerulea.*

Worldwide Impact: Research has shown that pigeons (among other species) are responsible for the spread of a number of diseases, including psittacosis or ornithosis, cryptococcal meningitis, histoplasmosis, toxoplasmosis and encephalitis, which are communicable to humans. Pigeons also damage and deface buildings with their droppings, weaken mortar by pecking at it for its lime content, block gutters, downpipes, and drains with nesting material, reduce the yield of agricultural crops (especially grain), and compete with domestic fowl for food. In some places Feral Pigeons have become a local hazard at airports.

Eurasian Collared Dove
Streptopelia decaocto

Natural Range: Originally probably confined to Afghanistan, India, Burma, Sri Lanka and Chinese Turkestan, from where many years ago it colonised naturally (and/or was perhaps introduced to) Iran. Thence it spread westwards to Turkey, possibly as early as the sixteenth century but certainly by the early 1700s. From Turkey the species expanded its range further west into mainland Europe, first arriving in England in 1952, and by the early 1970s most of continental Europe, apart from northern Scandinavia and the Iberian Peninsula, had been colonised. *S. decaocto* also invaded much of the Middle East and parts of North Africa, and is presently 'saturating the Iberian Peninsula' (Hengeveld 1997). The reasons for the species' dramatic range expansion have yet to be established.

Naturalised Range: Asia: Bahrain; Qatar; China; Japan. North America: USA; West Indies.

Bahrain; Qatar
Eurasian Collared Doves have for many years been imported as cage-birds from India and Iran to Bahrain and Qatar, where some were released in the 1960s and where the species subsequently became established in the wild. Since then the population has greatly increased, and *S. decaocto* is now one of the most numerous birds in Bahrain. Although the Eurasian Collared Doves' invasion of Arabia could be part of their natural range expansion, Hirschfeld & King (1992) suggest that they may well have been introduced to Arabia, since early breeding records in Bahrain coincide with reported releases.

China
According to Stresemann & Nowak (1958), with whom Goodwin (1970) agrees, *S. decaocto* was transported by man from India to northern China, where it escaped and spread into Mongolia, Manchuria, and North and South Korea. Vaurie (1961), however, considers that the species arrived in northeastern China naturally and/or by introductions from western Inner Mongolia and/or western China.

Japan
Eurasian Collared Doves from China were imported as cage-birds to Honshu in the eighteenth or early nineteenth century (certainly before about 1830), where they escaped and by 1875 had become established in the Kwanto region near Tokyo (Fisher 1953). By the 1980s they were confined to the Kanto Plain in Saitama where, however, they were said to be increasing (Brazil 1985), having previously almost died out due to over-shooting (Brazil 1991).

United States
Eurasian Collared Doves were probably introduced by man, or colonised naturally southeastern Florida from the Bahamas (where the species was introduced in 1974), in the late

1970s or early 1980s, where by 1982 they had formed a breeding colony in Dade County. In the following decade they spread north, initially along the Atlantic and Gulf coasts, and became established state-wide, from where they are 'rapidly colonising in North America' (Sibley 2000: 256). Populations that became established in Texas and North Carolina in the early 1990s may derive from Florida (Smith 1987, Stevenson & Anderson 1994, James 1997, Ramagosa & Labisky 2000).

According to the AOU (1998: 222) Eurasian Collared Doves are now:

> … common to abundant from the Tampa and Palm Beach areas south to Key West, breeding locally west to Destin in the Panhandle; also established locally in coastal Georgia, South Carolina, and southeastern Louisiana, occurring casually north to North Carolina (nesting 1995) and Pennsylvania, and west to southwestern Louisiana, Arkansas, and central and northwestern Texas (origin uncertain); a small population in southeastern Colorado is of uncertain origin.

Impact: In Pinellas County, Florida, *S. decaocto* is hybridising with a feral population of the Ringed Turtle Dove or Barbary Dove *S. risoria* (James 1997), a domesticated variety believed to be derived from the African Collared Dove *S. roseogrisea.*

West Indies

In 1976 a small number of Eurasian Collared Doves were released on the island of Guadeloupe, where a population became established based in the town of Saint-Claude. *S. decaocto* now occurs throughout Guadeloupe, and has spread to Martinique, Dominica, Montserrat and Nevis. This population is clearly distinct from one in the Bahamas, from where Eurasian Collared Doves have colonised Florida, Cuba and other islands (Barré *et al.* 1997). The AOU (1998: 222) says that *S. decaocto* in the Caribbean is established:

> in the Bahama Island (New Providence 1974), whence it has spread to other northern islands in the Bahamas (Grand Bahama, Abaco, Bimini, Eleuthera, Andros), to Cuba, to the Lesser Antilles (Montserrat, St Kitts, Dominica, Guadeloupe) … apparently spreading in the Caribbean.

According to Raffaele *et al.* (1998: 299–300) the Eurasian Collared Dove in the West Indies was:

> Introduced to New Providence in the Bahamas in 1974, it is now a common year-round resident in the northern Bahamas (New Providence, Abaco, Bimini, Grand Bahama, Andros and several of the Berry Islands) and is still expanding its range. It apparently spread to Cuba from the Bahamas in the 1980s and is now fairly common locally around Havana and at the extreme western tip of the Guanahacabibes Peninsula. … a common resident in the Cayman Islands, likely the result of a separate introduction. Introduced to Guadeloupe in 1976, the species is locally common, including on nearby Les Saintes. It is now locally common on Martinique where first reported in 1994. A few individuals have been reported from St Christopher [St Kitts], Nevis, Montserrat and Dominica; nesting has been recorded on the latter two islands. It can be expected that the entire West Indies will soon be colonised by birds from the existing populations.

Impact Worldwide: Wherever it occurs, *S. decaocto* is a pest of stored grain; it also competes with other species for resources such as food, and contributes to the transmission of diseases (Ramagosa & Labisky 2000).

Barbary Dove (Ringed Turtle Dove)
Streptopelia risoria

Natural Range: The African Collared Dove *S. roseogrisea*, the ancestor of the domestic Barbary Dove, occurs from Senegal, Gambia and Mauritania to Sudan, Eritrea, Ethiopia, N Somalia and SW Arabia.

Naturalised Range: Europe: Spain. North America: USA; West Indies. Australasia: New Zealand. Atlantic Ocean: Canary Is.

Spain

The earliest record of the Barbary Dove in Spain was from the city of Valencia in 1985. F. J. García (in Martí & Del Moral 2003) reported at least 30–50 pairs nationally, principally on the east coast in Valencia, where the population is declining as that of the Collared Dove *S. decaocto* increases. Two pairs have been recorded in Mallorca in the Balearic Islands.

United States

According to D. Goodwin (pers. comm. 1985), all pre-1940 records of introductions to the United States of 'Ringdoves' and 'Collared Doves' refer, unless clearly stated otherwise, to Barbary Doves.

Barbary Doves are established locally in parts of Florida (e.g. Winter Park, Orange County, and St Petersburg, Pinellas County), from where they have colonised parts of Alabama, where by 1978 they occurred in Athens, Birmingham, Auburn, Montgomery, Hayneville and Mobile, and the Houston region of eastern Texas (Long 1981). The AOU (1998: 221) records *S. risoria* as 'introduced and established in west-central Florida (Pinellas County) … and apparently also eastern Texas (Houston region) and Alabama (Montgomery). Other North American populations (e.g. in Los Angeles) have failed to become established'. Sibley (2000: 256) says that the 'Ringed Turtle Dove … fares poorly in the wild. Small populations may persist in some southern cities'. See also Vuilleumier 1991, Johnston & Garrett 1994, James 1997.

West Indies

Bond (1979: 254) lists *'Streptopelia risoria'* as occurring in a semi-feral state on New Providence in the Bahamas and on Puerto Rico. The AOU (1998) confirms the bird's survival on these two islands.

New Zealand

A small population of Barbary Doves became temporarily established in Masterton Park in North Island in the 1970s (Stidolph 1974). Small colonies, probably totalling less than 100 individuals, now occur near Whangarei, in South Auckland, Rotorua, Whakatone and especially near Havelock North (Heather & Robertson 1997).

Impact: In rural localities Barbary Doves feed on newly sown grain (Heather & Robertson 1997).

Canary Islands

Langley (2004) says that in the Canaries Barbary Doves are scattered throughout the islands, where the population is increasing on all the main islands except El Hierro. F. J. García (in Martí & Del Moral 2003) estimated the total population at between 120 and 150 pairs.

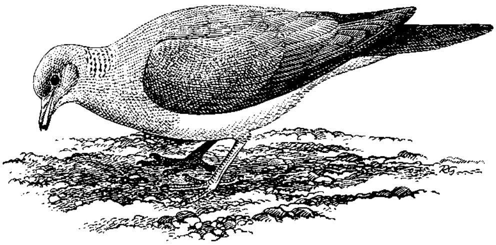
Madagascar Turtle Dove
Streptopelia picturata

Natural Range: Madagascar, Aldabra (South Is.), Isles Glorieuses and Comoros. (May also be native on some other islands in the Malagasy region).

Naturalised Range: Indian Ocean: Agaléga Is;? Chagos Archipelago; Mascarene Is; Seychelles Is.

The status of *S. picturata* on Indian Ocean islands is extremely complex and has yet to be satisfactorily resolved. Hawkins & Safford (in prep.) say it is endemic in the Malagasy region i.e. Madagascar, the Comoros, Seychelles, Mascarenes, the Iles Eparses (a collection of French-administered islands – Glorieuses, Juan de Nova, Bassas da India, Europa and Tromelin – surrounding Madagascar), Cargados Carajos/ St Brandon, and Agaléga. However, although it is apparently endemic to the region it does not occur naturally on all the islands in the region.

Benson (1970a) suggests that Madagascar



Madagascar Turtle Dove

Turtle Doves may have been imported to the Amirantes, the Chagos Archipelago and the Seychelles (and possibly to other Indian Ocean islands) by seventeenth- or eighteenth-century pirates and corsairs as a source of food.

Agaléga Islands

According to Guého & Staub (1983), *S. picturata* was introduced from the Mascarenes to the Agalégas soon after the islands were settled by the French in 1818. The species survives there in small numbers.

Chagos Archipelago

Madagascar Turtle Doves were well established and widely distributed on Diego Garcia in the early 1960s, having possibly been introduced from the Seychelles (Hutson 1975). Some authorities have even assigned a subspecific name to the Chagos population which could, however, be a hybrid of introduced races. Alternatively, the species could even be native to the archipelago, in which case it would not, as is currently believed, be endemic to the Malagasy region (R. J. Safford pers. comm. 2004).

Mascarene Islands

Although Cheke (1987: 76) admits that 'the information is too poor even to establish whether the Malagasy Turtle Dove *Streptopelia picturata* [on Mauritius and Réunion] is introduced or native', he goes on to argue persuasively in favour of the former, possibly in the eighteenth century (Mauritius) and nineteenth century (Réunion). It is now known from subfossil deposits (Mourer-Chaviret *et al.* 1999) that *S. picturata* was once native to the Mascarenes (Mauritius, Réunion and Rodrigues), but the species was presumably eradicated before being replaced by importations from Madagascar. Staub (1976) reported *S. picturata* to be widely established on Mauritius but to be scarce on Réunion except around Saint Philippe in the southeast. It was clearly well-established on the latter by the 1860s (e.g. Maillard 1862). Jones (1996) listed it as widespread in suitable habitats on Mauritius.

Seychelles Islands

From Mauritius or Madagascar *S. p. picturata* has apparently been imported to the Seychelles, where according to Newton (1867) the species was then established but uncommon on Mahé, to which it was believed to have been imported around 1850. Diamond & Feare (1980) record the species as breeding on all the main islands. Madagascar Turtle Doves (possibly *picturata* x *rostrata* hybrids) were translocated to the Amirantes before 1967, where they interbred with *S. p. aldabrana*: formerly endemic to Aldabra (Benson 1970a).

Impact: Except on Cousin, Cousine and possibly Frégate (Diamond & Feare 1980), introduced *S. picturata* has produced a hybrid swarm in the Seychelles with the rare endemic *S. p. rostrata* (Penny 1974, Simberloff 1996).

Spotted-necked Dove (Spotted Dove)
Streptopelia chinensis

Natural Range: From Pakistan eastwards through Nepal, Bhutan, Assam, India, Sri Lanka, Bangladesh, Burma and mainland SE Asia to C and E China, Taiwan and Hainan.

Naturalised Range: Asia: Indonesia. North America: Mexico; USA; West Indies. Australasia: Australia; New Zealand. Indian Ocean: Mascarene Is. Pacific Ocean: Fiji Is; Hawaiian Is; New Britain; New Caledonia; Philippine Is; Polynesia.

Indonesia

Meyer (1879) records the introduction of *S. c. tigrina* to several eastern Indonesian islands, including Sulawesi (from Java around 1835), the Moluccas and some small islands in the Flores Strait. The AOU (1998) also refers to the species' successful introduction to Sulawesi. Dickinson (2003) says that *S. chinensis* has been introduced to the Sunda Islands and eastward to Timor in Indonesia.

United States; Mexico

Spotted-necked Doves of the nominate subspecies were first introduced from eastern China to California in the early twentieth century, where by 1917 they were common residents in North Hollywood (Grinnell & Miller 1944). By the early 1920s they had become abundant throughout much of the Los Angeles basin and a decade later had spread west to Santa Monica, south to Inglewood, north to Pasadena and to Alhambra. By around 1940 they had expanded their range eastwards over the coastal plains south of the San Gabriel Mountains, were to be found in Los Angeles and Orange Counties, and had been recorded in San Bernardino County eastwards to Riverside County. By the 1960s, Spotted-necked Doves had spread northwards to Santa Barbara and Santa Monica, eastwards to Pear Blossom, southeast to Palm Springs and south to Oceanside and San Diego, and subsequently to the Salton Sea. By the early 1970s the population appeared to have stabilised and the rate of expansion had decreased, probably due to the presence of deserts and an absence of the species' favoured *Eucalyptus* trees (Hardy 1973, Vuilleumier 1991). Spotted-necked Doves appeared on Santa Catalina in the Channel Islands after the mid-1970s, probably as a result of an independent introduction (Johnston & Garrett 1994).

The AOU (1998: 222) says that Spotted-necked Doves are currently 'established … in southern California (primarily from Santa Barbara, where now rare, and Bakersfield south to San Diego and the Coachella Valley) and (probably) extreme northwestern Baja California (Tijuana area [Mexico]), casually to Imperial Valley'. Spotted-necked Doves seem to be contracting their range in Santa Barbara County and in the San Diego region, but may be continuing to spread in the San Joaquin Valley (Johnston & Garrett 1994). Peterson (1990) refers to an expansion of range into southern Arizona.

Impact: Although in some suburban habitats *S. chinensis* seems to outnumber the smaller native Mourning Dove *Zenaida macroura*, White-winged Dove *Z. asiatica* and Band-tailed Pigeon *Columba fasciata*, there seems little evidence of any interspecific competition (Gottschalk 1967).

West Indies

According to the AOU (1998: 222), 'A small population may persist on St Croix, [US] Virgin Islands (introduced in 1964)'. Raffaele *et al.* (1998: 300) said that *S. chinensis* was 'very local around Estate Canaan in the Virgin Islands (St Croix) resulting from releases in 1964. It bred in small numbers in the wild before Hurricane Hugo struck St Croix in 1989. Its present status is unknown'. This population is not mentioned by Bond (1979).

Australia

The offspring of eight Spotted-necked Doves of the nominate subspecies, imported to the Botanic Gardens in Melbourne by the Victoria Acclimatisation Society (see Lever 1992), were released near Melbourne and at Cape Liptrap between 1870 and 1874. Twenty more were unsuccessfully liberated in Adelaide, South Australia, in 1881, and the present population in that state is descended from birds that escaped from the Adelaide zoo in 1931. Spotted-necked Doves in Perth, Western Australia, are derived from stock deliberately released by the South Perth zoo in and after 1898. The species was reported by Chisholm (1926) to be then common in Sydney, New South Wales, from where it had spread inland to the Blue Mountains. Spotted-necked Doves may have been introduced to southern Queensland in 1912 (Chisholm 1919), but the population in the north of the state is descended from birds liberated at Gordonvale in the 1940s.

By the early 1970s, Spotted-necked Doves were well established in Perth, in Adelaide and many adjacent rural areas, in parks and gardens in Melbourne, in some of the larger provincial cities in Victoria, and in Sydney and Brisbane. In the south and in Western Australia they occurred mainly in urban environments, but in Queensland also in rural areas. Pizzey (1980) recorded Spotted-necked Doves within their range as common and well established in urban and some rural localities from Cooktown in northern Queensland to the Eyre Peninsula and Kangaroo Island in South Australia. Populations in Tasmania were centred on Hobart (since 1918) and Launceston; the species was also present on Rottnest and other offshore islands. The position is little changed today (Barrett *et al.* 2003)

Impact: Where the two species occur sympatrically (e.g. in New South Wales), *S. chinensis* has largely displaced the native Bar-shouldered Dove *Geopelia humeralis*. In Western Australia, Spotted-necked Doves have been accused of spreading the flea *Echidnophaga gallinaceae*. In parts of eastern Australia they damage germinating pine seedlings and horticultural crops, and consume food intended for domestic poultry (MacLean 1960).

New Zealand

Wodzicki (1965: 432) said that the 'Malay Spotted Dove' (= *S. chinensis*) was introduced to New Zealand early in the twentieth century, and was then 'locally abundant, North Island', where it became established and common in and around Auckland, from Albany south to Papakura and Karaka. According to Heather & Robertson (1997: 351):

> The Spotted Doves in the Auckland area, from Albany to Pukekohe, probably originated from escaped cage birds and from a substantial liberation at Mt Eden in the 1920s. They are mainly found … around Howick, Whitford, Clevedon and Karaka; a few birds have been recorded as far south as Miranda on the Firth of Thames. Small populations have established recently in rural Bay of Plenty near Te Puke and Opotiki.

Mascarene Islands

Oustalet (1897) quotes J. Desjardins as saying that Cossigny de Palma imported *tourterelles* from Bengal to the island of Mauritius in 1781 which Oustalet (1897) suggested were *S. chinensis* – a proposal with which Cheke (1987) concurred. The earliest definite record of the species in Mauritius was in 1834 by Oustalet (1897). Meinertzhagen (1912), Staub (1976) and Cheke (1987) reported *S. chinensis* to be common on the island, where it is now ubiquitous (Jones 1996). The form present is believed to be the Asiatic *S. c. tigrina* (Hawkins & Safford in prep.).

Fiji Islands

In about 1900 (Pratt *et al.* (1987) say in the early 1920s) Spotted-necked Doves from Australia were imported as cage birds to Viti Levu, where they were first recorded as being established in 1923. Thirty years later they had spread from here to all the main islands, including Nukulau and the coasts of Taveuni, and to some of the smaller islands, and were 'a very common species in most man-modified habitats' (Watling 1982: 79–80), mainly below 1,200m elevation (Pratt *et al.* 1987).

Impact: In the Fiji Islands Spotted-necked Doves are a serious pest of sorghum and lodged (wind- or rain-flattened) or harvested rice (Parham 1954, Watling 1982).

Hawaiian Islands

Spotted-necked Doves of the nominate subspecies are believed to have been first introduced to Hawaii from China in 1788, and according to Caum (1933) were very common on Oahu by 1879. Schwartz & Schwartz (1949) said they were well established in the archipelago before the turn of the century, and Fisher (1951) said they had colonised Niihau from Kauai (where they had been introduced around 1890) by about 1930. In about 1890 they were also introduced to Maui, Hawaii, Molokai and Lanai (Caum 1933). Schwartz & Schwartz (1949) said they were widespread throughout the islands, mainly up to 1,200m elevation though in some places to 2,400m, and in a wide variety of habitats.

They estimated the total population to number 88,680 birds. In 1961, eight Spotted-necked Doves from California were successfully released on the Puu Waawaa Ranch on Hawaii.

Zeillemaker & Scott (1976) said that Spotted-necked Doves were common in agricultural land and pastures, in exotic forests and scrubland, and in mixed *Metrosideros collina* and *Acacia koa* native woodland on Kauai, Oahu, Molokai, Lanai, Maui and Hawaii, while Walker (1967) lists them as also present on Kahoolawe.

Scott *et al.* (1986) found that during the preceding 40 years the species' range had greatly expanded on Hawaii, Maui and Molokai. In Kona, considerable numbers occurred at Puu Waawaa, at Kahuku, and in agricultural localities in south Kona (Honomalino to Manuka) and south and east of Kailua. On eastern Maui, *S. chinensis* was present on the northwest slopes of Haleakala, at low altitude in the Keanae Valley, and at low densities across Kahikinui. On Molokai, the species showed a massive intrusion into the northern valleys. In western Maui, Lanai and Kauai Scott *et al.* (1986) found little change in the species' distribution from that recorded by Schwartz & Schwartz (1949). Throughout the islands, Scott *et al.* (1986: 247) found Spotted-necked Doves to be 'widely distributed at all elevations in low numbers, although they are usually absent from high elevation forests and grasslands'. The AOU (1998: 222) said the species was established 'on the main islands from Kauai eastward'.

Impact: Spotted-necked Doves in the Hawaiian Islands are implicated in the dispersal of the exotic Banana Poka *Passiflora mollissima* and of Lantana *Lantana camara* (Lewin 1971). More seriously, Shehata *et al.* (2001) found a high prevalence (20%) of *Plasmodium relictum capistranoae* malarial infection in *S. chinensis* in the islands, which poses a threat to native birds.

New Britain

According to Mayr (1945), the race *tigrina* has been introduced to New Britain, where it became naturalised in the extreme north around Rabaul.

New Caledonia

Delacour (1966) says that *S. chinensis tigrina* from southeast Asia was introduced in 1939 to New Caledonia, where it became established in numerous villages and cultivated localities, but was greatly reduced in numbers by shooting in Noumea.

Philippine Islands

Although the AOU (1998) lists *S. chinensis* as occurring naturally in the Philippines, Dickinson (2003) says it was introduced there.

Polynesia

According to the AOU (1998: 222), Spotted-necked Doves are established on 'various islands of Polynesia', but no further data are provided. Pratt *et al.* (1987) make no mention of populations in Polynesia.

Laughing Dove
Streptopelia senegalensis

Natural Range: Sub-Saharan Africa. Also NW Africa, the Levant, southern Arabia, the Indian subcontinent and E to Xinjiang.

Naturalised Range: Australasia: Australia. Atlantic Ocean: Principe I. Indian Ocean: ?Mafia I. Mascarene Is; ?Socotra I.

Australia

In 1898–99 Laughing Doves of the nominate form (western Arabia and sub-Saharan Africa) were released near Perth, Western Australia, by the South Perth zoo, where they were regarded as established before 1912. Until at least 1920 numbers were recaptured for transfer elsewhere in the state, where they appear to have thrived wherever pine trees were available for nesting. Since the mid-1930s Laughing Doves have been extending their range in southern Australia; by 1958 they were established in several localities between Geraldton and Tambellup east to Beacon and Merriden, with discrete populations at Kalgoorlie and Esperance

(Sedgwick 1958, Jenkins 1959). By the late 1970s they had reached Cue and Mount Magnet east of Geraldton. Pizzey (1980) recorded them east to Southern Cross (325km from Perth), north to Geraldton (375km) – occasionally to Shark Bay (750km) – and 400km south to Albany. Laughing Doves became established on Rottnest Island (around 1930) and subsequently on Garden Island off the Perth coast (Storr 1965). They remain confined to southwestern Western Australia (Barrett *et al.* 2003).

Principe Island

According to Snow (1950), Laughing Doves from São Tomé in the Gulf of Guinea were introduced in 1905 to another Portuguese island, Principe, 100km to the north, where they became common in settled areas and in plantations. How the species arrived in São Tomé is unknown.

Mafia Island

Mackworth-Praed & Grant (1957) consider that Laughing Doves of the nominate subspecies may have been introduced to Mafia Island off the coast of Tanzania.

Mascarene Islands

Laughing Doves in the Mascarenes are restricted to Mauritius, where the descendants of around 20 birds that escaped or were released from an aviary in about 1989/1990 (R. J. Safford pers. comm. 2004) are now established in the Tamarin and Black River area in the southwest. The form in Mauritius is believed to be the Asiatic *S. c. cambayensis* (Hawkins & Safford in prep.).

Socotra Island

Laughing Doves on Socotra Island may be natives or introduced (Hawkins & Safford in prep.).

Island Collared Dove
Streptopelia bitorquata

Natural Range: Philippine Is. and N Borneo, and from Java E to Timor.

Naturalised Range: Asia: Sumatra. Pacific Ocean: Mariana Is.

Sumatra

Although firm evidence is lacking, Delacour (1947) considered that the presence of *S. bitorquata* on the island of Sumatra is probably due to human intervention.

Mariana Islands

According to Pratt *et al.* (1987), Island Collared Doves of the Philippine and Borneo race *dusumieri* were introduced in the 1700s, presumably by the Spanish, to the Mariana Islands from Guam north to Saipan. Until at least the mid-1940s they were abundant in rice fields, grasslands and open country in the south, but thereafter declined, according to Ralph & Sakai (1979), surviving only in small numbers on Guam, Rota and Saipan. Pratt *et al.* (1987: 191), however, say the species remains 'common'.

Zebra Dove
Geopelia striata

Natural Range: From S Burma through Thailand to Sumatra, Philippines, Java and Lombok.

Naturalised Range: Asia: Borneo; Sabah; Sulawesi; Molucca Is. Atlantic Ocean: St Helena I. Indian Ocean: Agaléga Is; Chagos Archipelago; ?Îles Glorieuses; Juan de Nova I; Madagascar; Mascarene Is; Seychelles Is. Pacific Ocean: Hawaiian Is; Philippine Is; Society Is.

Borneo; Sabah

Smythies (1960) says that the few Zebra Doves then surviving in southern Borneo were descended from birds released by local tribesmen. In 1965, two pairs were liberated at Tanjong Aru, Kota Kinabalu, on the coast of Sabah in northern Borneo, where Gore (1968) found the species to be established.

Sulawesi; Molucca Islands

According to Peters (1937), Zebra Doves were probably introduced to Sulawesi and also to Ambon in the Moluccas. Stresemann (1936) recorded them on the southern peninsula and in the south-central region of Sulawesi, where Escott & Holmes (1980) reported them at Gorontalo in the extreme north.

St Helena Island

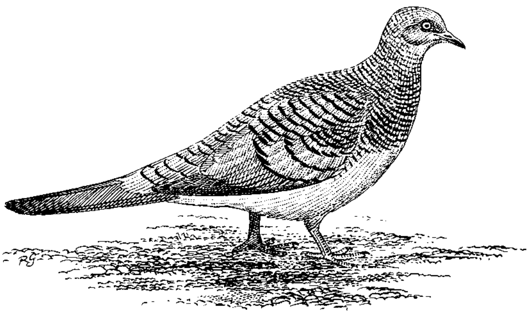
Zebra Doves may have been introduced to St Helena as early as the second half of the eighteenth century by French ships homeward bound from Mauritius, which are known to have stopped in St Helena. Unidentified doves seen on the island from 1775 could have been of this species (Rowlands *et al.* 1998). The only known introduction was reported by Melliss (1870), at an apparently unrecorded date but before the early 1860s when the species was reported to be fairly common. Today, Zebra Doves on St Helena are a dominant species, being common, tame and virtually ubiquitous, occurring in settlements and wherever there is vegetation, including tall trees, though generally avoiding high, exposed and arid habitats (Rowlands *et al.* 1998). They are also known to visit some of St Helena's offshore islands. See also McCulloch 2004.

Agaléga Islands

According to Guého & Staub (1983), Zebra Doves (probably introduced from the Mascarenes) are well established on both Île du Nord and Île du Sud in the Agalégas.

Chagos Archipelago

In 1960 an immigrant from the Seychelles, Raymond Mein, introduced Zebra Doves to the Chagos Archipelago, where in the same year a group of 14 was observed by Loustau-Lalanne (1962) at Pointe Este. Hutson (1975) reported that local islanders claimed that in about 1966 a dozen birds had been released on Diego Garcia, but he treated the report as suspect as Zebra Doves were first seen there some six years previously. By 1971 Zebra Doves had dispersed from Pointe Este, but were nowhere common.



Zebra Dove

Îles Glorieuses

Benson *et al.* (1975) were informed by M. Penny that H. Desramais had introduced Zebra Doves in 1969 to Îles Glorieuses, where they still occur (Probst *et al.* 2000).

Juan de Nova Island

Introduced Zebra Doves occur on Juan de Nova Island off the west coast of Madagascar (Bertrand 2000).

Madagascar

Although Rand (1936) said that introduced Zebra Doves had apparently died out on Madagascar, Staub (1976) found them to be common in lowland areas. Presumably either Rand was mistaken or there was a further introduction to the island.

Mascarene Islands

Bernardin (1773), writing of his visit to Mauritius in 1768–70, referred to a *'tourterelle'* which Cheke (1987) believed was the Zebra Dove noted by Sonnerat (1782) shortly thereafter. Meinertzhagen (1912) said the species had been introduced to Mauritius from the Malay Peninsula around 1750, while Benedict (1957) and Staub (1976) said the birds were imported from the Sunda Islands and Malaysia by Cossigny de Palma in 1781. They reached (or were transferred to) Round Island off Mauritius before 1860, and later appeared on neighbouring Flat Island. Zebra Doves are now common and widespread on Mauritius (Showler 2002, Hawkins & Safford in prep.).

By the 1860s, Zebra Doves were well established also on Réunion (e.g. Maillard

1862), and remain so today up to an altitude of *c.* 1,500m (Barré *et al.* 1996).

According to Staub (1973, 1976), Zebra Doves were introduced to Rodrigues in 1764. Bertuchi (1923), however, says they did not arrive until 1862, when some were released by the crew of a visiting vessel. Jones (1996) recorded the species to be widely established in suitable habitats. According to Showler (2002: 19) the Zebra Dove '… is very common, especially in open woodland, at all altitudes'.

Seychelles Islands

Newton (1867) found Zebra Doves to be well established in lowland regions in the Seychelles, where they became one of the commonest land birds, especially near settlements, in the archipelago (Barré & Barau 1982). They now occur on all the main granitic islands: Bird, Denis, Coëtivy, D'Arros, St Joseph, Desroches, Farquhar and Assumption; on the last-named they were introduced from Mauritius in 1976 (Skerrett *et al.* 2001; Hawkins & Safford in prep.). According to Benson (1970b) and Penny (1974), the species was probably introduced to Cosmoledo Atoll, where Hawkins & Safford (in prep.) imply it may have died out.

Hawaiian Islands

Zebra Doves were introduced to Oahu by the Honolulu City Council in 1922 and to Kauai by Dora Isenberg, and also to Maui and Molokai (Caum 1933). By the mid-1930s *G. striata* was established on all the main islands except Hawaii, to which, according to Munro (1944), it had only recently been transferred, but which Schwartz & Schwartz (1949) say was probably colonised naturally from Maui between 1935 and 1938. By the late 1940s, Zebra Doves were well established in suitable habitats on all the larger islands except Hawaii, where they occurred only on the Kona coast and in parts of North Kohala. Schwartz & Schwartz (1949) censused the total population at nearly 240,000.

In 1961–62, 18 Zebra Doves were released on the Puu Waawaa Ranch on Hawaii, where they are now established. Zeillemaker & Scott (1976) said *G. striata* was abundant on agricultural land and pastures and in residential areas and community parklands on Kauai, Oahu, Molokai, Lanai and Maui, and common on Hawaii; the species has also occurred on Kahoolawe. Berger (1981), Pratt *et al.* (1987) and Pratt (1994) confirm its continuing abundance an all the main islands.

Impact: Zebra Doves in the Hawaiian Islands are associated with the spread of introduced grasses, herbs, and shrubs (Stone 1985). They were found by Shehata *et al.* (2001) to be entirely free from *Plasmodium relictum capistranoae* malarial infection.

Philippine Islands

Whitehead (1899) suggested that Zebra Doves may have been introduced as cagebirds to the Philippines. Du Pont (1971) says that Zebra Doves from Borneo have been imported to Lubang, Luzon, Mindoro and Verde.

Society Islands

In 1950 W. A. Robinson successfully released 21 Zebra Doves from the Hawaiian Islands at Paea in Tahiti. By the early 1970s they had colonised maritime areas of Papara on the south coast to Arue on the north via the entire west coast, and by the mid-1970s they were established and common continuously along the coast from Arue to Papeari (Thibault & Rives 1975). Pratt *et al.* (1987) said that *G. striata* was expanding its range on Tahiti and Holyoak & Thibault (1984) considered that new populations might be developing on the neighbouring island of Moorea.

Common Ground Dove
Columbina passerina

Natural Range: From the S USA, S through C America and the West Indies to S Venezuela W to N Brazil.
Naturalised Range: Atlantic Ocean: Bermuda

Bermuda

According to D. B. Wingate (pers. comm. 1981), the Common Ground Dove was 'probably introduced [to Bermuda] as a caged bird from the Bahamas [where the form is *C. p. bahamensis*] in the 1600s or 1700s because no specific mention was made of small doves by the first settlers'. However, the AOU (1998) and Raine (2003) treat *C. passerina* as a native resident in Bermuda. (See also e.g. Bourne 1957).

Emerald Dove
Chalcophaps indica

Natural Range: From India and SE Asia through Indonesia to N and E Australia.
Naturalised Range: Asia: Hong Kong (China).

Hong Kong (China)
According to Webster (1975), Emerald Doves have been introduced to Hong Kong (China), where some are resident and breed in the Tai Po Kau Forestry Reserve and possibly in parts of the new territories. See also Viney *et al.* 1996.

Caribbean Dove
Leptotila jamaicensis

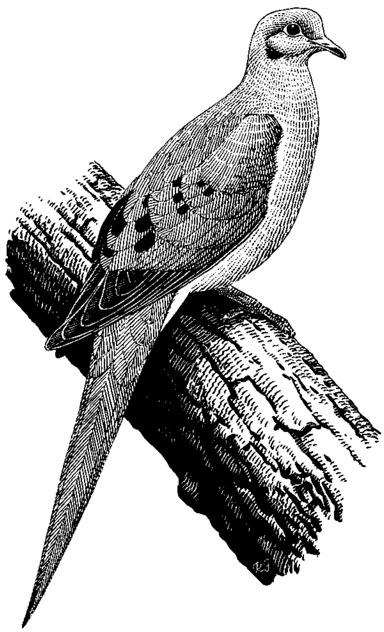
Natural Range: N Yucatán peninsula and islands, NE Belize, Honduran Is, Cayman Is, Jamaica, San Andrés Is. (off EC Nicaragua).
Naturalised Range: North America: West Indies.

West Indies
Brudenell-Bruce (1975) says that Caribbean Doves of the nominate subspecies were introduced from Jamaica to New Providence in the Bahamas as part of a project to restore the islands' avifauna decimated by hurricanes in the 1920s. Bond (1979) and the AOU (1998) confirm the species' introduction to and establishment on New Province, where Raffaele *et al.* (1998) describe it as an uncommon and local resident.

Mourning Dove
Zenaida macroura

Natural Range: From northern N America S through the Caribbean to Costa Rica and W Panama.
Naturalised Range: Pacific Ocean: Hawaiian Is.

Hawaiian Islands
Mourning Doves were unsuccessfully introduced to the island of Hawaii in 1929 or 1930 (Walker 1967). Between 1962 and 1965 a total of 168 birds were released on the Puu Waawaa Ranch on Hawaii, where they became locally established (Lewin 1971). Although Zeillemaker & Scott (1976) make no mention of *Z. macroura* in the islands, Pyle (1977: 112, 118) lists it as a 'new introduction: apparently established and breeding, but for less than 25 years': it had actually been on Hawaii for a maximum of 15 years. Berger (1981) said that Mourning Doves were established only in the North Kona region on Hawaii. Scott *et al.* (1986: 249), who were told that in 1974 the population numbered between 500 and 1,500 birds, found the species to be 'restricted to the



Mourning Dove

north slopes of Hualalai and the high-elevation open woodland on Mauna Loa' in the Kona area. Pratt *et al.* (1987), Pratt (1994) and the AOU (1998) confirm the species' continuing presence on Hawaii, where Pratt *et al.* (1987) say the population may be gradually increasing.

PSITTACIDAE (COCKATOOS AND PARROTS)

Galah
Eolophus roseicapilla

Natural Range: Australia and Tasmania.
Naturalised Range: Australasia: New Zealand.

New Zealand
A shipment of smuggled Galahs released by a vessel off the coast of Horowhenua in the 1970s failed to become established. Recently, however, escaped cage-birds have formed wild breeding populations in South Auckland and in the northern Waikato, and have been observed on Pakihi and Ponui Islands in the inner Hauraki Gulf. The bulk of the population, estimated at fewer than 100, is centred on Ponui Island/the Hunua Ranges and the Pukekohe/Port Waikato regions. The largest recorded flock comprised 35 birds (Heather & Robertson 1997).

Impact: Since *E. roseicapilla* is a major pest of grain crops in Australia (Heather & Robertson 1997), the species requires careful monitoring in New Zealand.

Little Corella
Cacatua sanguinea

Natural Range: S New Guinea and much of Australia apart from the S.
Naturalised Range: Asia: Singapore.

Singapore
Little Corellas were established and presumed to be breeding on St John's Island south of Singapore in the 1980s (T. Silva pers. comm. 1985).

Tanimbar Corella
Cacatua goffini

Natural Range: Tanimbar I.; Tula (Kai Is.).
Naturalised Range: Asia: Singapore.

Singapore
Dickinson (2003) describes this species (listed by the World Conservation Union as 'Lower Risk: Near Threatened') as occurring in the wild on Singapore Island, to which Wells (1999) adds its satellites (St John's, Sentosa).

Yellow-crested Cockatoo
Cacatua sulphurea

Natural Range: Sulawesi and adjacent islands, Masalembu Besar I. (Java Sea), the main Lesser Sunda Is. (Lombok to Alor and Timor) and Sumba I.
Naturalised Range: Asia: ?China (Hong Kong); Singapore.

China (Hong Kong)
Webster (1975) recorded the presence (but not the breeding) of this species in Happy Valley and at the university, while Viney (1976) saw it in Happy Valley, at the university, at Victoria Barracks, and on Stonecutters Island west of Kowloon, where breeding was strongly suspected. See also Viney *et al.* 1996.

Singapore
Rowley (in Forshaw 1980) said that small groups of *C. sulphurea* appeared to be established in the Botanic Gardens in Singapore, and T. Silva (pers. comm. 1985) said that in 1983 some had been seen on Sentosa Island. Dickinson (2003: 184) says the species is 'Feral in Singapore'.

Sulphur-crested Cockatoo
Cacatua galerita

Natural Range: New Guinea and adjacent islands, Aru Is., N, E and SE Australia, and Tasmania.

Naturalised Range: Asia: ?Indonesia; Singapore. North America: ?USA; West Indies. Australasia: New Zealand. Pacific Ocean: Palau Is.

Indonesia
Sulphur-crested Cockatoos of the New Guinea race *triton* may have been introduced to Ceramlaut and Goramlaut in the Moluccas (Long 1981).

Singapore
Although Madoc (1956) states only that escaped Sulphur-crested Cockatoos were occasionally found in the wild in Singapore, C. J. Hills (pers. comm. 1985) says they have been breeding there for over 40 years. Seng (1997) lists this species only as escaped.

United States
Although the species is not mentioned by the AOU (1998) and is included by Sibley (2000: 266) among those species of which there are 'as yet no stable feral populations', Troops & Dilley (1986: 140) say 'Nest sites documented in the Miami area', while Lee *et al.* (1999) state that the species has been established in southern Florida since the late 1950s.

West Indies
Sulphur-crested Cockatoos first bred successfully on New Providence in the Bahamas in the mid-1990s, where by 1998 there was a population of six free-flying birds (Lee *et al.* 1999).

New Zealand
Writing of the Sulphur-crested Cockatoo in New Zealand, Thomson (1922: 137) stated that 'This species is frequently to be seen on the Waitakerei Ranges, where it appears to have established itself', having been introduced in the early 1900s (Heather & Robertson 1997). Baker (1991) says the first introduction took place in 1920.

From the 1920s onwards large numbers of Sulphur-crested Cockatoos were imported from Australia to New Zealand, where escaped pets became established near Auckland and at Wellsford, Hunua Hills, Glen Murray and Fordell, and in Turakina Valley, Hunterville, Waikato, and Wainuiomata (Oliver 1930). This distribution was confirmed by Kinsky (1970). Falla *et al.* (1979) found *C. galerita* to occur in limestone country between the lower Waikato and Raglan, and in the watersheds of the Turakina and Rangitikei in North Island, with a small colony in the Wainuiomata Valley. Heather &

Sulphur-crested Cockatoo

Robertson (1997), who estimated the probable population at less than 1,000, said that the species occurs in scattered locations from Northland to Canterbury (South Island), the principal sites being western Waikato (*c.* 200), Turakina (*c.* 300) and Wellington (*c.* 50).

Impact: In the past, Sulphur-crested Cockatoos have been accused of damaging haystacks by pulling them apart to get at the seed heads. However, according to Heather & Robertson (1997), although they occasionally feed on grain crops they cause only minor damage, probably because the population is regularly cropped for the pet trade.

Palau Islands

Sulphur-crested Cockatoos of the New Guinea form *triton* have been introduced to the Palau Islands, where around 1950 they were said to be breeding and spreading (Ripley 1951). According to Pratt *et al.* (1987: 208) they were 'Introduced after World War II … found … from Koror to Eil Malk. May be spreading. Population small but increasing'.

Kuhl's Lorikeet
Vini kuhlii

Natural Range: Rimitara I. (Tubai Is.).
Naturalised Range: Pacific Ocean: Line Is.; Kiribati Is.

Line Islands; Kiribati Islands

Kuhl's Lorikeets are said to have been imported from Rimitara to Teraina and Tabuaeran by local people, where they are believed to have become established before 1798 and where they are now common. In 1957 six were transferred to Kiritimati Island. Although Pratt *et al.* (1987) say that *V. kuhlii* has disappeared from Kiritimati, Dickinson (2003) lists it as still occurring there and also as present in the Kiribati Islands.

Red Shining Parrot
Prosopeia tabuensis

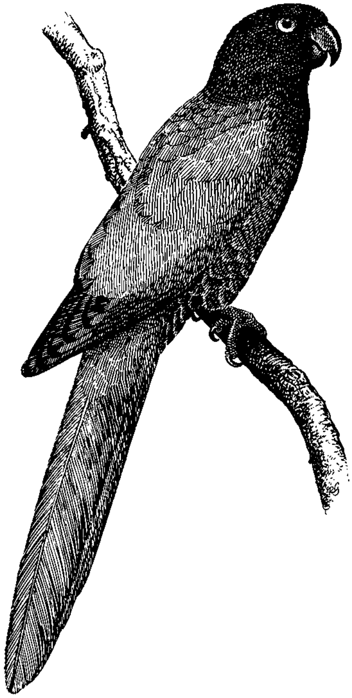
Natural Range: Fiji Is.
Naturalised Range: Pacific Ocean: Tonga Is.

Tonga Islands

According to Watling (1982: 92):

> There is little doubt that the range has been extended by human agency. … there was a considerable trade with the Samoans and Tongans for its red feathers, and there is documented evidence of live parrots being taken to Tonga in the eighteenth century. Either it was purposely introduced to the islands of 'Eua and Tongatapu there, or escaped birds became naturalised there. The population on Tongatapu has died out … but it still thrives on 'Eua.

Red Shining Parrots are today common on 'Eua in inland forests, in deep wooded gullies,



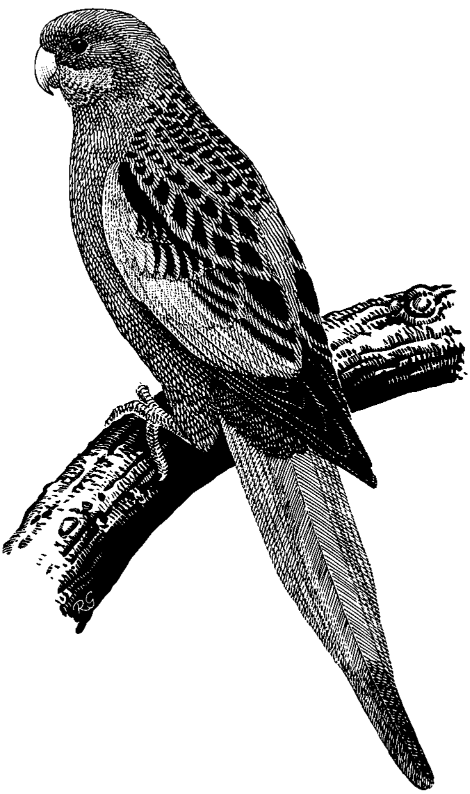
Red Shining Parrot

and in forest ecotone in the east of the island. They also occur in plantations and in coastal forests (Pratt *et al.* 1987). Rinke (1986) estimated the population at 1,000, ± 50%. Because of increasing deforestation and predation by the island's human population (for feathers, meat, and pets) Rinke (1986) believed that the number of Red Shining Parrots on 'Eua will decline.

Crimson Rosella
Platycercus elegans

Natural Range: NE Queensland to SE South Australia, including Kangaroo I.

Eastern Rosella
Platycercus eximius



Crimson Rosella

Natural Range: SE Queensland to SE South Australia and Tasmania.
Naturalised Range: Australasia: New Zealand. Pacific Ocean: Norfolk I. (*elegans*).

New Zealand
In 1910 a small shipment of Crimson and Eastern Rosellas that had been refused entry to New Zealand was released off Otago Heads on South Island, where before 1930 they became established in the Waitakere Range. Wodzicki (1965: 433) described them as 'locally common, North and South Islands', while Kinsky (1970) said that in North Island Eastern Rosellas were well established and spreading throughout Northland, and also occurred in Wairarapa, Waikanae and the upper Hutt Valley; in South Island they were found mainly in Otago. Falla *et al.* (1979) said that Rosellas were well established in North Island near Auckland from where they were spreading south, and in South Island a small population survived near Dunedin. Since 1963–64 a small colony of *P. elegans* is said to have been established in suburban Wellington. Baker (1991) confirms the two species as members of New Zealand's exotic avifauna.

Impact: As early as the 1920s damage to orchards by Eastern Rosellas was being reported near Dunedin (Oliver 1955). This, however, is said to have been more than compensated for by their destruction of the larvae of the Golden-haired Blowfly *Calliphora laemica* which had also been introduced from Australia.

Norfolk Island
Introduced Crimson Rosellas were well established and abundant on Norfolk Island by at least the late 1960s (Smithers & Disney 1969). See also Barrett *et al.* 2003.

Impact: Competition for food and nesting sites with Crimson Rosellas has probably contributed to the decline of the endemic Norfolk Island Parakeet *Cyanoramphus cookii* (King 1978–79), which is classified as Critically Endangered by the World Conservation Union.

Eastern Rosella

Budgerigar
Melopsittacus undulatus

Natural Range: The interior of Australia.
Naturalised Range: Asia: Japan. North America: USA. Atlantic Ocean: ?Canary Is.

Japan
Budgerigars occur in much of lowland coastal Honshu north to Miyagi-ken, Shikoku, and western Kyushu, and also on Okinawa, and may have bred at Niigata-Ken, Honshu. Birds that escape from captivity regularly augment the naturalised population. In winter, Budgerigars often join flocks of Eurasian Tree Sparrows *Passer montanus* (Brazil 1991). The OSJ (2000) lists *M. undulatus* as breeding in central and southwestern Honshu (Tokyo, Yamanashi, Okayama).

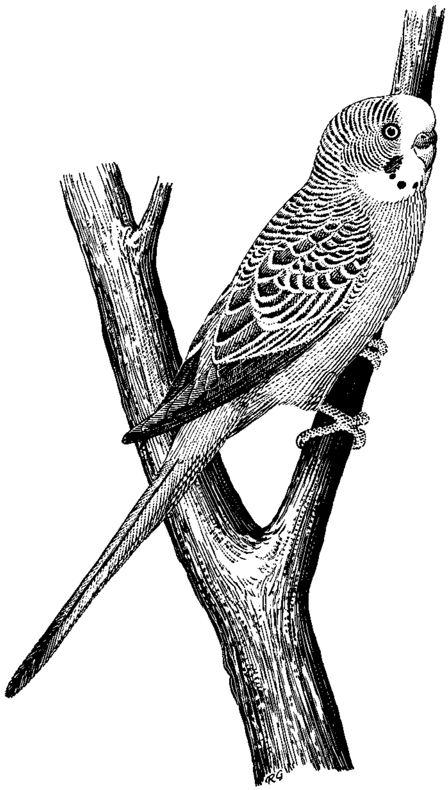
United States
By the early 1960s, several thousand free-flying Budgerigars, the descendants of escaped or deliberately released cage-birds, were established near St Petersburg on the Gulf coast of Florida. By the mid-1970s they had spread north to New Port Richey and 100km south to Englewood, with smaller colonies established elsewhere. The population in St Petersburg was estimated to number some 3,000. On the Atlantic coast, Budgerigars were established at Cocoa, Dade County, and by 1977 occurred at Jacksonville near the border with Georgia.

Shapiro (1980: 8) wrote that:

> the budgerigar is abundant in Ft Lauderdale and Ft Pierce on the east coast, and ranges extensively from Spring Hill in the north down to Sanibel Island on the west coast. Very few sightings were noted in the interior or the northern part of the state. The heaviest concentrations appear to be near Venice, St Petersburg, Seminole, Largo and Holiday.

Wenner & Hirth (1984) summarised the status and distribution of Budgerigars in Florida as being restricted to residential localities, breeding in colonies of 100 or more on the Gulf coast from Hudson to Fort Myers, with transient flocks occurring elsewhere. On the Atlantic coast, Budgerigars bred near Fort Pierce, Port St Lucie and Fort Lauderdale, with transient flocks from Miami and West Palm Beach to north of Fort Pierce, and sporadically north to Jacksonville. The densest populations occurred from Charlotte to Citrus Counties, in New Port Richey, Clearwater, St Petersburg, Largo, Seminole, Sarasota, Bradenton, Venice, Englewood and Port St Lucie, where some roosts were estimated to hold more than 8,000 birds. Budgerigars were virtually absent from the interior of Florida.

James (1997) listed *M. undulatus* as occurring in Pinellas and Pasco Counties and elsewhere on the Gulf coast. The AOU (1998)



Budgerigar

said the species was established in west-central Florida (Charlotte and Citrus Counties). According to Peterson (2002), thousands used to be established on the west coast of Florida with lesser numbers on the southeast coast, but that in recent years the population has dramatically declined.

A. E. Shapiro (pers. comm. 1980) listed a number of factors that contributed to the establishment of the Budgerigar in Florida: precocious breeding; breeding throughout the year; the ability to raise more than one brood annually; the ability to survive for lengthy periods without water; the species' ready use of artificial nest boxes and feeding tables; its nomadic tendency which helped it to expand its range; and its ability to adapt to inclement weather conditions.

Impact: Budgerigars in Florida provide an additional source of food for Red-shouldered Hawks *B. lineatus* and Red-tailed Hawks *B. jamaicensis*. They compete for food and/or nesting sites with Purple Martins *Progne subis*, Red-bellied Woodpeckers *Melanerpes carolinus* and Mourning Doves *Zenaida macroura*. Localised damage to citrus trees has been reported (A. E. Shapiro pers. comm. 1980).

Canary Islands

J. Clavell (in Martí & del Moral 2003) refers to a colony of up to 10 pairs having nested in Tenerife.

Eclectus Parrot
Eclectus roratus

Natural Range: The Moluccas, Sumba, Tanimbar, Aru, Biak, Admiralty, Bismarck and Solomon Is; New Guinea and neighbouring islands; Cape York Peninsula, Australia.
Naturalised Range: Asia: Seram. Pacific Ocean: Palau Is.

Seram

Forshaw (1980) records the successful introduction of the New Guinea form *polychloros* to the Gorong Islands southeast of Seram.

Palau Islands

Ripley (1951) records the presence of this species in the Palau Archipelago. Forshaw (1980) believed the birds were probably of the New Guinea race. Pratt *et al.* (1987: 208) says that Eclectus Parrots were 'Introduced after World War II to Palau where confined to the forested "rock islands" from Koror to Eil Malk. Uncommon ….'

Rose-ringed Parakeet (Ring-necked Parakeet)
Psittacula krameri

Natural Range: From S Mauritania and Senegal to Sudan and Somalia. Also NW

Pakistan through India and Sri Lanka to SE China.

Naturalised Range: Europe: Austria; Belgium; British Isles; Germany; The Netherlands; Portugal; Spain. Asia: Arabia; China; Iran; ?Iraq; Israel; Japan; Singapore. Africa: Egypt; Kenya; South Africa; Tanzania (Zanzibar). North America: USA. Atlantic Ocean: Canary Is; ?Cape Verde Is. Indian Ocean: Mascarene Is; Seychelles Is. Pacific Ocean: Hawaiian Is.

Austria

Langley (2004) records the presence of a colony of Rose-ringed Parakeets in the city of Innsbruck.

Belgium

Cramp *et al.* (1985) state that small populations of Rose-ringed Parakeets have been established in Brussels since about 1970, and also in Antwerp. Their survival is confirmed by Hawkes (1986) and Lever (1997).

British Isles

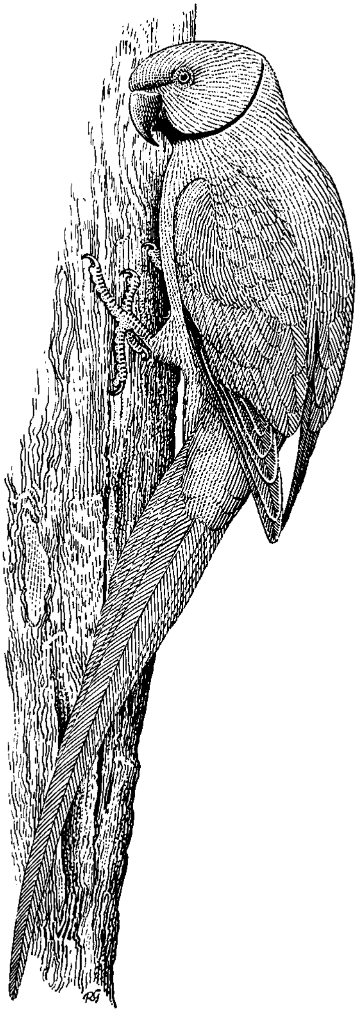
Rose-ringed Parakeets first bred in the wild in Britain (in Norfolk) as early as 1855, and according to Chandler (2003) may have occurred in south London between 1892 and 1899. However, in the twentieth century *P. krameri* first appeared in the wild in the British Isles (in England) in 1969, and by 1971 populations had become established near London in Surrey and Essex, and around Gravesend in Kent (Hudson 1974). Breeding was first confirmed in Surrey in 1971, and within two years successful nesting was also recorded in Greater London and Kent. By the mid-1980s, the species had expanded its range in Kent and had become established in south Buckinghamshire and east Berkshire, and later in neighbouring parts of the Thames Valley (Lever 1993).

In northwestern England, Rose-ringed Parakeets became established in the southern suburbs of Greater Manchester, where breeding was first recorded in 1974, westwards to Liverpool, Merseyside, where successful nesting first took place in 1980.

By 1983, Rose-ringed Parakeets had been recorded from numerous counties in England, Wales, and Scotland, and breeding had been confirmed in England in Berkshire, Kent, Surrey, Sussex, Norfolk, Greater Manchester, Greater London, Merseyside and West Yorkshire, and in Wales in Clwyd. B. Hawkes (pers. comm. 1984) estimated the total British population at about 1,000, of which 50% were in Greater London (300) and Kent (200).

Pithon & Dytham (1999) reported that in 1996 there were some 1,500 Rose-ringed Parakeets in the four main roosts, in Esher and Reigate in Surrey, at Lewisham in Greater London, and Ramsgate in Kent. Ogilvie & RBBP (1999) recorded *P. krameri* in 1997 as breeding in Buckinghamshire, Kent, Middlesex, Surrey, Berkshire and Dorset, and said that the total population may have numbered several thousand; the roost at Esher peaked at around 3,000 birds. Ogilvie & RBBP (2002) estimated the national total in 2000 as in excess of 4,300. By 2001 this figure had risen to over 6,000, with more than 4,000 at the Esher roost; Butler (2002), however, suggests that the true totals may have been higher than recorded. Despite reports in the popular press (e.g. Utton 2004) that the population was then around 20,000 and is expected to reach 100,000 by the end of the decade, the present total is likely to be between 7,000 and 10,000, and is continuing to increase except in parts of northwest England.

The rise in the population of Rose-ringed Parakeets in Britain has been attributed by C. Butler (in Owen 2003) to their ability to breed at a young age; high fledgling success; the absence of natural predators; and longevity. To these can be added their ability to withstand the harshest weather, and their acceptance of artificial feeding in winter (pers. obs.). The sources of the British (and European) populations are likely to have been 'homing' birds that failed to return and escaped and deliberately released pets owned by sailors returning to London and Liverpool (Lever 1977, 1987). The subspecies imported into Britain appear to originate entirely from the Indian part of the birds' natural range (*borealis/manillensis*) (Morgan 1993, Pithon & Dytham 2001).



Rose-ringed Parakeet

Impact: Breeding takes place before that of most British birds – in favourable years as early as January (pers. obs.) – the birds nesting mainly in the old nest-holes of Great Spotted Woodpeckers *Dendrocopos major* and Green Woodpeckers *Picus viridis*. Hence *P. krameri* competes advantageously with such native hole-nesting species as European Starlings *Sturnus vulgaris*, Great Tits *Parus major*, Eurasian Nuthatches *Sitta europaea*, Eurasian Tree Sparrows *Passer montanus*, Eurasian Jackdaws *Corvus monedula*, Tawny Owls *Strix aluco*, Little Owls *Athene noctua* and Common Kestrels *Falco tinnunculus*, and for winter food at bird-tables with various other species (pers. obs.).

Lever (1977, 1987) recorded damage caused by Rose-ringed Parakeets to the buds and blossom of various trees and shrubs, and to pears, plums and especially apples, and expressed the view that were the birds to increase and spread in fruit-growing counties such as Kent serious depredations were likely to occur. This is unfortunately coming to pass, and damage is being increasingly reported by viniculturists, orchardists and farmers. Crops to have suffered include apples, cherries, grapes, pears, plums, raspberries, strawberries, barley and maize (Owen 2003). Were Rose-ringed Parakeets to become established in even greater numbers in urban and suburban habitats they could pose a threat to humans from psittacosis.

Germany

In 1967 six Rose-ringed Parakeets became established in the grounds of Köln zoo, where breeding occurred two years later. Thereafter the population rapidly increased, and by 1983 numbered between 250 and 300, including 50 breeding pairs. New breeding sub-populations were subsequently formed at Brühl (1979), Erfstadt and Bonn, where breeding first occurred in 1979, and probably also at Wiesbaden and between Leverkusen and Düsseldorf, where around 100 were counted in 1979 (B. Hawkes pers. comm. 1984, Cramp *et al.* 1985). The species' survival in Germany is confirmed by Hawkes (1986), Ernst (1995), Gebhardt (1996) and Lever (1997).

The Netherlands

Rose-ringed Parakeets first bred in The Hague in the late 1960s, where by 1975–76 the population numbered about 30. A few years later a colony settled in Rotterdam, and by 1975–76 Amsterdam, Haarlem and parts of Zeeland had been colonised (Teixeira 1979). The national population rose between 1977 and 1981 from 40–50 to several hundred (Taapken 1981, Cramp *et al.* 1985, Lensink 1996). Lensink (1998a) put the number of breeding pairs at 5–10 in 1973–77 and 80–100 in 1992–94, and listed the species as definitely established. The claim by Lensink (1996) that Rose-ringed Parakeets are vulnerable to harsh winters in The Netherlands is not in accord with the position elsewhere (see e.g. Murgui 2001: 157).

Portugal

'… it has been recorded regularly in the city of Lisbon and in Cascais town, where it probably breeds. Several roosts are known, but no figures are available' (Costa *et al.* 1997: 563).

Spain

A breeding population has been present in Barcelona and Málaga since the mid-1980s (Batllori & Nos 1985). The Spanish breeding bird *Atlas* (A. Román Muñoz in Martí & del Moral 2003) found 213–254 breeding pairs, a figure considered to be a considerable underestimate. Birds were concentrated along the Mediterranean coast, with 80–100 pairs in Barcelona alone. Elsewhere, Sevilla and Madrid, and Mallorca in the Balearic Islands, supported small numbers. The species was reported to be increasing and extending its range steadily since the beginning of the 1990s..

Arabia

Gallagher & Woodcock (1980) say that the Rose-ringed Parakeet has been introduced to the Arabian Gulf, northern Oman, and Yemen (Aden), where populations are derived from escaped cage-birds (Jennings 1981b). The species is established and breeding in Bahrain, the United Arab Emirates and on the Musandam Peninsula on the Arabian Gulf (Meinertzhagen 1954). In Bahrain, Rose-ringed Parakeets have been established since at least 1953, and roosts of up to 300 individuals occur in Manama. Between May and September many birds migrate to Saudi Arabia (Hirschfeld & King 1992). Rose-ringed Parakeets were first reported in the United Arab Emirates in 1972, where numbers are increasing in suburban areas along the coast between Dubai and Abu Dubai and also in inland localities. In March, some birds migrate northwest from the Gulf coast over-flying Das Island (Richardson 1992). In Oman, Rose-ringed Parakeets breed on Al Batinah, especially near Al Khaburah and Suwaiq (de Schauensee & Ripley 1953, in Forshaw 1980). In Yemen at least 22 pairs were established in Tawahi, Crater, Ma'alla and north to Shaykh Uthmān (Ennion 1962). The species also occurs in Hijaz in Saudi Arabia, and probably breeds south of Kuwait on the Arabian Gulf (Jennings 1981a, 1981b, Stagg 1989), and seems well established at King Abdul-Aziz University in Jeddah (Felemban 1993). Jennings (2004) lists *P. krameri* as breeding in Qatar (Dohar), Saudi Arabia (Dharan, Riyadh, and Jeddah), Bahrain (Manama), United Arab Emirates (Dubai and Abu Dhabi), Oman (Muscat and Salalah), Yemen (Sa'aa) and Aden.

China (Hong Kong and Macau)

P. krameri in Hong Kong and Macau since before 1903 may be descended from natural dispersers or more probably from escaped cage-birds. By the mid-1970s the species was abundant and widespread, particularly in northern Hong Kong, on the Mong Tseng Peninsula and near Homantin and Kowloon Tong (Forshaw 1980). Its survival is confirmed by the AOU (1998). See also Viney *et al.* 1996.

Iran

Free-flying flocks have been observed in Tehran and at Bandar Abbas, but establishment is unconfirmed (Forshaw (1980).

Iraq

Between 1938 and 1952 free-flying Rose-ringed Parakeets occurred near Baghdad, and in 1959 and later others were reported at Karradah Sharqiyah and at Al Kut where, however, the population may have been declining (Marchant & McNab 1962).

Israel

Rose-ringed Parakeets first escaped from Tel Aviv zoo and private collections in the 1960s, since when they have increased and spread over most of the coastal plain and the Jordan and Galilee Valleys (B. Hawkes pers. comm. 1984, Cramp *et al.* 1985). Some birds may also be natural dispersers from Egypt. The species is now common also in the northern valleys, and in the Jordan Valley as far south as Jericho. Roosts of hundreds and perhaps thousands exist along the coastal plain and elsewhere (Mendelssohn & Yom-Tov 1999).

Japan

Rose-ringed Parakeets are fairly common around Tokyo in central Honshu, and breed in considerable numbers in Osaka, Nagoya, and Tokyo, and as far south as the Ehima Prefecture on Shikoku, and Miyazaki-ken in southern Kyushu. Since 1982, a large communal roost of 800 individuals has been established at Tokyo Kogyo Daigaku (Brazil 1985, 1991, Eguchi & Amano 1999). The OSJ (2000) lists *P. k. manillensis* (southern India and Sri Lanka) as breeding in central Honshu (Chiba, Tokyo).

Singapore

Escaped Rose-ringed Parakeets were said by Medway & Wells (1976) to have established breeding colonies in Singapore. Their survival is confirmed by the AOU (1998) and Wells (1999).

Egypt

Rose-ringed Parakeets of the form *P. k. manillensis* from southern India and Sri Lanka (Goodman 1982) escaped from Giza zoo between 1901 and 1908, and are said to have been already abundant when others were set free in 1912 in the Egyptian delta (Nicholl 1912). By 1915 they were apparently well established in and around Cairo and at El Giza. By 1981 they had spread to Zamalek, where breeding was confirmed, and by the middle of the decade several hundred birds were said to be established in the Cairo/Giza locality (Cramp *et al.* 1985). The birds' survival is confirmed by the AOU (1998).

Kenya

Rose-ringed Parakeets were found to be breeding in the Nairobi National Park in 1969. These may have been escaped cage-birds (Cunningham van Someren 1969) or possibly naturally occurring vagrants (Forshaw 1980).

South Africa

Vincent (1972) mentioned that Rose-ringed Parakeets *P. k. borealis* (Pakistan and India to China) were first noted around Sordwana Bay, Zululand, in 1970, where up to 60 occurred in a single flock. These birds could have been natural dispersers from Zanzibar or more likely escaped cage-birds. P. A. Clancey (pers. comm. 1981, 1985 and T. B. Oatley pers. comm. 1981) said that Rose-ringed Parakeets were also established and breeding in the Burman Bush at Durban, where they were first observed in 1969 and where by the early 1980s flocks of up to 30 were not uncommon, and the species is probably increasing (Maclean 1993). Since the Rose-ringed Parakeet is preadapted to arid and semi-arid savanna, it has the potential to extend its current range into the drier regions of South (and southern) Africa (Brooke 1997, Richardson *et al.* 2000).

According to Weissenbacher & Allan (1985), flocks of adult and juvenile Rose-ringed Parakeets had occurred in and around Johannesburg since 1970; whether these colonies survive is uncertain.

Tanzania (Zanzibar)

Mackworth-Praed & Grant (1957) say that Rose-ringed Parakeets of the form *borealis* (Pakistan and India to China) were introduced to Zanzibar before 1935, where they still survive (AOU 1998) in and around Zanzibar town.

United States

Small numbers of Rose-ringed Parakeets, believed to be of the form *manillensis* (southern India and Sri Lanka), occur in Florida and California. The earliest recorded breeding record for Florida was in 1969 in North Miami, Collier County but prior breeding is believed to have occurred. Although Stevenson & Anderson (1994) considered that the species was established in Dade, Collier, and Dixie Counties, James (1997), who lists it as occurring in North Miami, suggests there was no well-established breeding population. The AOU (1998) says that Rose-ringed Parakeets are established in small numbers in Dade, Collier, and Dixie Counties.

A small colony of Rose-ringed Parakeets that may have been established near Los

Angeles, California in 1956 had died out by 1963 (Hardy 1973). By the mid-1970s, however, another population of about 15–20 became established in Santa Clara County. Small (1994: 284) said that they occurred principally 'in the vicinity of Pt Dume and nearby Zuma Canyon LA, where more than 20 birds reside. A few occur at the Los Angeles County Arboretum ...'. Garrett (1997: 185) describes *P. krameri* as present

> in coastal Los Angeles County, mainly in Malibu (especially lower Zuma Canyon), Playa del Rey, and Westchester. There is a small population in the San Gabriel Valley (Temple City) and scattered reports from other areas. ... The population in lower Zuma Canyon has diminished from thirty or more individuals to eleven or fewer since the mid-1980s ... The overall population in the greater Los Angeles area is estimated at >60 individuals.

Although Sibley (2000) says that Rose-ringed Parakeets are found in both Florida and California, the AOU (1998) makes no mention of them in the latter state, but says that since 1973 a small population has existed in Hampton, Virginia.

Canary Islands

Perez (1983) recorded the first breeding of escaped *P. krameri* in 1983 on Gran Canaria, where a decade later Trujillo Ramirez (1993) found the species in Maspalomas, Ayaguares and Los Palmitos Park. Small numbers of breeding birds have since been reported from Tenerife and Fuerteventura, and birds have been observed in Lanzarote (A. Román Muñoz in Martí & del Moral 2003).

Cape Verde Islands

According to Mackworth-Praed & Grant (1970), Rose-ringed Parakeets were probably introduced to the Cape Verde Islands. The species is, however, not referred to by Bannerman & Bannerman (1968).

Mascarene Islands

Although Gallagher & Woodcock (1980) indicate that Rose-ringed Parakeets occur naturally on Mauritius, they were in fact introduced by man. Carié (1916) records that some escaped from an aviary in Grand Port Louis in about 1886, where they rapidly increased and became established in native lowland forest (especially the Macabé Forest) in and around the Black River Gorges in the southwest. Carié (1916) also recorded another population at Pamplemousses, and Guérin (1940–1953), who said that the former population had spread across Mahébourg Bay to Pointe d'Esny and Beau Vallon, considered that the birds were still centred on St Louis and Pamplemousses, as also did Rountree *et al.* (1952), who added that they were also to be found on coastal plains in the south and southeast and at Alma and Quartier Militaire. Newton (1958) recorded them prior to 1957 also at Reduit and Vacoar, and regarded them as more widely distributed than had Rountree *et al.* (1952). James (1996) recorded them as widely established in suitable habitats. See also Sinclair & Langrand 2003.

Impact: Cheke (1987) and others (e.g. Feare 1996), have drawn attention to the potential threat posed by *P. krameri* to the endemic Mauritius Parakeet *P. echo* (classified by the World Conservation Union as Critically Endangered) where the two species occur sympatrically, as in the Macabé Forest. Although no hybridisation is known to have taken place, nest site competition is believed to occur.

The Grey-headed Lovebird *Agapornis canus*, introduced from Madagascar, was once common on Mauritius, but disappeared in the 1950s when *P. krameri* became widely established (Cheke 1987, Jones 1987, 1996). The Rose-ringed Parakeet would have competed with *A. canus* for maize (Guérin 1940–53, Jones 1987, 1996), although as Jones (1996) points out, the latter died out on Réunion and Rodrigues in the absence of the former.

Some local damage to maize *Zea mays* crops by Rose-ringed Parakeets has been reported on Mauritius (Benedict 1957).

Seychelles Islands

Although it has been suggested that *P. krameri* could be a natural colonist in the Seychelles, it is known that at least one introduction was made (in 1996), and other birds may have also arrived on ships from India. It is now a breeding resident on Mahé (Skerrett *et al.* 2001).

Impact: If a viable population were to develop in the Seychelles, Rose-ringed Parakeets could restore an important part of the natural seed dispersal and pollinator niche that is essential to the ecosystem of the archipelago and which was lost with the extinction of the endemic parakeet *P. wardi* (Skerrett *et al.* 2001).

Hawaiian Islands

Munro (1960) indicated that escaped Rose-ringed Parakeets had occurred in the Hawaiian Islands (principally on Oahu) for many years without becoming permanently established. In the 1970s about 30 were observed near Kalaheo on Kauai, and in 1981 Paton *et al.* (1982) found the species in Hanapepe Valley and near Kukuiolono on Kauai and confirmed breeding. Pratt *et al.* (1987) recorded very local breeding in the Hanapepe Valley, Kauai; Waimanalo, Oahu; and Hilo, Hawaii, but said the birds were only well established on Kauai. Pratt (1994) and the AOU (1998) confirmed the species' presence on these three islands.

Alexandrine Parakeet
Psittacula eupatria

Natural Range: From E Afghanistan to Bangladesh, E Assam, N Burma, N and W Thailand and Indochina. Also Sri Lanka and Andaman Is.
Naturalised Range: Europe: ?British Isles. Asia: Bahrain; Japan; ?Saudi Arabia; UAE.

British Isles

Between 1997 and 1999 one or two pairs of Alexandrine Parakeets out of a population of around a dozen bred successfully at Fazackerley, Merseyside (Ogilvie & RBBP 1998–2000). In 2001 and 2002 hybrid *P. eupatria* x *P. krameri* birds nested successfully at Sidcup in Greater London (Butler 2002, Ogilvie & RBBP 2003), where a population has yet to become established.

Bahrain

Alexandrine Parakeets have been recorded in the wild in Bahrain since 1989, and from 1991 small flocks have been regularly reported in gardens in Busaytin, Muharraq, southeastern Manama, and the Sehla area of Manama, where Hirschfeld & King (1992) believed they were likely to become established. This is confirmed by Jennings (2004).

Japan

The OSJ (2000) says that Alexandrine Parakeets breed in Tokyo, central Honshu.

Saudi Arabia

Jennings (2004) lists this species as also breeding in Jeddah.

United Arab Emirates

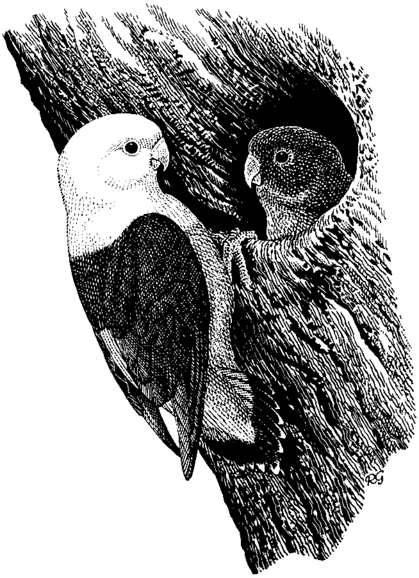
One or two pairs of Alexandrine Parakeets have bred around the fort at Abu Dhabi and the species occurs throughout the year at Zabeel and other places in Dubai and in Abu Dhabi, where Richardson (1992) believed there were several breeding populations. This is confirmed by Jennings (2004).

Grey-headed Lovebird
Agapornis canus

Natural Range: Madagascar.
Naturalised Range: Indian Ocean: ?Seychelles Is; ?Comoros Is.

Seychelles Islands

Grey-headed Lovebirds were introduced to Mahé in the Seychelles in 1906, where they became abundant. In the 1930s they were still very common, but thereafter suffered a dramatic decline and became rare except in Victoria, Port Launay, Anse la Mouche and Anse Boileau in the west. A small colony, descended from a separate introduction, became established on the island of Silhouette (Penny 1974, Diamond & Feare 1980).



Grey-headed Lovebird

COMOROS ISLANDS

Grey-headed Lovebirds have been introduced to the Comoros archipelago, where by the late 1950s they were quite common in cultivated and open country on Anjouan and Mayotte and occurred in smaller numbers on Moheli and Grand Comore (Peters 1937, Benson 1960).

Fischer's Lovebird
Agapornis fischeri

Natural Range: Rwanda and Burundi to NW Tanzania.

Yellow-collared Lovebird
Agapornis personatus

Natural Range: NE and C Tanzania.
Naturalised Range: Africa: Kenya.

KENYA

Fischer's and Yellow-collared Lovebirds, introduced to Kenya from Tanzania as cage-birds, were established and breeding in the wild in the former country by the mid- to late 1960s. Yellow-collared Lovebirds colonised residential parts of Nairobi, while Fischer's Lovebirds settled around Lake Naivasha and some other localities (Cunningham van Someren 1969, 1975, Zimmerman 1967, Ellis 1975). In about 1970, both species became established on the coast near Mombasa (especially at Nyali Beach) where hybridisation has occurred (Barlass 1975).

Impact: In agricultural districts, damage to grain crops (especially millet) has been recorded (Long 1981, Lever 1987).

Blue-and-Yellow Macaw
Ara ararauna

Natural Range: E Panama S to Paraguay, S Brazil and N Argentina.
Naturalised Range: North America: ?West Indies.

WEST INDIES

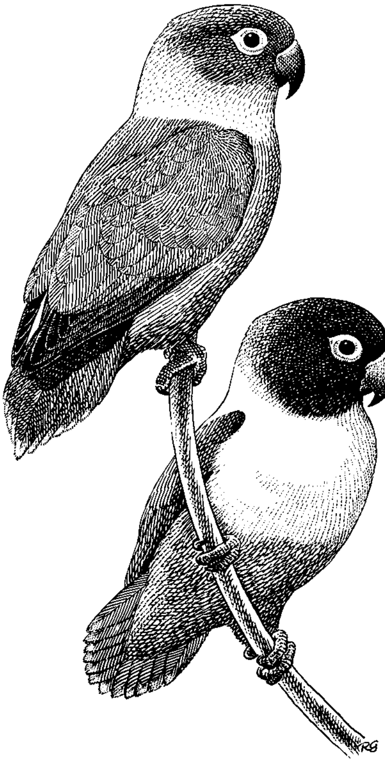
T. Silva (pers. comm. 1985) reported that this species had recently been observed in the wild in Puerto Rico, but that no breeding had yet been recorded. Successful breeding and establishment was first reported by Pérez-Rivera (1996). This species is not mentioned by Raffaele *et al.* (1998).

Chestnut-fronted Macaw
Ara severus

Natural Range: Panama S to E Venezuela, N Bolivia, N and C Brazil and the Guianas.
Naturalised Range: North America: USA.

UNITED STATES

According to O. T. Owre (pers. comm. 1980, 1985), Chestnut-fronted Macaws had for several years been nesting successfully around Miami in Dade County, Florida, where he estimated the population to number at least 50. Troops & Dilley (1986: 140) said that 'Paired



Fischer's Lovebird (above) and Yellow-collared Lovebird (below)

birds have been present in Miami for several years. Numerous nest sites have been documented'. Nevertheless, Stevenson & Anderson (1994) and James (1997) claimed that there is no evidence for establishment, although Sibley (2000) lists the species as occurring mainly in Florida. See also AOU (1998).

Blue-crowned Parakeet
Aratinga acuticaudata

Natural Range: N Venezuela, NE Colombia, S and NE Brazil, E Bolivia, N Argentina, W Uruguay.
Naturalised Range: Europe: ?British Isles; ?Spain. North America: USA.

British Isles
Blue-crowned Parakeets were first noted in the wild in England at Bromley in Greater London in 1997, and in 1999 at nearby Beckenham. In 2001 a nest containing four eggs was found in Bromley (Butler 2002, Butler *et al.* 2002). Since this species can survive at high elevations in South America, the climate of southern England should not prevent its establishment there.

Spain
Breeding has been recorded in four 10-km squares in Catalonia (ICO 2004)

United States
Since the early 1980s, Blue-crowned Parakeets have occurred in the upper Florida Keys, where they may be breeding (Robertson & Woolfenden 1992, James 1997, Kaufman 2000, Sibley 2000). Garrett (1997) recorded flocks of up to 13 regularly in the west-central San Fernando Valley in California, especially at Northridge, and others in the Simi Valley, Ventura County; in Redondo Beach; and in the San Gabriel Valley in Monrovia: the total Los Angeles population was estimated at fewer than 50 individuals. This species is not included by the AOU (1998).

Mitred Parakeet
Aratinga mitrata

Natural Range: C Peru to NW Argentina.
Naturalised Range: Europe: Spain. North America: USA.

Spain
A population of 100–150 birds is established in Barcelona and others probably breed in Gerona. A group of five individuals has been present in Mallorca (Balearic Islands) since 1993 (J. Clavell in Martí & del Moral 2003).

United States
Mitred Parakeets were present in Long Beach, Los Angeles County, California, by 1980 (Garrett 1989, Johnston & Garrett 1994). Small (1994) recorded flocks of up to 40 in the San Francisco and Sacramento areas, in

downtown Los Angeles, near Pt Dume, on Pt Fermin, in the San Gabriel Valley and in western San Diego County, and believed they were then the most numerous psittacid in the Los Angeles area. Mitred Parakeets were reported by Gallagher (1997) in Malibu (especially Zuma Canyon and Pt Dume), west Los Angeles, Culver City, Venice, central Los Angeles, Manhattan Beach, Redondo Beach, San Pedro, Long Beach, Huntington Beach, Highland Park, Temple City, Arcadia and El Monte. Flocks of up to 100 were observed, and the total population in the Los Angeles area was estimated at 690.

Kaufman (2000) and Sibley (2000) say that *A. mitrata* also occurs in Florida. The AOU (1998) makes no mention of this species.

Green Parakeet
Aratinga holochlora

Natural Range: Mexico (including Socorro I.), and E Guatemala to N Nicaragua.
Naturalised Range: North America: USA.

United States

Green Parakeets are established in large numbers (Kaufman 2000) in the lower Rio Grande Valley in southern Texas, probably as a result of introductions (AOU 1998) but perhaps partly as a consequence of natural vagrancy from Mexico (Sibley 2000). T. Silva (pers. comm. 1986) referred to successful breeding in Texas near Corpus Christi.

Red-masked Parakeet
Aratinga erythrogenys

Natural Range: W Ecuador, NW Peru.
Naturalised Range: Europe: Spain. North America: USA.

Spain

Since 1991 Red-masked Parakeets have been established in Valencia where about a dozen pairs now breed and roost in holes in the fifteenth-century tower beside the Botanical Gardens (Murgui 2000). The species also occasionally breeds in Barcelona (J. Clavell in Martí & del Moral 2003).

United States

Troops & Dilley (1986) reported attempted breeding by this species in Miami, Florida, where James (1997) confirms its presence in Dade, Monroe and Palm Beach Counties. In California it was not mentioned by Hardy (1973) and was only recorded sporadically by Johnston & Garrett (1994). More recently, small flocks have been observed in Temple City and adjacent Monrovia, and in Redondo Beach, where the greater Los Angeles population has been tentatively estimated by Garrett (1997) at about 70. This species is not included by the AOU (1998), although Sibley (2000) lists it as occurring mainly in Florida and California.

Orange-fronted Parakeet
Aratinga canicularis

Natural Range: Pacific slope of Mexico to W Costa Rica.
Naturalised Range: North America: USA; West Indies.

United States

According to Owre (1973: 494), Orange-fronted Parakeets have been 'reported from throughout the Miami area [of Florida] and from northward along the Atlantic Coastal Ridge', where breeding was suspected. Troops & Dilley (1986) say that Orange-fronted Parakeets were believed to be breeding in Miami and Fort Lauderdale, Florida. The AOU (1998) quotes Stevenson & Anderson (1994) as saying that reports from Florida are based on escaped cage-birds. Peterson (1990) records this species as also occurring locally in southern California.

West Indies

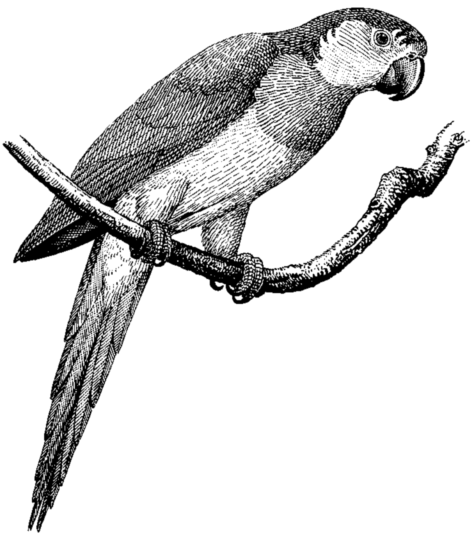
'Introduced to Puerto Rico, probably in the 1960s, this species is locally uncommon at

Cabezas de San Juan near Fajardo where it occurs in small numbers' (Raffaele *et al.* 1998: 309). The species' presence in Puerto Rico is confirmed by the AOU (1998).

Brown-throated Parakeet
Aratinga pertinax

Natural Range: Panama S to N and E Colombia and N Brazil and the Guianas, including Aruba, Curaçao, Bonaire, Tortuga and Margarita Is.
Naturalised Range: North America: ?USA; West Indies.

United States
According to Owre (1973: 494), the Brown-throated Parakeet 'is reported to have bred at Key West, Florida [in 1970–71], and there are increasing reports of the species in the Miami area'. Troops & Dilley (1986) found this species to be becoming increasingly common around Miami, where the AOU (1998) quotes Stevenson & Anderson (1994) as saying that reports from Florida are based on escaped cage-birds.



Brown-throated Parakeet

West Indies
Salvadori (1905–06), quoting Graf von Berlepsch, said that Brown-throated Parakeets were introduced to St Thomas in the Virgin Islands before the 1860s (apparently from Curaçao where the subspecies is the nominate *pertinax*), where a century later the population was widespread and numbered about 400 (Forshaw 1980). T. Silva (pers. comm. 1985) believed that the birds had not been introduced by man but had probably arrived naturally as storm-borne vagrants. Brown-throated Parakeets are today fairly common residents, particularly in the east. From St Thomas the birds spread naturally to Tortola, St John, Puerto Rico, Culebra, Vieques, Saba and Dominica. Brown-throated Parakeets are uncommon on Saba, where there appear to be two separate colonies, one at Wall's Bay and the other in the Bottom, and on Dominica (Raffaele *et al.* 1998). The populations on the other islands have died out (Wiley 1993, AOU 1998). The species has recently been recorded on Guadeloupe and Martinique (Raffaele *et al.* 1998).

Nanday Parakeet (Black-hooded Parakeet; Nanday Conure)
Nandayus nenday

Natural Range: SE Bolivia and SW Brazil to C Paraguay and N Argentina.
Naturalised Range: Europe: ?Spain. Asia: Israel. North America: USA; ?West Indies. Atlantic Ocean: Canary Is.

Spain
Four pairs nested in Málaga province in 2002, and breeding has also occurred in the Llobregat Delta and perhaps elsewhere in Barcelona (J. Clavell in Martí & del Moral 2003).

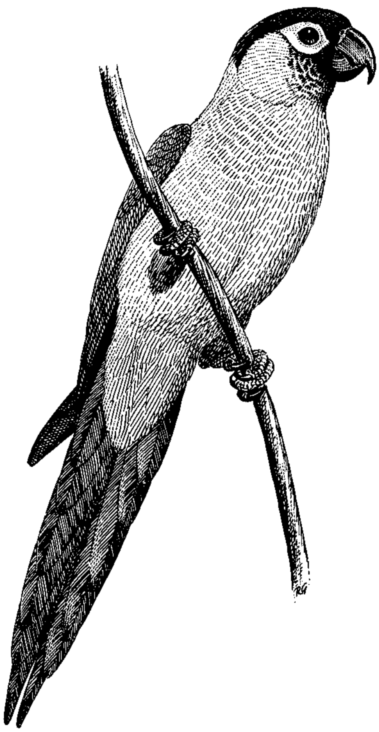
Israel
Nanday Parakeets first appeared in Israel in Emeq Hefer and south to the Carmel (Pardes Hanna and Binymina) in the 1970s, becoming established there during the 1990s (A Keller, pers. comm. to Mendelssohn

1999), presumably originally as escaped cagebirds.

UNITED STATES

Hardy (1973: 507–508) says that 'this South American species has been observed for several years in Loma Linda, San Bernardino County [California]', where Fisk & Crabtree (1974) believed the breeding colony was derived from birds that escaped from captivity in Yucaipa in 1969. In the 1970s and 1980s birds were seen in Pasadena, west Los Angeles and the Palos Verdes Peninsula (Los Angeles County) and at Moss Landing, Monterey County. By the 1990s, Nanday Parakeets were established in residential areas and neighbouring canyon bottoms dominated by California Sycamores *Platanus racemosa* from Brentwood, western Los Angeles to Pacific Palisades, and from central Malibu to lower Zuma Canyon. They have also been reported from Culver City and Rancho Park, West Los Angeles, the San Gabriel Valley, Huntington Beach, Orange County, the Palos Verdes Peninsula and the San Joaquin County foothills (Vuilleumier 1991, Johnston & Garrett 1994, Small 1994, Garrett 1997, AOU 1998, Kaufman 2000, Sibley 2000). Small (1994) estimated the Californian population at fewer than 100; Garrett (1997) said the total was over 180.

Nanday Parakeets are also established and breeding in St Petersburg, Dade County, near Miami, Florida (Troops & Dilley 1986, Robertson & Woolfenden 1992, James 1997, AOU 1998, Kaufman 2000, Sibley 2000).



Nanday Conure

WEST INDIES

Although T. Silva (pers. comm. 1985) said that Nanday Parakeets were not uncommon in Puerto Rico (Mayaguez), Raffaele *et al.* (1998: 307) reported the species to be 'Rare and local on Puerto Rico where it was introduced probably in the early 1970s. The species occurs in very small numbers primarily along the northeastern coast'. The AOU (1998: 693) says only that the species is 'widely reported' in Puerto Rico.

CANARY ISLANDS

According to J. Clavell (in Martí & del Moral 2003), Nanday Parakeets may breed in the Canaries.

Monk Parakeet
Myiopsitta monachus

Natural Range: Bolivia, Brazil, Paraguay, Uruguay and N and W Argentina.

Naturalised Range: Europe: Belgium; British Isles; Czech Republic; ?Germany; Italy; ?The Netherlands; ?Portugal; Spain. North America: USA; Canada; West Indies. South America: ?Venezuela. Atlantic Ocean: Canary Is.

BELGIUM

Released and escaped Monk Parakeets had by 1989 formed a colony of 30–35 breeding pairs in Brussels (Rabosee *et al.* 1995, Truffi & Šťastný 1997).

British Isles

Ogilvie & RBBP (2001) reported the establishment in 1999 of a breeding colony of 17 Monk Parakeets at Borehamwood in Hertfordshire, which had increased to 20, including five or six breeding pairs, by the following year (Ogilvie & RBBP 2002). (*Myiopsitta monachus* is the only parrot among over 330 species that builds a large communal nest of sticks, in which several pairs of birds can breed, and which is also used for roosting). This colony had further increased to 32, including seven breeding pairs, by 2001 (Butler 2002, Ogilvie & RBBP 2003). Previous colonies in Devon (1987–98) and Cheshire (1988–93) have died out (Butler 2002).

Czech Republic

The population of escaped and released Monk Parakeets in the town of Sázava and the Sázava River valley in central Bohemia numbered 42 in 1989, and by 1990 had risen to 87 (Žoha 1993, Truffi & Šťastný 1997).

Germany

Although Truffi & Šťastný (1997) say that Monk Parakeets have not succeeded in establishing viable populations in Germany, Gebhardt (1997) lists them as having been first introduced in 1892 and as established locally.

Italy

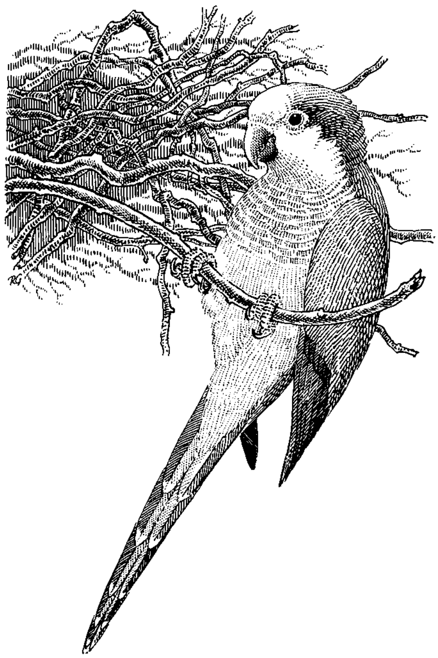
Since 1970 a colony of escaped or released Monk Parakeets has been established in Genoa, where the population numbers about 20–30. Since the early 1980s, another small colony has been present in Friuli (Udine), where ten birds were counted in 1988. At least 30 pairs have bred regularly since 1985 in the Pastrengo zoo-park (Truffi & Šťastný 1997). Biondi *et al.* (1995) identified two breeding colonies in Infernetto-Castlefusano and Ostia Antica-Dragona, while Bertolino (1999) recorded nesting in Piemonte at Saint Giovanni de Busca in 1997. Truffi & Šťastný (1997) said a colony at Lake Maggiore is not self-sustaining.

The Netherlands

Lensink (1998a) lists between one and ten breeding pairs of Monk Parakeets in The Netherlands in 1992–94, where Truffi & Šťastný (1997) regard the population as non-viable.

Spain; Portugal

Monk Parakeets are well established and spreading in Spain, where the 2003 *Atlas* found a population of at least 1,300 pairs, which is increasing by some 20% annually (A. Román Muñoz in Martí & del Moral 2003). Monk Parakeets were first recorded in the wild in Barcelona in 1975 (Batllori & Nos 1985). By 1985 a total of 97 were counted in Catalonia, principally in coastal areas near Barcelona, and in 1990–91 155 nests were noted in the city. In 1991–92 182 nests were found at 13 sites in Barcelona (Clavell *et al.* 1991, Sol *et al.* 1997, Truffi & Šastný 1997, Sol 2000) including Ciutadella (Langley 2004), and in 1999 779 nests were counted in the city, where the birds were almost ubiquitous (J. Clavell in Mayer 2001). The 2003 *Atlas* (Martí & del Moral 2003) similarly found 750 pairs in Catalonia, where the rate of increase



Monk Parakeet

has been 9–18% annually since the 1990s. Other large concentrations noted by Martí & del Moral (2003) are 390 pairs in Andalucía (chiefly along the coast in Málaga province) and in coastal Valencia (70 pairs). There are also populations in the Balearic Islands, especially in Mallorca but also in Menorca and Ibiza.

Away from the coast, Monk Parakeets have nested in Madrid since around 1985, where although Pascual & Aparicio (1990) said the population did not exceed a dozen birds, at least nine nests were found in 1992 (editorial comment in Mayer 2001). The Madrid population was at least 70 pairs at the time of the 2003 *Atlas*. Langley (2004) recorded the species as abundant in Casa de Campo, Madrid, and as also occurring in Portugal.

Langley (2004) estimated the total European population (including the Canary Islands) at over 3,000 pairs.

United States; Canada

Free-flying Monk Parakeets were first reported in the United States in New York in 1967, where nesting occurred in 1970. Successful breeding was confirmed in Florida in or before 1969 (Owre 1973); Michigan (1971); Ohio, Oklahoma, North Carolina, North Dakota and Nebraska (1972); and Texas (1973) (see e.g. Niedermeyer & Hickey 1977). In the late 1960s/early 1970s, Monk Parakeets were seen in Connecticut, New Jersey, Pennsylvania and Massachusetts (Clark 1992, Devine & Smith 1992, Olivieri & Pearson 1992), and by the mid-1980s the species was said to occur in southern and eastern states from Texas, Alabama and Florida north to Wisconsin and Maine. Several small colonies became established in Chicago, Illinois, where T Silva (pers. comm. 1985) believed many may die in severe winters. On the west coast, Hardy (1973) reported a number of short-lived populations in the early 1970s in southern California (see also Johnston & Garrett 1994, Garrett 1997).

In 1973 an eradication programme considerably reduced both the number and distribution of Monk Parakeets in the United States (Small 1994). Nevertheless, James (1997) found the species to be widely distributed in southern Florida, with smaller populations in suburban habitats on the east coast from Jacksonville, Duval County, to Plantation Key, Monroe County. Monk Parakeets also breed in the Tampa–St Petersburg region and elsewhere on the Gulf coast.

The AOU (1998: 233) described *Myiopsitta monachus* as:

> Introduced and established in the eastern United States from Illinois, Michigan, southern Quebec, southern New York, Connecticut and Rhode Island south to New Jersey, with individual reports west and south to California, Oregon, Idaho, Oklahoma, Kentucky, and Virginia (control measures in progress in several localities); and in Texas [and] Florida.

The birds in southern Quebec, Canada, presumably represent a natural dispersal from one of the northeastern states.

Kaufman (2000), Sibley (2000), and Peterson (2002) reported breeding in Connecticut, New York, Florida, Texas, Illinois (Chicago), Oregon and elsewhere.

All free-flying Monk Parakeets in North America are descended from escaped or released cage-birds. The population was estimated in the mid-1990s to number several thousand (S Pruett-Jones in James 1997).

Impact: In their native range Monk Parakeets are extremely destructive to a wide variety of crops. In the United States they feed on maize, wheat, sorghum, barley, oats, passion-fruit, citrus fruits, tomatoes, figs, apricots, plums, persimmons, loquats, pears, grapes, mulberries, peaches and cherries. Shields *et al.* (1974) observed that in New Jersey young American Elms *Ulmus americanus* had the top metre of their crown completely stripped of buds, flowers, and fruits. Many willows *Salix* spp. also suffered considerable damage, probably due to their utilization by the birds for food and nesting material.

West Indies

Although Bond (1979) makes no mention of

Monk Parakeets in the West Indies, Raffaele *et al.* (1998: 307) say the species was:

> Introduced to Puerto Rico, probably during the 1950s, it is common around El Morro in Old San Juan, the Isla Grande Reserve in Santurce and on the campus of the University of Puerto Rico in Río Piedras. It is also fairly common in the Luquillo Beach–Fajardo area and uncommon elsewhere on the coast. The species is expanding its range on the island. A feral breeding population exists in the Cayman Islands in George Town on Grand Cayman. Monk Parakeet is rare on Guadeloupe where there is one active nest site …. The population on Eleuthera in the Bahamas, first recorded about 1980, appears to be extirpated.

The AOU (1998) lists *Myiopsitta monachus* as introduced to and established on all the above islands, and also in the Dominican Republic [Hispaniola].

Venezuela

Ulloa & Badillo 1987) refer to the risk posed by the introduction of *Myiopsitta monachus* to Venezuela, but do not indicate if the birds are established and breeding.

Canary Islands

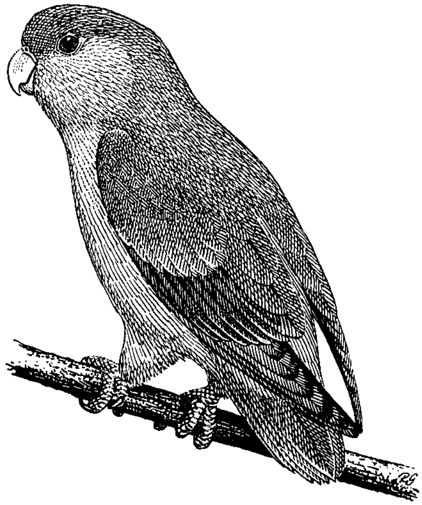
Monk Parakeets are common and increasing in Tenerife and Gran Canaria, and have also been reported on Fuerteventura, La Gomera and La Palma (A. Román Muñoz in Martí & del Moral 2003).

Green-rumped Parrotlet
Forpus passerinus

Natural Range: N Colombia and N Venezuela S through the Guianas to Brazil.
Naturalised Range: North America: West Indies.

West Indies

Bond (1979: 113) says that Green-rumped Parrotlets were introduced to Jamaica near Old Harbour around 1918; thereafter they expanded their range and became 'widespread in rather open country in lowlands on the southern side of the island', and also in natural forests and cultivated localities in upland areas. In the early 1900s they were also introduced to Barbados, where they became rare and were decreasing (Bond 1979, AOU 1998). They have also been introduced, unsuccessfully, to Martinique (Raffaele *et al.* 1998).



Green-rumped Parrotlet

Canary-winged Parakeet (White-winged Parakeet)
Brotogeris versicolurus

Natural Range: SE Colombia and NE Peru to S French Guiana and CN Brazil.

Yellow-chevroned Parakeet
Brotogeris chiriri

Natural Range: N, C, and S Bolivia, Paraguay, N Argentina to NE, C and SE Brazil.

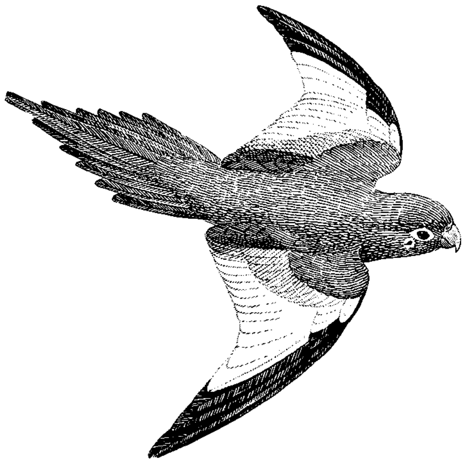
Naturalised Range: North America: USA; West Indies.

United States

These two forms were previously considered as conspecific, but were split by Collar (1997) on the grounds of morphological differences and near sympatry (Sibley & Monroe 1990).

By the early 1970s, Canary-winged Parakeets, imported as cage-birds, were established in San Pedro and the nearby Palos Verdes Peninsula, Los Angeles County, and in Riverside County, California (Hardy 1973), and in 1973 breeding was recorded at Pt Fermin, San Pedro. Since the 1980s, when the species had spread over much of the Los Angeles basin, *B. versicolurus* has been gradually replaced in southern California by *B. chiriri* (Johnston & Garrett 1994), and flocks of parakeets in the Los Angeles basin have been composed principally or exclusively of the latter species (Garrett 1993). Today, Yellow-chevroned Parakeets are widely distributed in the Los Angeles Basin, from south-central and downtown Los Angeles westward to West Hollywood and Beverly Hills and northward to Highland Park, Eagle Rock, South Pasadena and San Marino. Populations also occur from San Pedro and the Palos Verdes Peninsula north to Redondo Beach and Torrance (Garrett 1997). The southern California population of both species was estimated by Small (1994) at probably less than 300. Garrett (1997) put the Yellow-chevroned Parakeet population at a minimum of 380 and that of the Canary-winged Parakeet at not more than 20.

From the 1970s, Canary-winged Parakeets also maintained wild populations in Florida, largely in Sarasota and Tampa–St Petersburg along the Gulf coast and between Miami and Fort Pierce on the Atlantic coast (James 1997). In 1972, nearly 700 were counted at a roost in Coconut Grove, and the total population in the Miami metropolitan area was estimated at between 1,500 and 2,000 birds. By 1976, when flocks several hundred strong were not uncommon, Canary-winged Parakeets were said to be the commonest parrot in Florida. In recent years, *B. chiriri* has, as in southern California, almost entirely replaced *B. versicolurus* in southern Florida (Robertson & Woolfenden 1992; Smith & Smith 1993). This temporal replacement is a result in changes in the source, and thus in species, of birds imported into the United States (Johnston & Garrett 1994). See also: AOU (1998), Kaufman (2000), Sibley (2000), Peterson (2002).



Canary-winged Parakeet

Impact: In Miami, Canary-winged Parakeets were said by Owre (1973) to be damaging Mango *Mangifera indica* and other fruit crops.

West Indies

Bond (1979) and Raffaele *et al.* (1998) said that in the 1950s *B. versicolurus* was introduced to Puerto Rico, where Forshaw (1980) recorded a population of several hundred and where the species is now locally common with flocks exceeding 1,000 individuals. It has also been recently recorded from the Dominican Republic in Hispaniola (Raffaele *et al.* 1998).

Hispaniola Parrot
Amazona ventralis

Natural Range: Hispaniola and satellite islands.

Naturalised Range: North America: ?USA; West Indies.

United States

This species frequently occurs in the wild in

Florida, but establishment is unproven (Sibley 2000).

West Indies

According to Forshaw (1980), a shipment of Hispaniola Parrots refused entry to Puerto Rico was liberated off the port of Mayaguez in the west of the island, where several hundred became successfully established. They are today locally common in forests and woodlands of the foothills, especially in western and north-central localities (Raffaele *et al.* 1998).

According to the AOU (1998), Hispaniola Parrots have also been successfully introduced to St Croix and St Thomas in the Virgin Islands.

Red-crowned Parrot (Green-cheeked Parrot)
Amazona viridigenalis

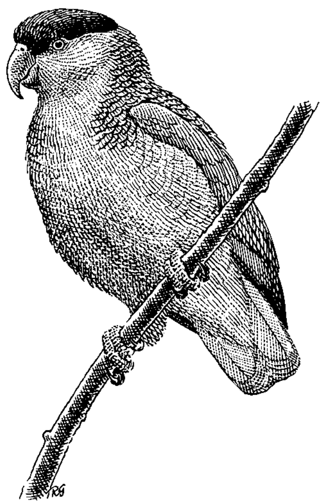
Natural Range: NE Mexico.
Naturalised Range: North America: USA; West Indies. Pacific Ocean: Hawaiian Is.

United States

'A breeding population in southern Texas (lower Rio Grande Valley, recorded northwest to Falcon Dam) is most likely established from escapes from captivity, but a wild origin for some of the individuals cannot be ruled out' (AOU 1998: 243). Sibley (2000) and Peterson (2002) concur with this assessment.

First recorded in California in 1963, Hardy (1973) considered Red-crowned Parrots to be both extremely local and rare, but the species has been increasing in urban Orange County since the early 1970s, where Gallagher (1997) recorded flocks of 50–70 in Santa Ana, Orange, Tustin, Anaheim and Fullerton. Small (1994) reported small flocks in the Hacienda Heights and Monrovia areas and in San Diego County, and estimated the state population at around 200. The principal centre of this species in California is from Altadena, Pasadena and Highland Park east to Glendora, and up to 750 birds have been estimated in Temple City (Mabb 1997a). Large populations are also present in the northern San Fernando Valley (Panorama City and Mission Hills west to Northridge and north to Sylmar), with a smaller colony on the Malibu coast near Pt Dume and the lower Zuma Canyon. Frequent breeding has been confirmed in the San Gabriel Valley (Mabb 1997b), in Orange County (Gallagher 1997) and at Pt Dume, Malibu (Garrett 1997). The last-named author conservatively estimated the California population at 1,080 individuals. Vuilleumier (1991: 333) describes the population as 'very small and geographically restricted'.

Owre (1973: 494) said that Red-crowned Parrots were 'the most abundant of the amazons [members of the genus *Amazona*] now present in southeastern Florida, They have been reported from the Florida Keys and are commonly seen throughout metropolitan Miami and in Fort Lauderdale. Troops & Dilley (1986) found *A. viridigenalis* to be fairly common in urban areas of Miami and Fort Lauderdale, especially in Coconut Grove, Coral Gables, South Miami and along the Middle River and at Colohatchee Park in Fort Lauderdale. The AOU (1998) and Kaufman (2000) confirm the species' presence in Dade and Monroe Counties in southern Florida.



Red-crowned Parrot

West Indies

'Introduced to Puerto Rico probably in the late 1960s, the species occurs in small numbers very locally around the coast. Near Salinas, as many as 40 birds have been reported in a single flock' (Raffaele *et al.* 1998: 313).

Hawaiian Islands

'... a small group has persisted since 1970 in the Hawaiian Islands (on Oahu)' (AOU 1998). This population is not mentioned by Pratt *et al.* (1987).

Lilac-crowned Parrot
Amazona finschi

Natural Range: W Mexico.
Naturalised Range: North America: USA.

United States

Since at least 1976 Lilac-crowned Parrots have been established and breeding in the San Gabriel Valley of California, with smaller numbers in the northern San Fernando Valley and the Malibu coast (Zuma) to Santa Monica/ West Los Angeles (Peterson 1990, Small 1994, Garrett 1997, Kaufman 2000, Sibley 2000). This population, which is not mentioned by the AOU (1998), was estimated by Garrett (1997) to number nearly 100 individuals.

Yellow-headed Parrot
Amazona oratrix

Natural Range: SW and S Mexico (including Tres Marias Is.) and Belize.

Yellow-crowned Parrot
Amazona ochrocephala

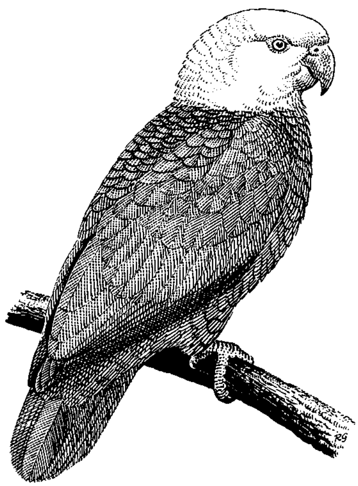
Natural Range: E Mexico to Colombia and Bolivia east to N and W Brazil and the Guianas.
Naturalised Range: North America: USA; West Indies.

(Although *A. oratrix*, *A. ochrocephala*, and the Yellow-naped Parrot *A. auropalliata* have frequently been regarded as conspecific, Dickinson (2003) follows the AOU (1998) in treating all three as separate species.)

United States

Troops & Dilley (1986: 138) recorded *A. ochrocephala* in Florida as 'Established in local colonies in Coconut Grove, Coral Gables, South Miami and at Colohatchee Park and along the Middle Road in Fort Lauderdale'.

In southern California few attempts have been made until recently to distinguish between *A. oratrix* and *A. ochrocephala*, and the introduction of both species was reported indiscriminately, with the birds occurring widely in the western San Gabriel Valley, west Los Angeles and elsewhere, where Hardy (1973: 508) reported them to be 'locally fairly common ... in flocks ... to an estimated 30 individuals' over a wide area, including Glendale, Alhambra, Pepperdine College, north Pasadena, Westwood, west Los Angeles, Lomita, San Bernardino, Brentwood, Altadena, Glendora, Ontario, Pomona and Loma Linda. Peterson (1990) reported local breeding in and around Los Angeles and in the western San Gabriel Valley, and that the birds were also frequently seen elsewhere. According to Small (1994), only *A. oratrix* has



Yellow-crowned Parrot

been confirmed as breeding in California, where at one time the range of these parrots extended from central Los Angeles and Hollywood west to Beverly Hills and Santa Monica, and from the foothills of the Santa Monica Mountains south through Culver City. In recent years the population has considerably declined, especially in the Beverly Hills, Westwood, Brentwood and Mar Vista areas; Garrett (1997) routinely saw flocks of ten to 20 Yellow-headed parrots in west Los Angeles in the 1970s, but only up to 12 in the 1990s. The birds have, however, been recorded in Pasadena, Monrovia, and near Arcadia, as well as in Orange (since the 1970s) and San Diego Counties (Small 1994, Gallagher 1997). Recent breeding was recorded by Gallagher (1997) in Garden Grove, Orange County. Garrett (1997) estimated the total southern Californian population at less than 60.

West Indies

Raffaele *et al.* (1998: 314) recorded *A. oratrix* as 'Introduced to Puerto Rico probably in the early 1970s, it is rare but known to breed. The species occurs very locally in small numbers along the north coast', where the AOU (1998) says it may be established.

Orange-winged Parrot
Amazona amazonica

Natural Range: N and E Colombia S to N Bolivia and E through most of N S America.
Naturalised Range: North America: ?USA; West Indies.

United States

Populations in Dade County (James 1997) in southern Florida are likely to be escaped birds or their descendants (Robertson & Woolfenden 1992). Sibley (2000) lists this species as frequently encountered in Florida.

West Indies

'Introduced to Puerto Rico probably in the late 1960s and to Martinique more recently, this species probably breeds on both islands. It is uncommon in metropolitan San Juan in small numbers and is unrecorded elsewhere on Puerto Rico. The species is moderately widespread in central Martinique where breeding occurred in 1994' (Raffaele *et al.* 1998: 313–314). The AOU (1998) records probable breeding in the San Juan area, Mayaguez, Salinas and Río Piedras.

CUCULIDAE
(CUCKOOS AND ALLIES)

Smooth-billed Ani
Crotophaga ani

Natural Range: C and S Florida, USA, the West Indies (from the Bahamas to Trinidad and Tobago), and from Mexico through Colombia and Ecuador to Venezuela and N Argentina.
Naturalised Range: Pacific Ocean: Galápagos Is.

Galápagos Islands

Rosenberg *et al.* (1990) and Sandler (1996), from whom much of the following is derived, have summarised the history and status of the Smooth-billed Ani in the Galápagos Islands.

The species was first recorded in the archipelago in the early 1960s by Harris (1973), who believed the birds were Groove-billed Anis *C. sulcirostris.* Although the birds' origin cannot be proved, it seems almost certain they were imported from Ecuador in the mistaken belief that they would prey on ticks (Acarina) and other parasites of cattle (Duffy 1981). Kramer (1984: 255), however, believed the birds were 'independent immigrants' from the South American mainland, although Harris (1974) doubted the birds' ability to make the 1,000km sea crossing.

After the initial 1960s sightings the species was not recorded again until 1979, when it was seen regularly in the farm zone (uplands) on Santa Cruz. During the El Niño of 1982–83, when the highest recorded rainfall in the Galápagos triggered an exceptionally successful landbird breeding season, the Ani population greatly increased, and by 1984 the birds were common on Santa Cruz with an estimated population of 800 in the farm zone (Bellesteros 1984). During the 1982–83 El Niño, Anis were also reported from Daphne, Genovesa, Santiago and southern Isabela, though by the late 1980s they had not been observed again on the first two islands. Since 1986, Anis have been recorded on Floreana, Pinzón, Santa Fé and San Cristóbal, and in 1988 on Fernandina. On Santa Cruz, Rosenburg *et al.* (1990) estimated the population in 1986 in the farm zone at 4,800 with a 95% confidence interval of 2,800 to 6,800 individuals; outside the farm zone they estimated 50–100 Anis occurred in the *c.* 2,300ha highland portion of the Galápagos National Park. On southern Isabela the population was also estimated to number between 50 and 100 birds.

Since the *garúa* (cool and misty) season of 1988 the population of Smooth-billed Anis, especially on Santa Cruz, has declined dramatically, probably due to the unusually cold weather and/or drought; on Santa Cruz the population in 1988 was estimated to number around 220, representing a decrease since 1986 of over 95%.

According to Castro & Phillips (1996), Anis then occurred in the farm zone on Isabela, Santa Cruz and Floreana, with a colony of around a dozen on Santiago, but had been eradicated from Santa Fé and Pinzón. Swash & Still (2000) recorded them as fairly common in the highlands of Isabela, Santa Cruz, Floreana and Santiago. F. Cruz (pers. comm. 2004) said they '… are numerous and well established in all the inhabited islands as well as Santiago, Pinzón, Marchena and Pinta. There are plans to eradicate them from Fernandina and Genovesa'. D. Weidenfeld (pers. comm. 2004) wrote that the Smooth-billed Ani '… is currently found on all the major islands and most of the minor ones, as long as they have some vegetation. They are quite common, though not abundant'.

Impact: As deforestation increases in the Galápagos so will the Anis' range doubtless expand, and breeding will probably take place on all islands with a humid vegetation zone where insects are plentiful. *Crotophaga* spp. are known to prey at times on nestlings and other small vertebrates, and this, combined with their aggressive nature, makes them a potential threat to native birds. They could also compete for food with Galápagos Mockingbirds *Nesomimus parvulus* and Dark-billed Cuckoos *Coccyzus melacoryphus.*

Further threats posed by Smooth-billed Anis are the dispersal of alien plants, such as Guava *Psidium guajava*, to islands with a moist vegetation zone, and the transmission of parasites and diseases such as malaria. Nevertheless, D. Wiedenfeld (pers. comm. 2004) said that '… there is no large-scale eradication effort under way nor being developed'.

TYTONIDAE (BARN OWLS)

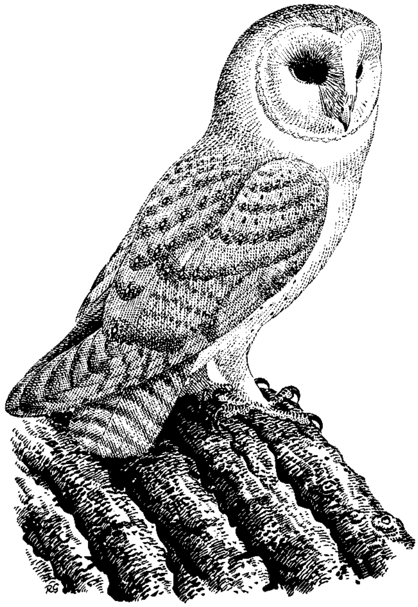
Barn Owl
Tyto alba

Natural Range: Virtually cosmopolitan: does not occur in Canada, Greenland, Iceland, northern Scandinavia, much of the northern Palaearctic, much of north-central Africa, Japan, Philippines, parts of Indonesia, and New Zealand.

Naturalised Range: Indian Ocean: Seychelles Is. Pacific Ocean: Hawaiian Is.

Seychelles Islands

On New Year's Eve 1951, 15 Barn Owls of the race *affinis* (Mauritania and Sudan to South Africa) were imported from South Africa and released at Union Vale on Mahé, and in 1952 two further consignments of six birds each were liberated at Le Niol. The purpose of the introduction was to control introduced Black Rats *Rattus rattus* (see Lever 1985). By 1958 Barn Owls had spread to North, Silhouette and Praslin, and by 1966 to Aride; they now occur on Mahé, Praslin, Curieuse, Aride, Silhouette, North and probably other granitic islands (Skerrett *et al.* 2001).



Barn Owl

Impact: Barn Owls have proved singularly ineffective in controlling Black Rats in the Seychelles, preferring instead to prey on more easily captured native birds. On Mahé, Praslin, La Digue and Silhouette, they contributed to the near eradication of the local form of the White Tern *Gygis alba candida*. Diamond & Feare (1980) recorded that on Cousin and Aride (and perhaps elsewhere) they take White Terns, Lesser Noddies *Anous tenuirostris*, Audubon's Shearwaters *Puffinus lherminieri* and Bridled Terns *Sterna anaethetus*, and doubtless other species. Fisher *et al.* (1969) also implicated Barn Owls in the decline, through aggressive competition for nesting and roosting sites, of the endemic Seychelles Kestrel *Falco araea* and Seychelles Scops Owl *Otus insularis*, classified respectively as Vulnerable and Critically Endangered by the World Conservation Union. As Feare (1988) points out, however, the decline of several other endemic species that had been attributed to Barn Owls actually occurred before the alien's arrival. Skerrett *et al.* (2001) say that Barn Owls are accused of predation on endemic tenrecs (Tenrecidae).

Hawaiian Islands

Between 1958 and 1963 a total of 86 Barn Owls from California and Texas (*T. a. pratincola*) were released at Kukuihaele on Hawaii, at Hauula on Oahu, in western Molokai and on Kauai (Tomich 1962), to control Black Rats *Rattus rattus* in sugarcane plantations (see Lever 1985). Today, Barn Owls are established on all the main islands from Kauai eastwards (Scott *et al.* 1986, Pratt *et al.* 1987, Stone *et al.* 1988, Pratt 1994, AOU 1998).

Impact: Of 104 Barn Owl pellets examined by Tomich (1962), only nine contained traces of Black Rats. As in the Seychelles, the potential exists for *T. alba* in the Hawaiian Islands to have a negative impact on the islands' avifauna, including the local endemic race of the Short-eared Owl *Asio flammeus sandwichensis* (Lever 1987, 1994).

STRIGIDAE (OWLS)

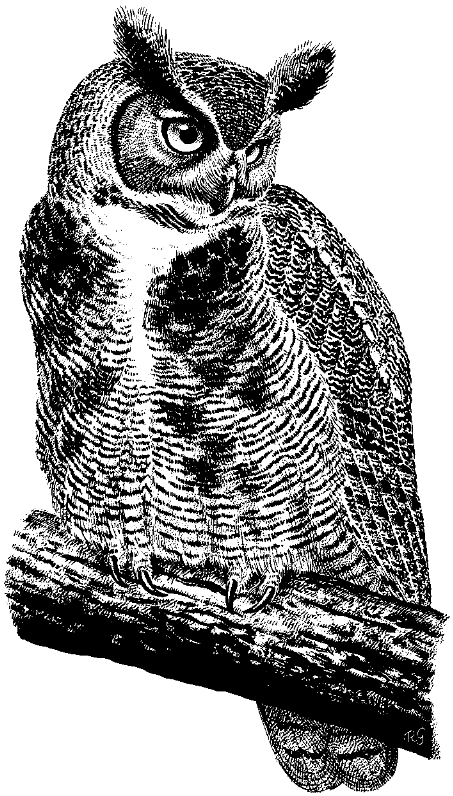
Great Horned Owl
Bubo virginianus

Natural Range: from C Alaska, USA, S through Central America to C Peru, W Bolivia and W Argentina.
Naturalised Range: Pacific Ocean: Marquesas Is.

Marquesas Islands

In 1927 Mgr Le Cadre acquired eight Great Horned Owls from San Francisco (presumably *B. v. saturatus* or *B. v. pacificus*) to '*combattre l'invasion des rats*' (see Lever 1985) on the island of Hiva Oa, where they became fairly abundant both on the coast and inland up to 1,000m above sea level (Holyoak & Thibault 1984).

Impact: On Hiva Oa, Great Horned Owls have been reported to kill domestic poultry. They have probably also been at least partially responsible for the decline of the local race of the endemic White-capped Fruit



Great Horned Owl

Dove *Ptilinopus d. dupetithouarsii* (Holyoak & Thibault 1984).

Little Owl
Athene noctua

Natural Range: Much of the Palaearctic region N to around 57°N in Denmark and 50°N in Manchuria, S to about 27°N in W Africa and 5°N in Ethiopia and Somalia.

Naturalised Range: Europe: British Isles. Australasia: New Zealand.

British Isles

Unsuccessful attempts to introduce Little Owls to Britain from continental Europe were made in 1842 or 1843 and in 1876–77. Limited success was achieved by E. G. B. Meade-Waldo, who between 1874 and 1900 released a total of 90 birds in Kent. The Little Owls in Britain today, however, are mainly descended from a large number imported from The Netherlands (*A. n. vidalii*) between 1880 and 1890 by Lord Lilford. Little Owls liberated in Hertfordshire (*c.* 1890) and Yorkshire (*c.* 1890 and 1905) failed to establish, but others set free in Sussex (1900–01), Essex (1905 and 1908), and in Hampshire and Yorkshire met with some success (Witherby & Ticehurst 1908).

Although by the early twentieth century Little Owls were only breeding regularly in Northamptonshire, Bedfordshire, Rutland and Kent, thereafter they spread more rapidly, and by the 1920s were found in every county of England and Wales south of the River Humber, apart from Cornwall and Caernarvonshire. These two counties were colonised in the following decade, as were Yorkshire, Durham and Northumberland. Westmoreland and Cumberland (Cumbria) were reached in the 1940s and early 1950s. Little Owls have been recorded in Scotland (but not north of Midlothian) since 1925, but first bred, near Eldron in Berwickshire, only in 1958 (Glue 1993, 2002). A few individuals have been reported from Ireland but none yet from the Isle of Man.

While the species was still spreading north in the 1940s it suffered an apparent decline in some southern and western counties, probably due to some exceptionally harsh winters. Between 1956 and 1965 it also noticeably declined in southeastern England, possibly due to contamination of its prey by toxic pesticides, and it has been slow to recover (pers. obs.).

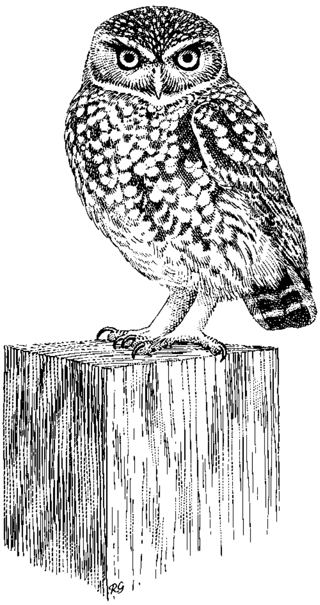
Fitter (1959: 218) attributes the success of the Little Owl in Britain to the fact that in the 1870s there was '… a vacancy for a small diurnal, mainly insect-eating bird of prey'.

Although Linn (1979) follows Fisher (1966) in claiming that the Little Owl is recorded in Late Ice Age deposits in Britain, Harrison (1988) says that 'A Pleistocene record from Chudleigh in Devon, often cited, is in fact based on a Sparrowhawk [*Accipiter nisus*] bone, but it [the Little Owl] appears to have been present in the Mendips in the early interglacial about 500,000 years ago. There is no further evidence except for the odd vagrant, more frequent in the early nineteenth century'. (I am grateful to W. R. P. Bourne for drawing my attention to the above references).

Impact: In the 1930s the Little Owl was widely accused, even by such respected biologists as C. B. Ticehurst, T. A. Coward, and J. Ritchie, of predation on the chicks of domestic poultry and game-birds. Hibbert-Ware (1937–38), however, showed that the bulk of the species' diet consists of largely injurious insects, with lesser numbers of other invertebrates, mammals (including such introduced pests as House Mice *Mus musculus*, Brown Rats *Rattus norvegicus* and young Rabbits *Oryctolagus cuniculus* (see Lever 1977) and small birds. Game-bird and poultry chicks are very rarely taken. Indeed, of the 60 or so alien vertebrates naturalised in Britain, the Little Owl is the only one that is actively beneficial to man.

New Zealand

Between 1906 and 1910 a total of 219 Little Owls from Germany (presumably *vidalii*) were imported to New Zealand by the Otago Acclimatisation Society (see Lever 1992) by whom they were released in various localities in South Island, including Canterbury.



Little Owl

By about 1915–16, Little Owls were said to be established in several districts in South Island, largely in central Otago. Thomson (1922: 140) said they had become 'firmly established in the south portion of South Island … they are now quite common around Dunedin'. By the mid-1950s, Oliver (1955) found Little Owls to be abundant from central Canterbury south to Foveaux Strait, and said they had spread into North Canterbury and to Stewart Island. Heather & Robertson (1997) reported them to be widespread on farmland and in towns in Nelson, Marlborough, Canterbury, Otago and Southland. A few occur in Westland and Fiordland, but there are no recent records from North or Stewart Islands.

Impact: Little Owls were introduced to New Zealand to prey on the various species of alien birds that had been introduced to control insect pests but which had, instead, proved a nuisance in crop-growing districts of Otago (see Lever 1987). Although Thomson (1922: 138) reported that as early as 1909 'several fruit growers in Central Otago reported [Little Owls] as having proved already a great boon to their orchards', the relief seems to have been short-lived, and small birds remain a pest of crops in Otago and Canterbury.

Although Oliver (1955) claimed that Little Owls may have contributed to the decline of such endemics as New Zealand Fantails *Rhipidura fuliginosa*, New Zealand Bellbirds *Anthornis melanura*, New Zealand Tomtits *Petroica macrocephala* and Grey Warblers *Gerygone igata*, Marples (1942) had previously shown that, as in Britain, insects are the main constituent of the Little Owl's diet, and that small birds comprise only some eight per cent of their total food intake. Nevertheless, Williamson and Fitter (1969: 443) considered that 'The contribution of Little Owls to the useful destruction of insects is as doubtful as their alleged useful effects in abating the small bird nuisance'. According to Druett (1983), there is evidence that Little Owls have thrived at the expense of the native Morepork *Ninox novaeseelandiae* through competition for food.

APODIDAE (SWIFTS)

Marianas Swiftlet
Aerodramus bartschi

Natural Range: S Mariana Is. (Guam, Rota, Aguiguan, Tinian, Saipan).
Naturalised Range: Pacific Ocean: Hawaiian Is.

Hawaiian Islands
Wiles & Woodside (1999), from whom much of the following account is derived, have traced the history of *A. bartschi* in Hawaii.

In May 1962 around 175 Marianas Swiftlets from Guam were released in the Niu Valley in southeastern Oahu, where contrary to reports of a lack of sightings after the release (Bowles 1962b, Donaghho 1970, Berger 1972), the birds were seen in the vicinity of the valley for several months. In January 1965, a second shipment of about 210 birds from Guam was liberated at the Waimea Falls in the Waimea Valley in northwestern Oahu. Both of these consignments were taken from a cave on Guam known as Firebreak 3.

No further observations of Swiftlets on Oahu were made until 1969, when Donaghho (1970) found around 25 birds foraging in the North Halawa Valley, from where, and in adjacent localities, all subsequent sightings have been recorded.

Shallenberger & Vaughn (1978) discovered the birds' nesting cave, situated at an altitude of 425m above sea level and some 17km from Niu Valley and 32km from Waimea Falls. The site is a small man-made tunnel, probably excavated before the Second World War as a potential source of irrigation; it is 59m in length, 1.0–1.3m wide, and 1.5–1.8m high. The cave is wet throughout the year, with water dripping from the ceiling and lying in pools on the floor. In 1997 the colony was believed to number 66 individuals, with at least 17 breeding pairs.

Since 1969, most sightings have been made within a 5km radius of the cave, suggesting that the colony is restricted to a single breeding site, and an apparent absence of other suitable nesting places may limit any significant expansion of the population, although rumours exist of other small colonies in remote parts of the Ko'olau Mountains.

Because of its small size, low winter nocturnal temperatures and dampness, the cave in the North Halawa Valley is probably a marginal nesting site; on the other hand, there appears to be an absence of human intrusion and of cockroaches, which damage and destroy nests in the Marianas.

Marianas Swiftlets were introduced to Hawaii for aesthetic reasons and, it is said, to control insect pests (Woodside 1970). In its native range, where the population is believed to number only between 2,000 and 2,275 individuals, the species is threatened by the introduced Brown Tree Snake *Boiga irregularis*

Marianas Swiftlet

(see Lever 2003) and cockroaches, so the population on Oahu is of conservation significance.

Note that the nomenclature of this species is confused: it was formerly classified as a race of the Uniform (or Island or Vanikoro) Swiftlet *A. vanikorensis*. Recent taxonomic research, however, has split it into three allopatric species, though additional investigations may result in further revision. Since it is not endemic solely to Guam but to the other southern Mariana Islands, the vernacular name of the Marianas Swiftlet (Dickinson 2003) seems more appropriate than the Guam Swiftlet (AOU 1998, Wiles & Woodside 1999). Earlier references (including Lever 1987) refer to it as the Edible-nest Swiftlet.

ALCEDINIDAE (KINGFISHERS)

Laughing Kookaburra
Dacelo novaeguineae

Natural Range: E Australia from the Cape York Peninsula to SC South Australia, SW Western Australia and Tasmania. (The discrete sub-population in Western Australia is derived from the translocation of several hundred birds from Victoria before 1896 and between 1897 and 1912: Serventy & Whittell, 1951–67).
Naturalised Range: Australasia: New Zealand.

New Zealand
Between 1864 and 1879 several attempts were made to introduce this species to New Zealand, including to Nelson, Otago, and Wellington. However, only one, made by Sir George Grey (then Governor of New Zealand) to Kawau Island in Hauraki Gulf, Auckland, in the early 1860s, was successful. Baker (1991) gives the date of introduction as 1866. In 1916 Thomson (1922) was told that a few occurred on the coast of Kawau Island near Auckland, and according to Oliver (1930) by the late 1920s some had crossed to the mainland where they had become common. By the early 1950s, Laughing Kookaburras were said to be established in North Auckland from Whangarei to Waitakerei Ranges, and remained so on Kawau Island (Oliver 1955). Wodzicki (1965) described them as locally rare, while Kinsky (1970) found them on Kawau Island and between Auckland and Whangerei. Falla *et al.* (1979) reported a small but apparently stable population between Cape Rodney and the Whangaparaoa Peninsula along the west coast of Hauraki Gulf. Kookaburras now occur in open country and on forest ecotones from near Whangarei south to the northern Waitakere Range, especially at Glenbervie, Whangateau, Dome Valley, Warkworth, Kaukapakapa, Puhoi, Wenderholm and Waiwera. The national population probably does not exceed 500 birds (Heather & Robertson 1997).

TYRANNIDAE (TYRANT-FLYCATCHERS)

Great Kiskadee
Pitangus sulphuratus

Natural Range: From S Texas, USA, to Paraguay, Bolivia and N Argentina.
Naturalised Range: Atlantic Ocean: Bermuda.

Bermuda
In 1905, a West Indian lizard, Graham's Anole *Anolis grahami* (see Lever 2003), was introduced to Bermuda from Jamaica 'to control the Mediterranean fruit fly'. In about 1946, a scale insect, *Carulaspis minima*, was accidentally imported in a shipment of nursery plants; within three years it had killed almost half of the islands' endemic Bermuda Cedars *Juniperus bermudiana*, and by 1951 some 85% had been destroyed. In an attempt to save the remaining trees, predatory ladybirds *Coccinella* spp. (Coleoptera) and Hymenoptera were imported to prey on the scale insects and on aphids. By then, however, *A. grahami* was so abundant that it prevented the introduced

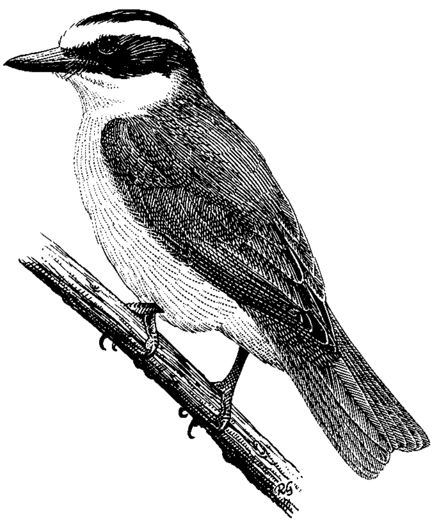
insects from becoming established. It was aided in this by two other alien lizards believed to have been introduced around 1940, the Panther Anole *A. bimaculatus leachii* from Antigua and the Barbados Anole *A. extremus* (see Lever 2003), and two species of ant (Hymenoptera) which were themselves eaten by lizards.

In 1957, on the recommendation of F. J. Simmonds of the Commonwealth Bureau of Biological Control, and in spite of protests from Bermuda's conservationists, some 200 Great Kiskadees from Trinidad (*P. s. trinitatis*) were released in Bermuda to try to control the lizards. Within a decade the Kiskadees had colonised suitable habitats throughout the islands and had become Bermuda's third or fourth most abundant bird (D. B. Wingate 1975, pers. comm. 1981, Crowell & Crowell 1976, pers. comm. 1981).

Impact: The introduction of the Great Kiskadee to Bermuda is a classic example of the folly of introducing a species as a biological controlling agent without having previously researched the likely consequences.

The fact that *P. sulphuratus* is an adaptable, generalised and opportunistic feeder with a catholic diet was apparently either overlooked or ignored. A survey conducted in the early 1960s showed that in Bermuda lizards comprise less than 10% of the Kiskadee's food, which consists principally of berries, vegetable matter, fish and the eggs and nestlings of native birds. A further survey carried out a decade later by D. E. Samuel (1975, pers. comm. 1981), revealed that of 57 Kiskadee stomachs analysed not one contained any trace of lizards. Nevertheless, according to Raine (2003), Kiskadees in Bermuda prey on the endemic Rock Lizard *Eumeces longirostros*. Although loss of habitat for urban development was doubtless a contributory factor, it seems likely that the decline of such terrestrial birds as the endemic White-eyed Vireo *Vireo griseus bermudianus* and Eastern Bluebird *Sialia sialis bermudensis* (and the introduced Northern Cardinal *Cardinalis cardinalis*) that occurred at this time, can be attributed at least in part to competition for food and predation of their eggs and nestlings by Great Kiskadees (D. B. Wingate pers. comm. 1981, 1986, 1999). Samuel (1975) observed Great Kiskadees using nest-boxes intended for Eastern Bluebirds as look-out perches, thus preventing the latter from occupying them.

Great Kiskadees in Bermuda are also regarded as a pest of soft fruit crops. In addition, they are alleged to prey on the larvae of Mosquitofish *Gambusia affinis* (see Lever 1994), which were introduced to control the eponymous insects.



Great Kiskadee

MELIPHAGIDAE (HONEYEATERS)

Noisy Miner
Manorina melanocephala

Natural Range: NE Queensland, EC to SE Australia. Also Tasmania.
Naturalised Range: Pacific Ocean: Solomon Is.

Solomon Islands
The Noisy Miner is said by French (1957) and Galbraith & Galbraith (1962) to have been successfully introduced to the Olu Malau

(Three Sisters) group in the southeastern Solomon Islands.

CRACTICIDAE (BUTCHERBIRDS)

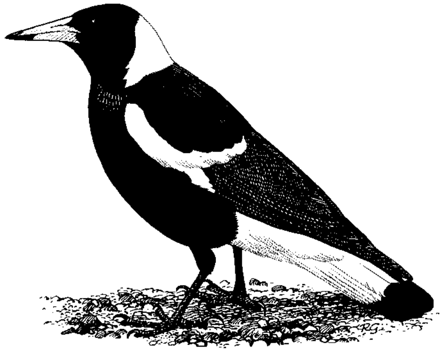
Australian Magpie
Gymnorhina tibicen

Natural Range: SC New Guinea, Australia, King and Flinders Is., and E Tasmania.
Naturalised Range: Australasia: New Zealand. Pacific Ocean: Fiji Is; ?Solomon Is.

New Zealand

Two forms of the Australian Magpie have been introduced to New Zealand, the Black-backed Magpie *G. t. tibicen* (coastal southeastern Australia) and the White-backed Magpie *G. t. hypoleuca* of eastern Tasmania and Flinders Island. Table 10 lists these introductions, made between about 1861 and 1883.

Thomson (1922) reported Australian Magpies to be fairly common in many parts of North Island from Wellington to north of Whangarei, and four years later he found them to be also common north of Timaru in north Canterbury on South Island. By 1945 there were three separate sub-populations; from the Bay of Islands to south Auckland; the southern North Island; and eastern South Island from Kaikoura to near Dunedin. The birds have continued to spread since then and now occur in open pastures, patches of forest and suburban areas throughout North Island and on some offshore islands. On South Island they occur in the east from Blenheim to Southland, and on the west coast around Hokitika and the Grey and Inagua Valleys. Inland, they are scarce but increasing in Marlborough, Nelson, Buller and South Westland. Both subspecies readily interbreed but *hypoleuca* predominates except in Hawke's Bay and North Canterbury, where up to 95% are *tibicen* (Heather & Robertson 1997).



Australian Magpie

Impact: Australian Magpies were introduced to New Zealand to prey on noxious insects. They also feed on introduced House Mice *Mus musculus* (see Lever 1985), but in addition prey on the eggs and nestlings of small birds as well as on lizards and honey-producing bees.

Fiji Islands

According to Watling (1982: 95):

> On Taveuni, the Australian Magpie is a common bird which was first introduced in the 1880s to control the Coconut Stick Insect (*Graeffea crouani*), which can on occasions be a serious pest of coconut palms [*Cocos nucifera*]. There have been at least two, and probably more, separate introductions from Australia. … some of these birds went to plantations on islands other than Taveuni, certainly to Vanua Levu and probably also to Viti Levu, but only on Taveuni are they established, although they are frequently seen on the southern coast of Vanua Levu.

Turbet (1941) says that Australian Magpies were then also established on the Lau Islands southeast of Taveuni.

On Taveuni the birds are confined to lowland plantations, mainly in the northwest, where Pratt *et al.* (1987) say they are fairly common and that wanderers are occasionally seen on Vanua Levu. Both the nominate subspecies and *G. t. hypoleuca* have been introduced to Fiji, where the population is now largely composite.

TABLE 10 Introductions of Australian Magpies *Gymnorhina tibicen* to New Zealand, 1861–1883.

Date	*Subspecies*	*Numbers*	*Introduced by*	*Released*	*Source*
? 1861	?	?	Sir George Grey	Kawau I., Hauraki Gulf	?
1864	*G. t. tibicen*	8	Canterbury Acclimatisation Society (A.S.)	Canterbury	Victoria
1865–69	?	81 (or 111)	Otago A. S.	Inch Clutha & Dunedin	?
1866	*G. t. tibicen*	4	Canterbury A. S.	Canterbury	Victoria
1867	*G. t. tibicen*	32	Canterbury A. S.	Canterbury	Victoria
1867	?	10	Auckland A. S.	Auckland	?
1868	*G. t. tibicen*	7	Canterbury A. S.	Canterbury	Victoria
1860s	*G. t. hypoleuca*	18	Canterbury A. S.	Canterbury	Tasmania
1870	*G. t. hypoleuca*	Large number	E Dowling	Glenmark	Tasmania
1870	?	1	Auckland A. S.	Auckland	?
1871	*G. t. hypoleuca*	24	Canterbury A. S.	Canterbury	Tasmania
1874	*G. t. hypoleuca*	?	Canterbury A. S.	Canterbury	Tasmania
1874	?	260	Wellington A. S.	Wellington	?
1883	*G. t. hypoleuca*	2	Canterbury A. S.	Canterbury	Tasmania

Sources: Thomson 1922; Oliver 1930.

Solomon Islands

Cain & Galbraith (1956, 1957) record the introduction of *G. t. tibicen* before 1945 to Guadalcanal, where some were seen until at least around 1960: whether any survive today is uncertain.

DICRURIDAE (DRONGOS)

Black Drongo
Dicrurus macrocercus

Natural Range: SE Iran, E Afghanistan, Pakistan, India, Sri Lanka, Burma to China, migrating in winter to SE Asia. Also Java, Bali and Taiwan.
Naturalised Range: Pacific Ocean: Marianas Is.

Marianas Islands

In 1935, the Taiwanese race (*harterti*) was introduced by the Japanese to Rota Island in the southern Marianas, from where by the early 1960s it had spread, apparently without human assistance, to Guam, over 100km to the south (Baker 1951). It soon became widespread and abundant on both islands (Ralph & Sakai 1979), mostly in the lowlands (Pratt *et al.* 1987).

Impact: A decline in the population of the Rota Bridled White-eye *Zosterops rotensis*, classified as Critically Endangered by the World Conservation Union, first became apparent in the 1960s when Black Drongos had become abundant. The current range of Drongos on Rota shows a negative correlation with that of the White-eye, which now occurs primarily in extensive stands of native *Sabena* forest (Craig & Taisacan 1994). Enbring *et al.* (1986) found Drongos to be abundant in the lowlands, where White-eyes are rare, but uncommon in forest areas. White-eyes seem particularly susceptible to predation by Drongos because they are very small flocking birds that forage in the exposed microhabit of the woodland canopy. It is noticeable that all native species too large for Drongo predation are widespread and common on Rota (Craig & Taisacan 1994). Fancy & Snetsinger (2001), however, considered it highly unlikely that the largely insectivorous Black Drongo could have been responsible for a widespread decline of the Bridled White-eye, and believed that the Drongo predation theory does not explain why White-eyes do not occur in several blocks of apparently pristine limestone forest at higher elevations where Drongos are absent, nor why Micronesian Honeyeaters *Myzomela rubrata* and Rufous Fantails *Rhipidura rufifrons* have not experienced similar declines. Fancy & Snetsinger (2001) concede, however, that in view of the very low White-eye population on Rota, even the seemingly low rate of predation by Drongos could have a significant impact on the population of the endemic species.

Although Baker (1951) found Rufous Fantails to be common on Rota, Enbring *et al.* (1986) reported them to be less abundant on Rota than on Saipan, Tinian, and Aquijan, where Drongos do not occur. Fantails are, however, less prone to avian predation than White-eyes because they are territorial (and thus more dispersed) and forage in the forest understorey.

CORVIDAE (CROWS AND JAYS)

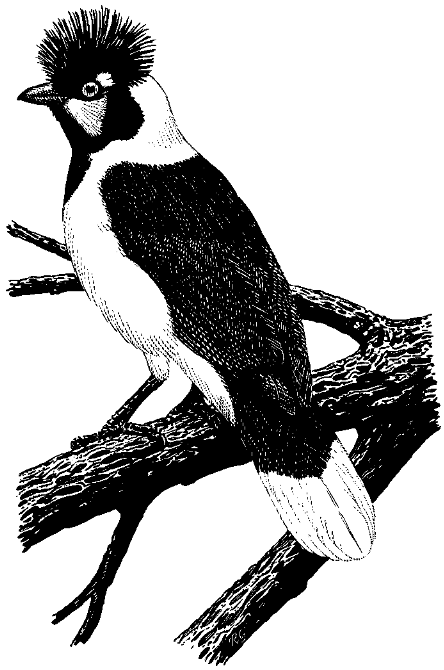
Tufted Jay
Cyanocorax dickeyi

Natural Range: The natural range of the White-tailed Jay *C. mystacalis*, the possible ancestor of the Tufted Jay, is between Guayaquil and Trujillo in coastal SW Ecuador and NW Peru.
Naturalised Range: North America: Mexico.

Mexico

The Tufted Jay occupies a very small range of barely 6,200 sq km in the *barrancos* (ravines) of the Sierra Madre Occidental in central and northeastern Nayarit, southeastern Sinaloa and southwestern Durango in western Mexico. Some 4,000km north of its possible ancestor, the White-tailed Jay *C. mystacalis*, this is one of the most remarkable avian disjunctions in the western hemisphere. For long regarded as a relict population (see Haemig 1979) or as descended from storm-borne waifs (Lever 1987), Haemig (1979), from whom the following account is derived, argues persuasively for a pre-Columbian introduction by man.

First made known to science as recently as 1934, the Tufted Jay was found by Moore (1935) to resemble the White-tailed Jay of South America closely. The two species are very similar in appearance, the few differences being attributable to the Tufted Jay's lengthy geographic isolation and its gradual morphological adaptation – thus conforming to Bergmann's and Gloger's ecogeographic rules (these state respectively that there is a tendency for the body size of endothermic animals to increase as the mean temperature of their surroundings decreases; and that there is a tendency for the pigmentation of endotherms to darken as the mean temperature and humidity of their surroundings increase). These conditions typify the tendency for one species to become divided into two when it has become separated into two discrete populations whose members no longer interbreed.



Tufted Jay

If the relict population and storm-borne waif theories are discounted, Haemig (1979) argues convincingly for an introduction by man. The Tufted Jay's restricted and disjunctive distribution; the fact that in western Mexico it does not occur below 1,200m, whereas the White-tailed Jay is a bird of the tropical lowlands; the species' poor reproductive success, which hinders dispersal; and its apparent maladaptation to its montane *barranca* environment, are all strongly suggestive of a man-induced origin.

If, however, the Tufted Jay represents a pre-Columbian introduction, why is it found in remote and mountainous western Mexico rather than in the centre and south of the country where the principal imperial cities were situated? Haemig (1979) answers this apparent conundrum by pointing out that a large number and a wide variety of artefacts that covered a timespan of many centuries have been discovered in various parts of western Mexico; these are stylistically dissimilar to any of those found in the rest of Mesoamerica, but bear a striking resemblance to objects of the same kind from coastal Ecuador and Peru (home of the White-tailed Jay). Some appear not to occur in the intervening countries of South and Central America, while those that are found there come principally from western Mexico and northwestern South America. The fact that articles showing many distinctive styles have been discovered has led anthropologists to believe that some form of cultural contact existed between the two areas, perhaps for millennia before the arrival of the Spanish *conquistadores*; much of such intercourse was probably through ship-borne trade, but at least some may well have been as a result of small-scale emigration from South America. Such emigration is further suggested by the burgeoning in western Mexico around 900 AD of a flourishing metallurgical industry that produced wares stylistically similar to those of Ecuador and Peru.

As Haemig (1978) points out, a thriving trade in the colourful feathers of several species is known to have existed in pre-Columbian times, and what more natural than that immigrants to western Mexico from northwestern South America should have brought with them not only artefacts and a knowledge of metallurgy, but also White-tailed Jays, whose vivid plumage and engaging habits would have enabled them to fill a dual role as both a source of feathers and as pets? As Haemig (1979: 86) concludes, the Tufted Jay is probably '… simply part of a general pattern of South American artefacts left in western Mexico by ancient man'.

House Crow
Corvus splendens

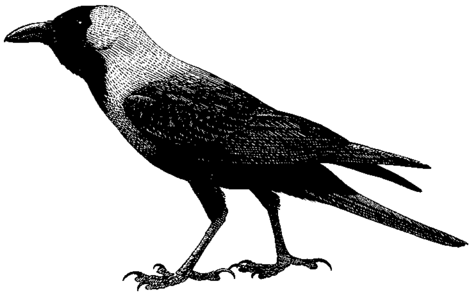
Natural Range: Pakistan, India, Nepal, Bangladesh, Bhutan, Sri Lanka, Maldive Is, Burma, S Yunnan and Thailand. Peters (1962) suggested that the form *C. s. insolens* (Burma, southern Yunnan, and Thailand) may have been introduced by man to Thailand, Lekagul & Cronin (1974) and Dickinson (2003) treat the species as resident there.

Naturalised Range: Europe: The Netherlands. Asia: Bahrain; China (Hong Kong); Israel; Jordan; ?Kuwait; Malaysia; Oman; Qatar; Saudi Arabia; Singapore; Socotra I; UAE;? Yemen (Aden). Africa: Djibouti; Egypt; Ethiopia; Kenya; Mozambique; Tanzania (including Zanzibar); Somalia; South Africa; Sudan. Indian Ocean: Andaman Is; ?Lakshadweep Is; Mascarene Is; ?Seychelles Is.

Ryall (1994, 1995, 2002), from whom much of the following accounts is derived, has summarised the history of the spread of the House Crow. See also Lever (1987).

The Netherlands

A small population of House Crows in the docks in Hoek van Holland in 1994 had increased, from both successful breeding by the founder pair and outside recruitment, to a total of eight by 2001 (Ryall 1995, 2002). They have since appeared in Park Ockenburg in The Hague, and are believed to be slowly spreading elsewhere (Langley 2004). This



House Crow

population is of particular interest as it shows that *C. splendens* can survive temperate winters and subsequently breed successfully (Ryall 2002).

Western Asia

Between about 1980 and 1994 House Crows became established in all the principal Arabian Peninsula ports, but remained absent inland, even in populated areas with a plentiful supply of water and refuse tips (M. C. Jennings in Ryall 1994). Jennings (2004) records breeding in Kuwait, Saudi Arabia (Dharan and Jeddah), Bahrain (Manama), the United Arab Emirates (Abu Dhabi and Dubai), Oman (Muscat and Salalah) and Aden (see also below).

Bahrain

Although first recorded in 1961, House Crows were only noted intermittently in the 1970s (Nightingale & Hill 1992), but since 1983 they have become residents in villages of north Bahrain where breeding has been periodically reported (Ryall 1994). Hirschfeld & King (1992) and Ryall (2002) say the population is fairly stable but small, and that one or two pairs may breed in the Mina Salman area of Manama.

Israel; Jordan

Krabbe (1980) records that in Israel the first pair of House Crows was seen in 1976 in Elat at the head of the Gulf of Aqaba, where they bred in the following year. From Elat, they have been seen flying across the Gulf to Aqaba in Jordan, where they have also bred. Paz (1987) considered them as only sporadic in Elat, but they appear to be established and increasing in Aqaba (A. A. Braunlich in Ryall 1994). Although there are a number of reports from Sinai, only that of a pair at Nabq in 1984 has been confirmed (Goodman & Meininger 1989). Today, the House Crow is a common breeding bird in Elat, and is frequently seen in the Arava to the north (Mendelssohn and Yom-Tov 1999).

Kuwait

Although first reported as present in 1972 and as breeding in 1983–84, Pilcher (1989) does not consider that House Crows are permanent residents in Kuwait, where their occurrence may be due to natural immigration. According to Gregory (2004), they have recently bred annually at Shuwaikh.

Oman

Meinertzhagen (1924) referred to House Crows resembling *C. s. zugmayeri* (Pakistan and northwestern India) as occasional natural visitors to Muscat, where he noted (Meinertzhagen 1954) that they were confined to the coastal strip. They later spread a few kilometres inland, especially where there was extensive construction work (Walker 1981). Gallagher & Woodcock (1980), who regarded the birds as either *zugmayeri* or intergrades with the nominate race (India: apart from the northwest, Nepal, Bangladesh and Bhutan), said that according to local people they had been imported to control ticks on livestock. Occasional sightings on the island of Al Masirah, 300km further south, may be a result of winter dispersal. House Crows, however, still do not occur in southern Oman (Ryall 1994), although they are now found along the coast between Muscat and Sohar and in some places are spreading inland (Ryall 2002).

Qatar

House Crows were first recorded in and to the north of Doha (Ras Laffan, Al Khar), at various coastal localities and on some offshore islands, in 1993 (Ryall 2002).

Saudi Arabia

House Crows were first reported in Jeddah in

1978 (Jennings 1981a), where they are now common breeding residents. They were first observed in the Eastern Province in 1980 and were recorded as breeding three years later (Ryall 1994). A flock of 15 was noted in the port of Yanbu, 300km north of Jeddah, in 1986 (Baldwin & Meadows 1987). In 1987 a flock of 30 House Crows was seen over Ras Tanura (F. E. Warr in Ryall 1994). A small number occurred in Haqil in the Gulf of Aqaba in 1989 (M. C. Jennings in Ryall 1994). The species has yet to be seen more than a few kilometres from the sea.

Socotra Island

A pair of House Crows that arrived on Socotra in 1996 or 1997 had increased to 26 by 1999, but the population has since been reduced (Ryall 2004).

United Arab Emirates

Jennings (1981b) found House Crows to be abundant in the late 1960s/early 1970s in coastal villages with palm plantations along the east coast. By early 1992, however, the population had greatly declined, probably because this area had developed from a simple fishing community into a modern residential one with a concomitant improvement in hygiene (M. C. Jennings in Ryall 1994). In 1987, House Crows were recorded on Das Island, at Abu Dhabi airport and Hatta, Huwailat, a short distance inland (Ryall 1994). House Crows have occurred in Dubai since at least 1977, where they are now locally common (Richardson 1990); a recent importation from Sri Lanka (*C. s. protegatus*) is referred to by Richardson (1992).

Yemen (Aden)

House Crows were seen in Aden in 1866 and 1892 by Barnes (1893), who said they had been introduced in the 1840s by an officer of the Bombay Infantry. Locally it is believed they were imported by Parsee immigrants from India to scavenge on their dead (Ash 1984b). By the 1960s they were established as common breeding residents in both Aden and in Shaykh Uthman, where by the 1990s the population was so large that a poisoning programme was initiated (M. C. Jennings in Ryall 1994). In 1989, House Crows were more common at Lahej, 30km inland, than they were in Aden (M. C. Jennings in Ryall 1994): a few were also noted ten kilometres north of Lahej, where they formed the most inland colony of the species in Arabia. Elsewhere in Yemen, House Crows have occurred at Shagra, Mukulla and Ghaydah (respectively 100km, 500km and 800km east of Aden); since 1975 in North Yemen where a decade later there were two discrete colonies; and also in 1983 at Hodeidd and 100km further south at Al Khawka on the coast (M. C. Jennings in Ryall 1994).

Impact: In Aden, House Crows harass such valuable natural scavengers as Black Kites *Milvus migrans* and Egyptian Vultures *Neophron percnopterus*. They also pose a health and hygiene hazard (Jennings 2004).

China (Hong Kong)

Single House Crows were reported in Kowloon Tong and Mai Po in 1974 and 1980 respectively. They may have been released by aviculturists (Chalmers 1986), although the coastal location of these sites makes a ship-assisted arrival more likely, perhaps from Malaysia (Ryall 1994). A further two House Crows were seen in Kowloon Tong in 1989, where the species is now believed to be breeding and where flocks of 10–20 are regularly seen (Ryall 2002).

Malaysia

Ward (1968) reported a breeding population of House Crows in Klang, Selangor, as long ago as 1898. In 1903, 56 birds were imported from Ceylon (Sri Lanka) (*C. s. protegatus*) to prey on caterpillars that were damaging crops (Willey *et al.* 1903). The species' progressive dispersal through Selangor and ultimate establishment in Kuala Lumpur is documented by Medway & Wells (1976). House Crows have continued to expand their range, especially in western coastal Malaysia, and now extend from Jeram south to Malacca and inland as far as Kulim (Ryall 1992), 15km from Pinang. There is also a disjunct population at

Johor Bahara in the south near Singapore. By 1986 the Klang population numbered around 20,000 (Ryall 1992) and that at Kuala Lumpur up to 6,000 (Lever 1987). The House Crow population in Malaysia continues to increase and spread along the west coast and inland (D. R. Wells in Ryall 1992). Recent records elsewhere include Kota Kinabalu, Sabah, since 1997 (Ryall 2002).

Singapore

Gibson-Hill (1950) reported a small colony of House Crows in trees in the dockland area in 1948, where 20 years later a roost of between 200 and 400 birds had become established (Ward 1968). Medway & Wells (1976) believed the birds had probably arrived in Singapore on ships. In 1987 the population was estimated by C. J. Hails (in Ryall 1994) at 1,800–3,700, the lower than expected total being attributed to efficient refuse disposal on the island. Hails believed that most of the birds were flying in from roosts in adjacent Johor Bahara, Malaysia, where ample refuse had enabled a considerable population to develop. By 2001 the population had increased to at least 20,000 (Ryall 2002).

Djibouti

In 1958, Clarke (1967) saw several House Crows in Djibouti Town, which he assumed had spread there from Aden, some 246km to the northeast. Twenty years later, Ash (1985) found them to be very common, and by 1987 the population numbered several thousand and was increasing. Welch & Welch (1984) observed about 18 in the small town of Obock on the opposite coast of the Golfe de Tadjoura. There are now smaller colonies in Tadjoura and Loyada (Archer 2001).

Egypt

The House Crow has occurred at Port Tewfik, Suez, since about 1922, '… where I observed it first in 1947 and was told it had been established for many years' (Goodwin 1976: 93). Ryall (1994) says it was originally misidentified as the Eurasian Jackdaw *C. monedula*, and incorrectly states it was identified by D. Goodwin from photographs. Meininger *et al.* (1980) and Bijlsma & Meininger (1984) outlined the expansion of range of House Crows of the nominate subspecies (India, Nepal, Bangladesh and Bhutan) in the region, where they estimated the 1981 population at between 800 and 850. By 1979, there were breeding colonies in several towns along the coast of the Red Sea from Ismailiya 300km south to Quseir (Goodman & Meininger 1989).

Ethiopia

According to A. Mahamued (in Ryall 1994) House Crows were introduced to Ethiopia (presumably as scavengers) during the British occupation after the Second World War. Urban & Brown (1971) believed that they may then have been present in Mitsiwa (Massawa), where they were abundant by the mid-1980s. They arrived in Assab, where they are now numerous, more recently (R. T. Wilson in Ryall 1994).

Kenya

Since their arrival on the coast at Mombasa in 1947 (Britton 1980), probably on a vessel from the long-established population on Zanzibar, House Crows of the nominate subspecies (India, Nepal, Bangladesh and Bhutan) have multiplied to pest proportions (Ryall & Reid 1987). In 1991, D. G. Kimanga (in Ryall 1994) estimated the population in Mombasa at over one million. Ryall (1992a) described their progressive expansion of range around Mombasa, and the formation in 1977 of a separate population at Malindi, 100km further north on the coast.

Since the early 1990s, singletons have been reported from Nairobi, 500km northwest of Mombasa; these are considered by Ryall (2002) to result from deliberate releases or escapes.

Mozambique

In 1976, J. C. Sinclair (in Ryall 1994) discovered a small breeding colony of House Crows on Inhaca Island in Algoa Bay, which the local inhabitants said had been established since the 1960s (Bijlsma & Meininger 1984). A decade later W. L. N. Tickell (in Ryall 1994) counted around 50 on the island. House

Crows have been present in Maputo also since 1976. The population on Inhaca numbered around 100 in 1999 (Ryall 2002).

Somalia

In 1950 four House Crows *C. s. protegatus* arrived at Cape Guardafui on a vessel from Colombo, Sri Lanka (Davis 1951), though they apparently failed to become established. The species was, however, later noted in the fishing village of Zeila in northern Somalia (Chazée 1987) and in 1988 several dozen Crows were seen in Berbera on the north coast (Fry & Keith 2000), to both of which they may have spread from Aden or Djibouti (Ryall 2002).

South Africa

House Crows may have occurred in Durban since 1966–67 (Newmann 1974). Two flew in to Durban from the sea, presumably from a passing vessel, in 1972 (Oatley 1973, Sinclair 1974). In 1973 the species was recorded at Camperdown, some 40km inland from Durban (Maclean 1993), and in 1975 nesting was observed by Cyrus & Robson (1980). In spite of attempted eradication, the species spread rapidly, and is now well-established in the Indian suburbs near Reunion airport where a roost of over 500 individuals assembles each evening (P. A. Clancey in Ryall 1994). House Crows also occur in northern Durban, and W. L. N. Tickell (in Ryall 1994) estimated the total Durban population in 1987 at 800–1,000 birds.

In 1975, House Crows appeared in East London, 500km south of Durban (Cyrus & Robson 1980; Maclean 1993), presumably as a result of a separate introduction, and in the docks at Cape Town in 1977 (Bijlsma & Meininger 1984) or 1979 (Maclean 1993). They have since spread northwards from Durban to Richards Bay (Allan & Davies 2001).

It is believed that House Crows made use of the increase in marine traffic down the east African coast during the closure of the Suez Canal between 1967 and 1980 to reach Durban (Brooke *et al.* 1986) and in the mid-1970s East London and Cape Town (Berruti 1997). If, as is currently believed, the range of the House Crow is partially governed by temperature, the cooler winters in the Cape Town region may have restricted its population growth (D. G. Allan in Berruti 1997).

House Crows in South Africa have been more frequently recorded in informal settlements, industrial sites and harbours than in natural habitats. Any increase in the area occupied by informal settlements and urbanisation will thus favour population increases in House Crows in South Africa, provided there is a concomitant increase in temperature. In the northern part of the species' range, where winter temperatures are normally higher, the expansion of informal settlements and urbanisation should ensure population and range expansion in areas with a high annual rainfall (Richardson *et al.* 2000).

Sudan

House Crows have occurred in Port Sudan since well before 1941, when a breeding colony of some 40 birds (Meinertzhagen 1949) was reported by Kinnear (1942) on a bridge near the harbour. The species is now numerous in Port Sudan (Clarke 1967, Ryall 1994).

Tanzania (including Zanzibar)

The introduction of House Crows of the nominate subspecies (India, Nepal, Bangladesh and Bhutan) in the 1890s by a Dr Charlesworth and the British diplomat Sir Gerald Portal, to clean up the refuse of Zanzibar Town (Vaughan 1930), resulted in the formation of the earliest African population of the species, which has acted as a reservoir for introductions to the mainland of both Kenya and Tanzania. Pakenham (1979) outlined the House Crow's expansion of range to other towns and villages on Zanzibar. According to Ryall (1994), a recent control campaign in Zanzibar Town met with considerable, albeit temporary, success.

In 1955, R. Fuggles-Couchman (in Ryall 1994) saw a few House Crows, presumably from Zanzibar, on a small island near Dar-es-Salaam; K M Howell (in Ryall 1994) first reported them in that town in 1972, where they subsequently multiplied and spread.

By 1988, N E Baker (in Ryall 1994) said they numbered between 15,000 and 20,000 and had dispersed around 30km to the north and west. The species' then distribution in Dar-es-Salaam is described by Manyanza (1989). A separate population that has been established for many years in the coastal town of Tanya, some 200km to the north, doubtless originates from another introduction from Zanzibar (Ryall 1994).

Impact: In Tanzania (and Kenya), House Crows destroy the nests, eggs, and young both of native birds such as the Collared Palm Thrush *Cichladusa arquata*, mousebirds (Coliidae), Golden Palm Weavers *Ploceus bojeri*, *Camaroptera* spp. and Rufous Chatterers *Turdoides rubiginosa*, and also of domestic poultry. They have also been accused of damaging farm crops and soft fruits. In compensation, they consume locusts and termites. In some localities House Crows seem to be displacing native Pied Crows *C. albus* as urban scavengers. On Zanzibar, the recent decline in the House Crow population has been accompanied by a recovery in the numbers of native species that had suffered from their predation (Alexander 1991).

Andaman Islands

House Crows were unsuccessfully liberated at Port Blair on South Andaman around 1860 to act as scavengers in the penal settlement (Beaven 1867). In the mid-1980s, Pittie (1988) saw six to ten *C. s. proteagus* from Sri Lanka or *C. s. insolens* from Burma, southern Yunnan and southwestern Thailand in the grounds of Bay Island Hotel in Port Blair.

Lakshadweep (Laccadive) Islands

Although Ryall (1994) says that House Crows are not native to the Lakshadweeps, their origin in the islands is uncertain. Ali & Ripley (1968–75) assigned them to the nominate subspecies (India, Nepal, Bangladesh and Bhutan), but Goodwin (1976) identified them as being of the Maldive Islands race *maledivicus* and implied that they are native in the Lakshadweeps. Dickinson (2003), however, does not include the Lakshadweeps in the House Crow's natural range. Even if the species is not a native of the Lakshadweeps, a short natural extension of range north from the Maldives cannot be ruled out.

Mascarene Islands

In about 1910 a number of House Crows became established on the island of Mauritius, having apparently travelled on ships from India (Meinertzhagen 1912, Guérin 1940–53) : they were therefore presumably of the nominate form. A population became established centred on the Roche Bois abattoir (Rountree *et al.* 1952) and the Port Louis meat market (Guérin 1940–53), from where the birds spread before 1939 southwest to Case Noyale (C. M. Courtois in Cheke 1987). Although the population in Port Louis was controlled to minimise the theft of food from the bazaar (Guérin 1940–53), a flock of around 40 persisted at Roche Bois until wiped out by a cyclone in 1945 (C. M. Courtois in Cheke 1987; in 1947 according to Ryall 1994). In 1950 two birds flew ashore in Port Louis off a vessel from Sri Lanka, and the population in the Port Louis/Roche Bois area slowly recovered to around 100 (Staub 1976). House Crows have also been observed at Cannoniers Point, near Grand Baie in 1956 (Newton 1958), and at Mahébourg (Staub 1976) and in Beau Bassin (Cheke 1987). Diamond (1987) and Feare & Mungroo (1990) described the species' spread to other settlements, and the latter estimated the total population at between 400 and 600 individuals. Hawkins & Safford (in prep.) refer to House Crows on Mauritius, especially in the Port Louis docks, the Terre Rouge estuary, in the Pamplemousses Botanic Gardens and in the Port Louis/Curepipe conurbation, and even occasionally over the forests of the southwest (R. J. Safford pers. comm. 2004). See also Simberloff 1992, Jones 1996 and Moulton *et al.* 1996.

Impact: According to Feare & Mungroo (1990), predation by House Crows on the nests of reintroduced Pink Pigeons *Nesoenas mayeri* and Mauritius Kestrels *Falco punctatus* on Mauritius (classified respectively as Critically Endangered and Endangered by the World Conservation Union) could pose a threat to the rehabilitation programmes for both species; native passerines, however, are not generally at risk because they are mainly confined to high native forest.

Seychelles Islands

A single House Crow of the nominate race arrived in Mahé in 1970 on a vessel from Bombay but no breeding was recorded until five more birds arrived in 1977. Although the population remained centred on Mahé, isolated individuals have also been seen on Bird, Aride, Praslin, Moyenne, Cousin, Silhouette and Ile aux Vaches Marines (Skerrett *et al.* 2001). After reaching a peak on Mahé of about 25 birds in 1986, centred around Anse Etoile, the population seems to have been eradicated by 1994 (Ryall 2002), the subsequent appearance of birds being attributed by Skerrett *et al.* (2001) to new arrivals.

Impact: House Crows have been observed destroying a nest of the endemic Seychelles Sunbird *Cinnyris dussumieri*, indicating the potential risk to native species should they become established (Skerrett *et al.* 2001).

Summary: As Ryall (1994) says, House Crows are spreading naturally throughout most of their naturalised range where, as commensals of man, they thrive in areas of poverty and squalor. In parts of Africa, such as Kenya, where the annual increase in the human population has been amongst the highest in the world, the range of the House Crow is expanding commensurately in both coastal and inland settlements. It will almost certainly eventually reach Madagascar, either on ships from India or Sri Lanka or by natural dispersal from Tanzania or Mozambique. This natural expansion of range is continuing through islands of southeast Asia (where it will doubtless spread naturally or by ship from Klang in Malaysia 100km across the Straits of Malacca to the more densely settled parts of Sumatra) towards Australia (where it has already occurred but is not yet established), eastern Asia, Europe (where it has occurred in Gibraltar and has bred in The Netherlands), and North and South America (where it has occurred but is as yet not established).

Ryall (1992a) has summarised the status of *C. splendens* as a pest species. As a versatile commensal of man it feeds largely on stolen food, crops, the young of domestic fowl, small native passerines and invertebrates. It also destroys domestic refuse bags, damages electricity cables, disorients television aerials, causes bird-strikes on aircraft, deposits excrement, spreads diseases, creates excessive noise, destroys fruit, wheat, and maize crops and drying fish, and allegedly preys on neonatal calves, kids, and lambs (Lever 1994). It even on occasion attacks humans. In most of the places in which House Crows have become naturalised there has been a marked decline in the native avifauna. Although House Crows are useful and efficient scavengers, the poverty and overcrowding in many African settlements provide an ideal breeding site for the birds, thus exacerbating an already existing problem, and their spread in Africa is being expedited by the proliferation of new human settlements throughout the continent.

Rook
Corvus frugilegus

Natural Range: Europe, W and C Asia east to Tien Shan and N Altai, wintering in N Africa and SW Asia. Also Mongolia and C and E China to S Yakutia, the Russian Far East and Korea, wintering in E Asia.
Naturalised Range: Australasia: New Zealand.

New Zealand

Table 11 lists introductions of Rooks to New Zealand between 1862 and 1875. In the 50 years after the first successful introductions in the 1870s Rooks expanded their range very slowly in New Zealand (Thomson 1922). Although sub-populations became established near Fielding in the 1920s (Thomson 1926) and near Pirinoa, southern Wairarapa, in the 1930s (Oliver 1955), the spread continued to be very slow until the sub-population in Hawke's Bay became so numerous that it had to be controlled in the 1960s and 1970s (Heather & Robertson 1997). Displaced birds then began to disperse more widely, and in the 1960s colonies became established near Miranda, Firth of Thames; Tolga Bay, Gisborne; and Waitotara, Taranaki. In the 1970s colonies were established in southern Hawke's Bay and at Aokautere, Manawatu; and in the 1980s in southern Waikato. In the first 100 years after their introduction to Canterbury, Rooks spread very little apart from the formation of a small colony near Middlemarch in North Otago (Heather & Robertson 1997).

Today, Rooks are locally common in hill country and arable land in Hawke's Bay, around Banks Peninsula, and near Christchurch. In 1978 the total population numbered a little under 30,000 birds, of which around 25,000 were in Hawke's Bay and 2,500 in Canterbury. In the next 20 years pest-control programmes reduced the species' population but increased its range in New Zealand, where occasional vagrants have occurred in Northland and Wellington and on Stewart and the Chatham Islands (Heather & Robertson 1996).

Impact: As early as 1917 (Thomson 1922), Rooks in New Zealand were being accused in the Hawke's Bay area of eating walnuts, sprouting oats and wheat and other cereal crops (especially maize), pumpkins, potatoes, peas, beans, stock feed and occasionally leaves of clover and grasses. They were said sometimes to attack new-born lambs and even (presumably sickly) adult sheep. In compensation, Rooks prey on a variety of injurious invertebrates, including, in the Hawke's Bay region, the grass grub *Costelytra zealandica* (the larvae of a scarabaeid beetle that eats the roots and leaves of a number of pasture plants), flies, caterpillars (especially porina) and wasps.

The effectiveness of Rooks in controlling injurious invertebrates is, however, open to question. For example, McLennan & MacMillan (1983) found that in their study area in Hawke's Bay although Rooks ate 15%–20% of the larvae of *C. zealandica* this predation was neither heavy enough to prevent further loss in pasture productivity nor to inhibit future generations of grass grubs from multiplying to pest proportions. Furthermore, by their probing of the turf in search of grubs Rooks themselves cause damage to pastures.

McLennan & MacMillan (1983) also addressed the question of what role Rooks might play in the control of other invertebrate pests, such as Black Field Crickets *Teleogryllus commodus*, White-fringed Weevils *Graphognathus leucoloma* and army-worms (Noctuidae) which occasionally damage pastures and crops. They found that when the Rook population in the Hawke's Bay area was reduced from around 7,200 to 900, reports of insect damage to crops and pastures did not increase, and concluded (p. 139) that 'the controversy over whether Rooks are on balance beneficial or harmful to agriculture has persisted for some 50 years, but cannot be resolved until the significance of their predation on insect pests is assessed'.

TABLE 11 Introductions of Rooks *Corvus frugilegus* into New Zealand, 1862–1875.

Date	*Number*	*Introduced by*
1862	3	Nelson Acclimatisation Society (A.S.)
*c.*1862	?	Canterbury A. S. (by Watts Russell)
1869	2	Auckland A. S.
1870	64	Auckland A. S.
1871	2 or 5	Christchurch A. S.
1872–73	40	Christchurch A. S.
1872–73	?	Hawke's Bay A. S., near Mangateretere,
1874	72	Hawke's Bay A.S.
1875	?	Christchurch A. S.

Sources: Thomson 1922, 1926, Oliver 1955. All importations came from England, and apart from the first two all appear to have been successful.

American Crow
Corvus brachyrhynchos

Natural Range: North America, from W, C and E Canada, S to S Florida.

Naturalised Range: Atlantic Ocean: Bermuda.

Bermuda

According to Phillips (1928: 56), '… the common crow of the Eastern States was introduced about 1876 to Bermuda, where for a time it became abundant. Later it was nearly exterminated but has continued to exist in small numbers ever since'. D. B. Wingate (pers. comm. 1981), however, antedates this introduction by 38 years. 'Although Bermuda had a native crow when the islands were first settled', he wrote, 'this was apparently exterminated. The present crow population originated from a pet pair of crows introduced from Halifax, Nova Scotia [the nominate form] by Lady Paget … in 1838'. In 1985 the population was estimated to be about 500. Today it is a common and widely-distributed species (Raine 2003).

Impact: Because of the damage American Crows cause to agricultural and horticultural crops they are unprotected in Bermuda (Wingate 1973). Some individuals have learnt how to remove the chicks of White-tailed Tropicbirds *Phaeton lepturus* by hovering before their cliff-face nests (Raine 2003).

Eurasian Jackdaw
Corvus monedula

Natural Range: Europe through N and C Asia to Kashmir, NW Xinjiang, W Mongolia, and SC Siberia.
Naturalised Range: Africa: Tunisia; Algeria.

Tunisia; Algeria

According to Payn (1948), the ancient colony of Eurasian Jackdaws in the city of Tunis in Tunisia, and the small number 350km away in Constantine in eastern Algeria, are both probably descended from escaped cage-birds. Dickinson (2003), who appears to treat these populations as native, says the race established in Tunisia and eastern Algeria is *C. s. cirtensis.*

Common Magpie
Pica pica

Natural Range: Much of the Palaearctic and parts of the northern Oriental regions.
Naturalised Range: Asia: Japan.

Japan

The form *P. p. sericea* (Amurland, Korea, China, Taiwan, Indochina and Burma) was reputedly brought back to northern Kyushu (southern coastal areas of the Fukuoka and Saga Prefectures) by the Great Taicoon or *Sei-i-taishogun*, Hideyoshi, on returning from his successful invasion of Korea in 1598 (Kaburaki 1934). It is still confined to north-western Kyushu where it is locally common in Kumamoto, Fukuoka, Saga and Nagasaki (Kaburaki 1934, Brazil 1985, Eguchi & Kubo 1992, Eguchi & Amano 1999, OSJ 2000). Individuals recorded from southern and eastern Kyushu, Honshu and Hokkaido are probably vagrants from Korea (Brazil 1991).

Impact: Occasional telecommunications disruption due to construction by Magpies of their bulky nests on telephone poles is reported in Kyushu, and some damage has also been recorded to agricultural crops. Predation of eggs and chicks of native species also occurs.

ALAUDIDAE (LARKS)

Eurasian Skylark
Alauda arvensis

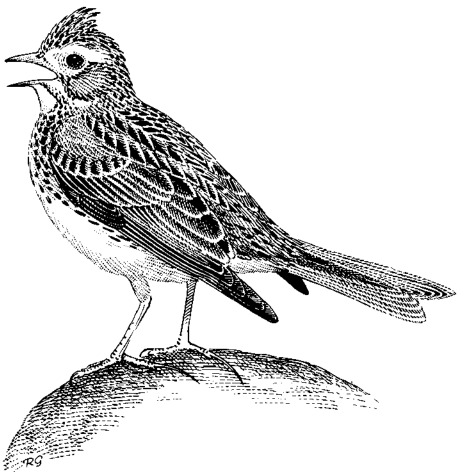
Natural Range: Much of the Palaearctic region south of the taiga in western Siberia, from where in winter birds migrate south to S Europe, N Africa; SW, E and SE Asia, China and Japan.
Naturalised Range: North America: Canada; USA. Australasia: Australia; New Zealand. Pacific Ocean: Hawaiian Is.

Canada

In 1902 or 1903 100 pairs of Skylarks (or 99 birds according to Cooke & Knappen 1941) of the nominate subspecies (Europe apart from the south) were imported from England and liberated on southern Vancouver Island, British Columbia. They were followed by a further 49 birds in 1912; others may have been unsuccessfully released at about the same time on the lower mainland at the mouth of the Fraser River. In 1908 or 1910, G. W. Wallace planted some more on the Saanich Peninsula of southern Vancouver Island, and in 1919 Mrs E. A. Morton is said to have freed five at Oak Bay.

Until about 1925 Skylarks on Vancouver Island seem to have done no more than maintain their numbers, but thereafter they began to increase until they became quite numerous (Phillips 1928, Scheffer 1935). By 1935 they were, according to Cooke & Knappen (1941: 180–181), 'as abundant as any of the other small birds in the occupied area ... [but] are not yet numerous enough to spread to adjoining sections'. In the following year, when the population was said to number 219 birds, a colony was discovered at Sidney, 27km north of Victoria. Twenty years later, when their numbers were about the same, Skylarks had colonised suitable habitats around Victoria and on the Saanich Peninsula (Scheffer 1955).

By 1962, when Skylarks had become established over an 8,000 ha area of low snowfall, the population had increased fivefold. However, the population suffered a decline later in the decade, when much of the birds' habitat was lost to urban development (Blake 1975). Today, a few hundred survive only in grasslands around the University of Victoria campus, on the Rithet Estate, near the airport, along the eastern side of the McHugh Valley, near Duncan, and in a few other places on the Saanich Peninsula (Johnston & Garrett 1994, AOU 1998, Sibley 2000).



Eurasian Skylark

United States

Although there have been numerous attempts to naturalise Eurasian Skylarks in the United States (listed in Lever 1987), the only established population is derived from natural dispersal from the introduced population on Vancouver Island in British Columbia, Canada.

In August 1960 Skylarks were first recorded on San Juan Island, Washington State (Bruce 1961), some 18km east of Vancouver Island across the Haro Strait, where breeding by some of the dozen pairs present was reported in May 1970. Although it was thought likely that Skylarks would spread to other islands in the archipelago and even to the Washington mainland, this does not yet seem to have occurred (AOU 1998).

Australia

Table 12 lists introductions of Eurasian Skylarks to Australia between 1850 and 1912.

As early as 1864 the Victoria Acclimatisation Society (see Lever 1992) reported that 'the Skylark may now be considered thoroughly established', and Ryan (1906) said the birds were well established around Melbourne, where they were slowly increasing and spreading. Tarr (1950) reported that Skylarks were fairly widespread in Victoria.

In South Australia, Skylarks were said to be well-established by the late 1940s on the Adelaide Plains, and at the same time were common along the coast of New South Wales and westward to some inland areas (McGill 1960). In 1963 some were reported on Lord Howe Island off the New South Wales coast (McKean & Hindwood 1965).

In 1907, the Tasmania Acclimatisation Society (see Lever 1992) claimed that Skylarks were established in several localities, including Invermay, East and West Tamar, Ormley near Avoca, Cataract Cliffs, Risdon, and Glenorchy near Hobart. By the late 1940s the species was settled in many agricultural districts, especially in southern Tasmania and on King and Flinders Islands in Bass Strait (Blakers *et al.* 1984).

Frith (1979: 193) reported that the Skylark was:

> now widespread in south-east South Australia, Tasmania, most of Victoria, and the southern New South Wales coast and tablelands. It avoids the drier inland. It lives mainly in well-cultivated lands and long-established pastures. It has success fully invaded the coastal heaths of New South Wales. Throughout its range it lives side by side with [Horsfield's Bushlark *Mirafra javanica*] and the [Australian Pipit *Anthus australis*]. All three birds have superficially similar habitat needs, but it is not known if the Skylark provides competition for either of the native species.

Pizzey (1980) reported Skylarks to be common in Tasmania, in southeastern South Australia and around Adelaide, on Kangaroo Island, and throughout most of Victoria, but less common on the Riverina and east coast

TABLE 12 Introductions of Eurasian Skylarks *Alauda arvensis* to Australia, 1850–1912.

Date	*Numbers*	*Introduced by*	*Released*
1850 or 1854	?	Robert Morrice	Barrabool Hills, Victoria
1856	?	?	New South Wales
1857	?	Bird dealer named Brown	?
1858	?	Bird dealer named Neymaler	Melbourne, Victoria
1859	?	'Mr Rushall'	Melbourne, Victoria
1860–74	2,854	Royal Zoological & Acclimatisation Society of Victoria	Various localities in Victoria
1862	?	South Australia Acclimatisation Society (A.S.)	?
1862 or 1872	?	?	Tasmania
1866, 1870–72, 1883	70+	?	Near Sydney, New South Wales, Blue Mountains, Maneroo, Ryde, etc.
1869	?	Queensland A. S.	Unsuccessful
1879	18	South Australia A. S.	Adelaide; Enfield
c. 1880	22 pairs/9 pairs	South Australia A. S.	Dry creek near Adelaide/Enfield
1881	147/36	South Australia A. S.	Near Adelaide/Kapunda
1887–92	?	?	Tasmania
After 1889	?	South Australia A. S.	Various localities on many occasions
1899	36	Mr Talbot of Malahide (Ireland)	Various localities
Before 1912	?	Western Australia Acclimatisation Committee	Unsuccessful

Source: Lever 1987. All importations are believed to have been of the European nominate subspecies.

tablelands of New South Wales. Today they are especially common in northern Tasmania and on King Island and the Furneaux Group in Bass Strait (Barrett *et al.* 2003).

Although largely migratory in the Northern Hemisphere, Skylarks in Australia appear to be sedentary, nomadic or only partially migratory, which may have contributed to their successful naturalisation but inhibited their further dispersal.

New Zealand

Between 1864 and 1879 at least 691 Skylarks of the European nominate subspecies (probably many more) were released in New Zealand by the Nelson, Otago, Canterbury, Auckland and Wellington Acclimatisation Societies (Thomson 1922), including 70 on Stewart Island in 1879 and some on the Chatham Islands by L W Hood in the late nineteenth century (Oliver 1955), and also doubtless by nostalgic settlers.

As early as the 1920s, Thomson (1922: 140) was able to say that 'The introduction of this bird was general throughout New Zealand … in every part they increased rapidly and spread throughout the whole country, but they confine themselves to cultivated districts, and are not found in the bush or open mountain country'. Forty years later, Wodzicki (1965: 433) reported Skylarks in New Zealand to be 'widely distributed and common, North, South, and Stewart Islands and Raoul [Kermadecs], Chatham and Auckland Islands: the last three island groups were apparently colonised naturally – the Aucklands in 1946'. Falla *et al.* (1979) found Skylarks to be established on the main islands in all types of open habitat up to 1,600m elevation, and on the Chatham, Auckland and Kermadec Islands; the species' status on Campbell Island is uncertain. Baker (1991) recorded breeding on the Chatham and Auckland Islands, but presence only on the Kermadec and Campbell Islands. Today, Skylarks are very common in sand dunes, farmland, tussock grassland and other open habitats from North Cape to Stewart Island, from sea level to subalpine herbfields at 1,900m. They also occur on some offshore islands; they are common on the Chatham Islands, and occur as vagrants on the Kermadecs, Snares, Auckland and Campbell Islands (Heather & Robertson 1997). There is some flocking and local movement in autumn, but as in Australia there is no pattern of migration (apart from a small northerly one from Farewell Spit), which may help to explain the species' naturalisation in New Zealand.

Impact: Although at first sight the Skylark would seem to be an unlikely species to cause problems, as early as 1899 T. S. Palmer wrote of Skylarks that although in their natural range they were almost universally regarded as beneficial, in New Zealand they had become an agricultural pest. This is confirmed by Thomson (1922: 140–141) who wrote that 'next to the [House] sparrow [*Passer domesticus*] the Skylark is considered by farmers to be the most destructive of the small birds which have been introduced to New Zealand. They are particularly destructive in spring, when they pull wheat and other grains out of the ground just as they are springing. They also uproot seedling cabbage, turnip and other farm crops'. The depredations were confirmed by Oliver (1955).

Hawaiian Islands

Skylarks of the nominate subspecies (Europe apart from the south) were first imported to the Hawaiian Islands from England in 1865, when ten were released at Leilhua on Oahu. Here they were joined in 1870 by others sent from New Zealand by the Hon A. S. Cleghorn: in the latter year, some were also set free on Kauai by Frances Sinclair. Later importations of New Zealand Skylarks were liberated at Moiliili on Oahu, from where some were subsequently transferred to Kauai, Maui (1886), Hawaii (1902), and Molokai and Lanai (1917). The introductions to Oahu and Maui were said by Henshaw (1904) to have been successful, and Bryan (1908) found them to be common on grasslands on Molokai. Although Munro (1944) states that the form *A. a. japonica* (Sakhalin, Kuril and Ryukyu Islands and Japan) was unsuccessfully introduced in 1934, the AOU (1998) indicates that this form, as well as the nominate one, is established in the Hawaiian Islands.

According to Fisher (1951), Skylarks were released on Niihau before 1920 by Francis [sic] Sinclair, who later released some of his birds on Kauai. By 1936, Skylarks were apparently fairly common on Lehua Island (to which they had presumably flown from Niihau), and in 1947 Fisher (1951) found the species to be scarce but widespread on the latter island.

By the mid-1950s, Skylarks were said to occur on Hawaii, Oahu and Lanai, and Peterson (1961) reported them to be widely distributed on Niihau, Maui and Hawaii, local on Oahu, Molokai and Lanai, and scarce on Kauai. A decade later, Berger (1972) recorded Skylarks as common on Hawaii, Maui and Lanai, slightly less so on Oahu, and rare or absent on Kauai, where they are believed to have died out around 1938. The Hawaiian Audubon Society (1975) claimed that Skylarks were established on all the main islands, but were most common on the slopes of Mauna Kea and Mauna Loa on Hawaii and on those of Haleakala on Maui. Zeillemaker & Scott (1976) recorded Skylarks as local and uncommon on Oahu and Lanai, as uncommon on Molokai, as common on Maui and Hawaii, and as accidental visitors to Kauai. It is noticeable how, between the mid-1950s and mid-1970s, the status (and even presence) of Skylarks on the various islands apparently varied from decade to decade.

More recently, Pratt *et al.* (1987: 228) say that Skylarks were '… abundant on Hawaii, Maui, and Lanai. Less common on Molokai, Niihau, Lehua, and Oahu. … Straggler from Siberia to NW Hawaiian Is. (Kure, Midway)'. Pratt (1994) curiously omits the Skylark from his list of introduced and established birds in Hawaii, where the AOU (1998) states that they occur on the main islands eastward from Niihau. It is said that the Skylarks' expansion of range in the Hawaiian Islands has been adversely affected by the growth of pineapple and sugar-cane plantations.

Impact: Caum (1933) reported damage caused by Skylarks to lettuce seedlings on Kauai, and Stone (1985) implicated them in the dispersal of introduced grasses, herbs and shrubs.

PYCNONOTIDAE (BULBULS)

Red-whiskered Bulbul
Pycnonotus jocosus

Natural Range: India, the Andaman Is., Nepal, Bangladesh, Burma, Assam, Yunnan, S China, N Vietnam, S Indochina, and Thailand S to SC Malay Peninsula.

Naturalised Range: Europe: ?Spain. Asia: ?Java; ?Sumatra; ?UAE. North America: USA. Australasia: Australia. Indian Ocean: Comoros Is; Madagascar; Mascarene Is; Nicobar Is; Seychelles Is. Pacific Ocean: Hawaiian Is.

Spain
According to Langley (2004), the Red-whiskered Bulbul may be in the process of becoming established in Spain.

Java; Sumatra
Medway & Wells (1976) and Long (1981) say that Red-whiskered Bulbuls may have been introduced to Java and Sumatra, where the species is a popular cage-bird, but they supply no supporting data.

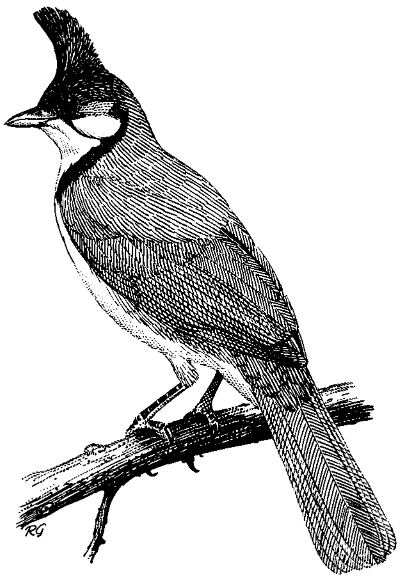
United Arab Emirates
Jennings (2004) lists breeding by this species in Dubai and Abu Dhabi.

United States
The escape into the wild of the Red-whiskered Bulbul in Florida resulted, as Owre (1973) points out, in the naturalisation of a new family of passerines in the Western Hemisphere.

In 1960, between five and ten pairs that had been imported from Calcutta (where the form is *P. j. emeria*) escaped from a bird farm in Kendall, Dade County, where they bred successfully in the wild in the following year and from where by the autumn they had ventured as far afield as Princeton, 56km southwest of

Miami. In 1963 a flock of 23 was counted in Kendall, and by the following year the population had increased to between 35 and 50. Fisk (1966: 10), who suggests the form in Florida may be *P. j. pyrrhotis* (northern India and Nepal) claims that the population had increased to 'perhaps 100 roosting in a flock'.

During their first decade in the wild there was an annual increment in the population of some 30–40% to a little under 250 birds by 1969–70, when some 8.2 sq km of Kendall had been colonised. By 1973 the population had doubled to around 500, and was continuing to increase and spread slowly in a southerly direction. The reluctance of the species to expand its range more rapidly has been attributed to the birds' attachment to communal roosts. Although the claim by Carleton & Owre (1975) that 'no obvious ecological factors exist that will prevent colonisation of the entire tropical zone of south-eastern Florida' may prove incorrect, the suggestion by James (1997: 152) that 'It now seems more likely that the family Pycnonotidae will be extirpated in the Western Hemisphere' may be somewhat premature. Although P. W. Smith (in James 1997) claimed the population was continuing to decline, Islam & Williams (2000) say there have been no population estimates since the 1980s. The species' survival in Dade County, Florida, centred on Miami and Coral Gables, is also confirmed by the AOU (1998) and Sibley (2000).



Red-whiskered Bulbul

In about 1968 some Red-whiskered Bulbuls became established in the Los Angeles County Arboretum (Arcadia), and in Huntington Gardens and San Morino, California, where they are popular cage-birds (Hardy 1973). Initially the population increased considerably and spread in the Pasadena/San Gabriel Valley (Small 1994), and in spite of subsequent attempts to eradicate them, a small number continue to survive (Johnston & Garrett 1994, Small 1994, Islam & Williams 2000).

Impact: Red-whiskered Bulbuls feed principally on small drupaceous fruits, berries and syconia of over two dozen exotic species, for which they compete with several native birds. To a lesser extent they also feed on the exotic Brazilian Holly or Pepper *Schinus terebinthifolius* which has been widely disseminated by birds in southeastern Florida, on 19 alien *Ficus* spp., on seven alien *Lantana* spp., and on up to 10 species of exotic jasmines (Oleaceae) – all of which they help to spread, to the disadvantage of native species (Carleton & Owre 1975). Although in much of its natural range *P. jocosus* is regarded as an agricultural and horticultural pest, Carleton & Owre (1975) found no evidence of damage to citrus and other commercial fruit crops in Florida. In California, on the other hand, the birds became a threat to local citrus crops (Islam & Williams 2000).

Australia

Red-whiskered Bulbuls imported to New South Wales in 1880 from China (where the nominate form occurs) apparently disappeared. Others introduced around the turn of the century fared better, and a number became established near Sydney. Some were reported at Homebush in 1902 and at Double Bay in 1917. They were breeding at Hunters' Hill in 1919 and at Wahroonga two years later, and by about 1920 were apparently common in the Sydney suburbs, where by 1933 flocks of up to 100 were established. By 1950 Red-whiskered Bulbuls had spread up to 100km from Sydney, and a decade later were said to be common within 150km of Sydney except in the south (McGill 1960). According to Frith (1979: 188) they were '… very abundant in city and suburban gardens and [have] colonised some nearby semi-rural districts'. Frith (1979) believed it was unlikely that *P. jocosus* would be able to spread very far north of Sydney through the dry sandstone gullies and *Eucalyptus* forests where there is little fruit.

Red-whiskered Bulbuls were first recorded in Victoria at Ashfield in 1915–16 and at Geelong and in gardens in Melbourne in 1948, where a decade or so later they were said to be fairly well established.

Between 1943 and 1945 there were sporadic records of Red-whiskered Bulbuls in northern Adelaide and Westbourne Park, South Australia (Paton 1985), where Long (1981) said they had become common.

Pizzey (1980) described the national distribution of *P. jocosus* as follows: common and widespread in New South Wales around Sydney, extending into the Lower Hunter Valley, and also occurring (doubtless as a result of a separate introduction) at Coffs Harbour 450km north of Sydney; in Victoria, a smaller colony occurred in and around South Yarra; in South Australia the species was found at various places near Adelaide. Blakers *et al.* (1984: 358) described the Red-whiskered Bulbul as 'now present on the coast from Lake MacQuarie to the Shoalhaven River, and west to the Blue Mountains' in New South Wales. Barrett *et al.* (2003) indicate the species' survival in New South Wales.

It is noteworthy that whereas in Florida the Red-whiskered Bulbul is an almost exclusively urban and suburban species, in New South Wales it has ventured into rural areas, thickets and heavily timbered gullies.

Impact: As early as the 1920s Red-whiskered Bulbuls were being accused of damaging peas, figs and strawberries in New South Wales (MacPherson 1924), and Frith (1979) said that in Sydney they were regarded as a pest in gardens and orchards. In compensation, they prey on vine moth larvae and other injurious invertebrates.

Comoros Islands

Louette (1999) and R. J. Safford (pers. comm. 2004) say that Red-whiskered Bulbuls from Mauritius have been introduced to Mayotte, most southerly of the Comoros Islands.

Madagascar

Bertrand (2000) records the presence of *P. jocosus* on Juan de Nova off the west coast of Madagascar.

Mascarene Islands

In 1891 a consignment of Red-whiskered Bulbuls of the form *P. j. emeria* (India, Bangladesh, Burma and Thailand) arrived in Port Louis, Mauritius, where in the following year their aviary was destroyed by a cyclone and all the birds were killed (Carié 1916, Guérin 1940–53). A second shipment of between one and six pairs, imported like the previous one by Gabriel Reynaud, arrived in or shortly after 1892 (Moulton *et al.* (1996) incorrectly give the date as 1886). These birds subsequently escaped from captivity and by 1910 were distributed throughout Mauritius (Carié 1910, Meinertzhagen 1912). Carié (1916) found the species to be already the most abundant bird on the island – a status confirmed by Cheke (1987). Hawkins & Safford (in prep.) found *P. jocosus* to occur throughout Mauritius and also on offlying islets.

In 1972 Red-whiskered Bulbuls were imported to St Philippe in southern Réunion, apparently by someone returning from Mauritius (Staub 1973a, 1976, Barau 1978, Barre & Barau 1982). In 1978 they were recorded at Ste Marie in the northeast, to which they had probably been taken by human agency. Between 1980 and 1985 the birds rapidly colonised the east coast of Réunion, and by 1990 they occurred in many parts of the island, including the central plateau at an altitude of 1,500m, and in the west where they inhabited gardens and areas of scrub. By 1995 they had dispersed from the western scrubland and had colonised numerous forests: the first of which was the Salazie crater. By 1999 they were observed in small numbers in other craters such as Cilaos and Mafate, and were established throughout the island up to 2,000m elevation (Besnard *et al.* 1996, Barré *et al.* 1998, Mandon-Dalger *et al.* 1999, Clergeau & Mandon-Dalger 2001). They are said by Hawkins & Safford (in prep.) to be increasing their range rapidly.

Mandon-Dalger *et al.* (1999) found that the warm and rainy eastern slopes were colonised first, and remain the most densely populated region. They noted a negative correlation between the numbers of birds and the altitude. On Réunion, unlike other alien birds, *P. jocosus* enters native forest and is not confined to anthropic localities. Clergeau & Mandon-Dalger (2001) calculated the average rate of dispersal at around 6.2km a year between 1972 and 1982 and about 14.7km a year in the decade from 1985, and concluded that the rate of spread of the species in the Mascarene Islands was much faster than in other places to which it has been introduced.

Impact: As early as 1912, Richard Meinertzhagen was recording orchard damage caused by Red-whiskered Bulbuls on Mauritius. Jones (1987) refers to competition on Mauritius for geckos (Gekkonidae) between *P. jocosus* and the Mauritius Kestrel *Falco punctatus* (classified as Endangered by the World Conservation Union) and for the flowers of *Nuxia verticillata* between *P. jocosus* and the Pink Pigeon *Nesoenas mayeri* (classified as Critically Endangered). On Réunion, Barré & Barau (1982) believed that Red-whiskered Bulbuls may eat the eggs and nestlings of small native passerines. Cheke (1987) considered that although nest-predation by *P. jocosus* caused heavy losses to endemic Mascarene White-eyes *Zosterops borbonicus mauritianus* and Mauritius Olive White-eyes *Z. chloronothus*, the former remains common and the latter is far from rare within its dwindling forest habitat; this may be because native passerines are largely restricted to upland forest (Feare & Mungroo 1990). Temple (1974) states that on Mauritius competition for food with the Red-whiskered Bulbul (and Common Myna *Acridotheres tristis*) was a major threat to the survival of the endemic subspecies of the Olivaceous Bulbul *Hypsipetes borbonicus olivaceus* (classified as Vulnerable by the World Conservation Union), and Jones (1996) considered that competition with the two aliens was preventing *H. b. olivaceus* and the Mauritius Cuckoo-shrike *Coracina typica* (also Vulnerable) from spreading outside native forest. On Réunion, Barré & Barau (1982) believed that Bulbuls (and Mynas) were competitors and predators of *H. b. borbonicus.*

Nicobar Islands

Red-whiskered Bulbuls (*P. j. whistleri*) have been introduced from Port Blair in the Andaman Islands to the Nicobars, where they are said to be common on Trinkat and Camorta Islands, and possibly also on Nancowry, but they are not believed not to occur elsewhere (Abdulali 1964, 1967).

Seychelles Islands

In 1977 Prŷs-Jones *et al.* (1981) saw at least six Red-whiskered Bulbuls on Assumption Island in the Seychelles, the origin of which was Mauritius (R. J. Safford pers. comm. 2004). In 1986, Roberts (1988) counted about 100 pairs in one locality, and estimated the total could be double that figure, widely spread in a variety of habitats throughout the island. By 1997 the total had risen to between 1,000 and 1,500 individuals (Skerrett *et al.* 2001).

Impact: The small atoll of Aldabra, which was added to the World Heritage List in 1982, lies only 27km from Assumption Island. Prŷs-Jones *et al.* (1981) and Roberts (1988) have drawn attention to the threat that would be posed to the unique and near pristine fauna and flora of Aldabra were Red-whiskered Bulbuls ever to gain access to the atoll. The former authors reviewed the potential threats to the Aldabra avifauna from disease, hybridisation, competition and nest-predation by *P. jocosus.*

Hawaiian Islands

In 1965 two Red-whiskered Bulbuls were seen on the Lower Makiki Heights on Oahu, where several were observed in the following year and two dozen were reported in 1967. Pratt *et al.* (1987), Pratt (1994), and Shehata *et al.* (2001) give the date incorrectly as 1966; the AOU (1998) says the introduction took place in 1967. Islam & Williams (2000) correctly give the date as 1965). The birds later spread to Pacific Heights, Kaimuki and the Punchbowl areas and along the length of Manoa Valley (Berger 1975).

The subsequent expansion of the numbers and range of the Red-whiskered Bulbul on Oahu has not been as dramatic as that of the Red-vented Bulbul (Berger 1975a, Van Riper *et al.* 1979). Zeillemaker & Scott (1976) recorded Red-whiskered Bulbuls as local and uncommon in residential districts and community parklands on Oahu, where by 1979 they occurred from Hawaii Kai to Pearl City Heights. Pratt *et al.* (1987) recorded them as well established in the Honolulu area, and said that they could be expected anywhere on the island within a few years. *P. jocosus* was first recorded on the windward side of the Ko'olau Mountains in about 1990, and it has bred successfully in the Kāne'ohe– Kailua area. The Honolulu Christmas Bird Count for 1967 recorded only two birds; by 1994 the total had risen to 191 (Islam & Williams 2000).

Impact: Red-whiskered Bulbuls on Oahu showed a prevalence of 27.5% *Plasmodium* malarial infection during the period of study by Shehata *et al.* (2001), which is consistent with their potential to act as a potent source of pathogens among Oahu's indigenous avifauna. It is known that on other islands the Hawaii Amakihi *Hemignathus virens* is a suitable host for *Plasmodium* strains occurring in the archipelago, and that its survival rate when infected is low; thus the endemic Oahu Amakihi *H. flavus* may well be at risk (Shehata *et al.* 2001).

Red-vented Bulbul
Pycnonotus cafer

Natural Range: Pakistan, India, Sri Lanka, Assam, Bangladesh, Burma, W Yunnan.

Naturalised Range: Europe: ?Spain. Asia: UAE; ?Kuwait; ?Qatar; ?Saudi Arabia. Australasia: ?New Zealand. Pacific Ocean: Fiji Is; Hawaiian Is; ?Marshall Is; New Caledonia; Samoa; Society Is; Tonga Is.

Spain
First recorded in Spain in 1998. One or two pairs have nested in Torremolinos, Málaga, since 2000 (J. Clavell in Martí & del Moral 2003).

United Arab Emirates
Jennings (1981b) says that the Red-vented Bulbul is breeding in small numbers in the United Arab Emirates, where it has hybridised with the native White-spectacled Bulbul *P. xanthopygos* in Abu Dhabi and Dubai; its establishment is confirmed by Richardson (1992) and Jennings (2004).

Kuwait; Qatar; Saudi Arabia
Islam & Williams (2000) and Jennings (2004) refer to the presence of a small population in Kuwait (Manama), where breeding was confirmed in 1986. Jennings (2004) also mentions breeding in Qatar (Doha) and Saudi Arabia (Jeddah).

New Zealand
According to Turbott (1956), Red-vented Bulbuls of the race *bengalensis* (northeastern India, S Assam, and Bangladesh) were released in Auckland in 1952, and within two years the population in such suburbs as Takapuna, Mount Eden and Remuera, and in Stanley Bay, numbered some 50 birds. By 1955 these potential pests had apparently been eradicated, but since 1984 Heather & Robertson (1997) record the presence of small numbers in North Shore and Mount Eden; these may be survivors of the original introduction or represent a new importation.

Fiji Islands
The arrival of Red-vented Bulbuls in Fiji around 1903 can, according to Watling (1978b, 1982), be linked to that of Indian labourers who might well have brought the birds with them because they have a special

place in Indian literature, folklore and poetry, and as fighting birds. Most of the Indian immigrants came from Uttar Pradesh, with large numbers from Bengal and Bihar, where *P. c. bengalensis* (the form established in Fiji) occurs.

By the 1980s, Red-vented Bulbuls were common only on Viti Levu and on some small off-lying islands such as Beqa; on the former they are abundant in both agricultural and residential districts, are frequently seen in clearings and patches of immature secondary seral associations (floodplains, riverine habitats and landslips) in forests, and occasionally in mature woodlands. Lesser numbers have occurred on Ovalau, Wakaya and Taveuni, which may have derived from natural dispersal or deliberate translocations (Watling 1982).

Impact: Watling (1979) found that in the Sigatoka Valley (the most important horticultural region of Fiji) agricultural crops comprise less than 3% of the birds' diet. Minor damage was done to tomatoes, aubergines, brassicas, cowpeas, pigeon peas and longbeans, but none of commercial significance. Although bulbuls are aggressive birds, Watling (1979) observed only a limited amount of attacks on native species. The only indigenous bird with which *P. cafer* competes for food appears to be the White-throated Pigeon *Columba vitiensis* (for an expanded account see Lever 1987: 316–317).

Hawaiian Islands

In 1966 a flock of at least half-a-dozen Red-vented Bulbuls was sighted at Waipahu on Oahu (Donaghho 1966); these birds may have escaped while in transit at the Honolulu airport, but were more probably deliberately (and illegally) released in the previous year with Red-whiskered Bulbuls (Berger 1975a, Williams 1983b). By 1967 they had been recorded near Fort Shafter, in Kailua, and at Waimanalo, from where they later spread to Manoa Valley and the Moanulua Gardens.

Zeillemaker & Scott (1976) recorded their status as still uncommon, but Berger (1981: 193) said that 'This abundant species now occurs from Hanauma Bay and Koko Crater to Waipahu and Wahiawa on the leeward side of Oahu and from Waimanaloa to Laie on the windward side. It will not take many years before the species is found throughout the island'. Since then, the population and distribution of Red-vented Bulbuls have exploded dramatically (much more so than those of the Red-whiskered Bulbul), and they now occur in almost all parts of Oahu (Islam & Williams 2000). Nine birds were counted in the Honolulu Bird Count in 1968; by 1994 the total had risen to 2,302. Islam & Williams (2000) list first records for other islands as follows: Hawaii (Kona, 1982; Hilo, 1987); western Molokai (1983); Kauai (near Anahola, 1985; near 'Ele'ele, 1997); Maui (Pukalani–Makawao area, 1988); and Kahoolawe (1989). Since bulbuls are largely sedentary and most sightings on other islands have been close to the coast, these birds may have travelled on board inter-island boats or be the result of separate releases (Williams 1983b).

Impact: See under *P. jocosus*. *P. cafer* examined by Shehata *et al.* (2001) in the Lyon Arboretum in Honolulu, Hawaii, in 1994–96 were found to have a prevalence of 50% *Plasmodium* malarial infection.

Marshall Islands

Red-vented Bulbuls first arrived in the Marshall Islands on Majuro in 2000, where they became established principally in the agricultural region of Laura. The birds are believed to have either been introduced deliberately or to have arrived as ship-borne stowaways (Van der Velde 2002).

Impact: This is the first record of the species in Micronesia, and Van der Velde (2002) expressed her concern for colonisation of other islands in the Marshalls and elsewhere (e.g. Pohnpei and Kosrae) in the region. Competition for food could have a negative impact on Majuro's only native land bird, the local race of the Micronesian Imperial Pigeon *Ducula oceanica ratakensis*, and predation could seriously affect the endemic Arno Skink

Emoia arnoensis. The notoriously invasive Lantana *Lantana camara* has so far been fairly quiescent in the Marshall Islands but could well be spread by Bulbuls.

New Caledonia

Heather & Robertson (1997) and Islam & Williams (2000) record the establishment of Red-vented Bulbuls in New Caledonia, but provide no further details.

Samoa

In 1943 some Red-vented Bulbuls from Fiji (*P. c. bengalensis*), destined for New Caledonia, were diverted to Western Samoa, where they were landed and later released at Apia on Upolu. By at least 1963, when some were observed at Pago Pago (but probably by the late 1950s), they had made the 75-km sea crossing (or had been deliberately transferred) to Tutuila in American Samoa, where they were reported to be abundant by 1965. They did not appear on Savai'i – only 15km from Upolu – until 1974. The species became common in residential and agricultural (but not in natural) habitats on Upolu and Tutuila, but less so on Savai'i (Pratt *et al.* 1987). Gill *et al.* (1993) found *P. cafer* on Savai'i only in the southeast and northwest, and Gill (1999) recorded the species throughout Upolu.

Society Islands

Red-vented Bulbuls were first recorded on Tahiti, in the residential district of Patutoa, Papeete, in 1979 (Bruner 1979), where their establishment was confirmed by Pratt *et al.* (1987). Their means of arrival on Tahiti is apparently unrecorded.

Impact: Aggressive behaviour by introduced Red-vented Bulbuls on Tahiti has contributed to the decline of the endemic race of the Tahitian Monarch *Pomarea n. nigra*, classified as Critically Endangered by the World Conservation Union (Blanvillain *et al.* 2003).

Tonga Islands

In 1928 or 1929 a pair of Red-vented Bulbuls (probably, as in Fiji, *bengalensis*) was released or escaped from captivity on the island of Ninafo'ou. In the 1940s, some of their descendants were transferred by Prince Tungi to control insect pests on Tongatapu, from where they dispersed to 'Eua, a distance of some 20km. Dhondt (1976a) recorded them as abundant on Tongatapu, and in 1976 Watling (1978b) found them to be widely distributed but less common than on Fiji. Pratt *et al.* (1987) recorded Red-vented Bulbuls only on Nukualofa and 'Eua.

Sooty-headed Bulbul
Pycnonotus aurigaster

Natural Range: Burma, Indochina, Java, Bali, Thailand, China and Vietnam.
Naturalised Range: Asia: Singapore; Sulawesi; Sumatra.

Singapore

In about 1923 Sooty-headed Bulbuls, the descendants of cage-birds imported from Java, became established in the suburbs of Singapore where, although C. J. Hails (pers. comm. 1985) said they were dying out (or had done so), Dickinson (2003) indicates their survival.

Sulawesi

Stresemann (1936) recorded the introduction from Java of *P. a. aurigaster* to Sulawesi, where it became established on the southern peninsula, and where Dickinson (2003) confirms its survival.

Sumatra

Before the mid-1930s, Sooty-headed Bulbuls of the nominate subspecies (Java and Bali) were successfully introduced from the former island to Medan on the northeast coast of Sumatra (Kuroda 1933–36), where Dickinson (2003) confirms their survival.

Yellow-vented Bulbul
Pycnonotus goiavier

Natural Range: The Malay Peninsula and

associated islands, Borneo, Indochina, Thailand and the Philippine Is.
Naturalised Range: Asia: Sulawesi.

SULAWESI

In May 1977, small groups of Yellow-vented Bulbuls were observed by Escott & Holmes (1980) at Ujung Pandang in southern Sulawesi, where they became established. The form present in Sulawesi is *P. g. analis* (the Malay Peninsula eastwards to Lombok). Natural immigration can probably be discounted because of the lengthy sea crossing involved.

SYLVIIDAE (OLD WORLD WARBLERS)

Japanese Bush Warbler
Cettia diphone

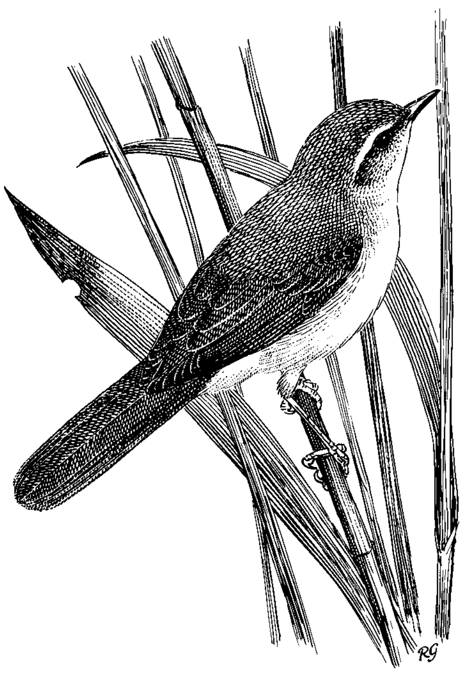
Natural Range: China, Korea, the S Russian Far East, Sakhalin, Kuril, Ryukyu, Borodino and Bonin Is., and C and S Japan. Winters south to S China and SE Asian mainland.
Naturalised Range: Pacific Ocean: Hawaiian Is.

HAWAIIAN ISLANDS

Japanese Bush Warblers were first introduced to control insect pests on Oahu in 1929 (Caum 1933). Between the following year and 1941 a further 116 were liberated, some in the Nu'u-anu Valley. Although the birds were apparently doing well in 1937, it was a further decade before the first nest was found (Berger 1977). By 1956 Japanese Bush Warblers were expanding their range on Oahu, and occurred in moist areas in the Koolau Range and especially in the upper Pa Lehua sections of the Waianae Mountains (Berger 1972).

Zeillemaker & Scott (1976) recorded *C. diphone* as uncommon, in exotic forests and scrub and mixed indigenous forests. According to Berger (1981: 198), the Japanese Bush Warbler occurred 'in the Waianae Range from Peacock Flats in the north to Pa Lehua in the south. In the Koolau Range the species is found from Waialae Iki Ridge to Waimea Valley and Pupukea, as well as on the windward side of the Pali as far north as Kahuku (*Elepaio* 38: 56). The birds are common at the Makiki nursery in Honolulu and in Moanahua Valley'. Bush Warblers were heard on Molokai and Lanai in 1979 (Pyle 1979, Conant 1980) and on Maui in 1980 (Carothers & Hansen 1982). Since the mid-1980s the population on Molokai has increased dramatically (Scott *et al.* 1986).

Pratt *et al.* (1987), who erroneously say Japanese Bush Warblers were first introduced to Oahu in the 1930s, record the species as abundant on Oahu and as having recently spread to Molokai, Lanai, Maui and perhaps Kauai, a distribution confirmed by Pratt (1992) and the AOU (1998).



Japanese Bush Warbler

TIMALIIDAE (BABBLERS AND PARROT-BILLS)

Melodious Laughing Thrush
Garrulax canorus

Natural Range: China, Laos, Vietnam, Hainan and Taiwan.
Naturalised Range: Asia: Japan. Pacific Ocean: Hawaiian Is.

Japan
Eguchi & Amano (1999) list the Melodious Laughing Thrush among those introduced species that have established long-term self-sustaining populations in Japan, where the OSJ (2000) describes it as a resident breeding species in parts of central Honshu (Fukushima, Tokyo, Kanagawa and Yamanashi) and Kyushu (Fukuoka, Saga and Oita).

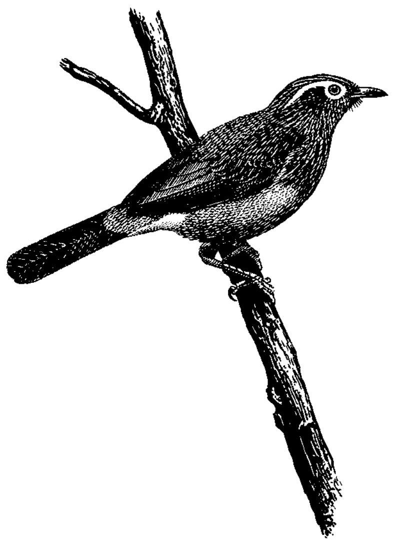
Hawaiian Islands
In the late nineteenth century the Melodious Laughing Thrush was imported as a cage-bird by Chinese immigrants to Oahu, where according to Caum (1933) a number escaped following a major fire in the Chinese quarter of Honolulu in 1900. More of the nominate subspecies (China, Laos and Vietnam) were brought in from China and released on Maui in 1902 and on Molokai and Hawaii in 1909, and in 1968 birds from Oahu were translocated to Kauai. Caum (1933) found them to be then well established on Oahu.

According to Munro (1944), the Melodious Laughing Thrush soon became widely distributed and abundant, and managed to penetrate deeper into the native forests than any other alien species: it was common on Kauai, local on Oahu and Hawaii, and scarce on Molokai and Maui. Richardson & Bowles (1964) found it to be common on Kauai, where it occurred from sea level up to 1,400m in montane forest, in moist forested valleys and in barren and arid canyons on the south Na Pali coast. It was equally at home in exotic and in native woodland with a high annual rainfall in the Alakai Swamp region where, in Kokee, it was especially common. Ord (1967) recorded it as also abundant on Hawaii, Maui and Oahu, from 120m up to the tree limit.

Scott *et al.* (1986) found the Melodious Laughing Thrush to be well-established in considerable numbers in various parts of Hawaii from sea level to 2,900m; to be fairly common in low- to mid-elevation (up to 2,500m) mesic and hydric forests, and in xeric areas along gulches and near water on east Maui, but absent from high-altitude wet forests; on Kauai, the species occurred in low densities that decreased in the higher and moister areas of the south Alakai. Scott *et al.* (1986) failed to find the species on either Molokai and Lanai. On all islands where it occurs, the Melodious Laughing Thrush is most common below 1,000m.

Pratt *et al.* (1987) and the AOU (1998) list *G. canorus* as common on Kauai, Maui and Hawaii, and uncommon and local to rare on Oahu and Molokai.

Impact: Stone (1985) lists the Melodious Laughing Thrush as one of those alien species implicated in the dispersal of exotic grasses, herbs and shrubs in the Hawaiian Islands.



Melodious Laughing Thrish

Greater Necklaced Laughing Thrush
Garrulax pectoralis

Natural Range: Nepal, Assam, Burma, Thailand, Laos, SE China and Hainan I.
Naturalised Range: Pacific Ocean: Hawaiian Is.

Hawaiian Islands
In 1919, Greater Necklaced Laughing Thrushes were imported by Dora Isenberg to Kauai (Caum 1933), and around 1950 others (probably from Kauai) are believed to have been released on Oahu (Bryan 1958). By 1964 they were apparently sparsely distributed on the former island in the Wailu Homesteads region (Richardson & Bowles 1964). Pratt *et al.* (1987) listed *G. pectoralis* as 'Uncommon and local, apparently nomadic, along stream valleys in the lowlands [of Kauai]. Most often seen along Huleia Stream'. Pratt (1994) and the AOU (1998) confirm the species' survival on Kauai.

Grey-sided Laughing Thrush
Garrulax caerulatus

Natural Range: Nepal, Assam, Burma and W Yunnan.
Naturalised Range: Pacific Ocean: Hawaiian Is.

Hawaiian Islands
Caum (1933) said that in 1928 five unidentified *Garrulax* sp. were released on Oahu, but it was not until 1978 that the species was identified as *G. caerulatus* (Taylor & Collins 1979).

Pratt *et al.* (1987: 265) say of the Grey-sided Laughing Thrush that it was 'Introduced to Oahu sometime before 1947. Apparently established in N. Koolau Mts. (Poamoho Trail) but rarely seen'. The AOU (1998: 697), having in the 1983 edition expressed reservations about the specific identification by Taylor & Collins, says that the species '… was frequently reported in the northern Koolau Mountains along the Poamoho Trail during the 1940s and 1950s; well-substantiated reports in the same locality in 1978 (Taylor & Collins 1979) and 1986 (Bremer 1987) suggest that the species may persist in small numbers'.

Masked Laughing Thrush
Garrulax perspicillatus

Natural Range: C and E China to N and C Vietnam.
Naturalised Range: Asia: Japan.

Japan
The Masked Laughing Thrush is one of the introduced species listed by Eguchi & Amano (1999) as having established long-term and self-sustaining populations in Japan. The OSJ (2000) lists it as a regular breeding species in broadleaved and mixed forests and low altitude bamboo in central Honshu (Tokyo, Kanagawa).

Red-billed Leiothrix
Leiothrix lutea

Natural Range: The Himalayas eastward through Assam, Burma and Vietnam to SE China.
Naturalised Range: Europe: France; ?Spain; ?Germany. Asia: Japan. Indian Ocean: Mascarene Is. Pacific Ocean: Hawaiian Is.

France
According to Langley (2004), between 100 and 150 pairs of the Red-billed Leiothrix are established in France, mainly in the Pyrénées-Atlantique, with a smaller colony near Paris.

Spain
Langley (2004) says that *L. lutea* is becoming established in Spain. It has occurred and bred near Barcelona since 1993 (J. Clavell in Martí & del Moral 2003).

Germany
Pannach (1992) and Grimm & Doerr (1994) record the occurrence in the wild of *L. lutea* in Grosskantine and in Rheinland-Pfalz

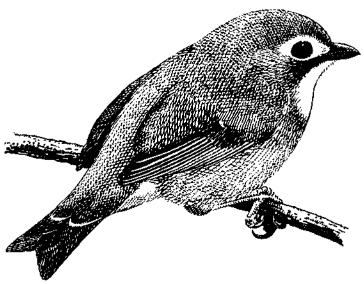
respectively, but the species' status today, if it survives, is unrecorded.

Japan

Since the 1980s, many naturalised populations of the Red-billed Leiothrix (probably of the nominate subspecies) introduced from China have become established in central and southwestern Japan (Yamashina Institute for Ornithology 1993, Tojo 1994, Eguchi & Amano 1999). The expansion of the species' range and the increase in the population have been greatest above 1,000m in Kyushu (Eguchi & Amano 1999). Between 1988 and 1991 only a single individual was seen in the Massif Tsukuba, where in 1992–93 it was common and recorded frequently (Tojo 1994). It is found mainly in *Tsuga* and *Abies* deciduous broadleaved forests with a dense understorey of dwarf bamboo, and favours low layers of forest vegetation (Eguchi & Masuda 1994), in central Honshu (Ibaraki, Tokyo, Yamanashi, Shizuoka, Wakayama, Osaka and Hyogo) and Kyushu (Fukuoka, Kumamoto, Oita and Miyazaki).

Impact: Amano & Eguchi (2002a) studied the nest-site selection and characteristics in Kyushu of the Red-billed Leiothrix and the sympatric native Japanese Bush Warbler *Cettia diphone*. Both species nest exclusively in bamboo. *L. lutea* constructs well-concealed pendulous nests in the bamboo canopy, whereas *C. diphone* builds nests on bamboo stalks in places of high stalk density in dense vegetation. This segregation of nesting microhabitats enables both species to breed sympatrically. Even when the two species nested in close proximity no direct interaction was observed between them. However, there is likely to be some indirect competition; a high density of nests could attract predators, and the breeding success of the Bush Warblers may be low as a result of interference competition with the Leiothrix.

Amano & Eguchi (2000b) also studied the foraging niches of *L. lutea* and such sympatric natives as *C. diphone*, the Long-tailed Tit *Aegithalos caudatus*, the Great Tit *Parus major*, Coal Tit *P. ater*, Varied Tit *P. varius* and Willow Tit *P. montanus* with a similar altitudinal distribution (Eguchi & Masuda 1994). The Leiothrix was found to forage in the lower vegetational layer with bamboo, intermediate in height between the foraging levels of *C. diphone* and the various *Parus* spp. Foraging height, the extent of foraging on deciduous trees and foraging techniques were quite distinct between *L. lutea* and the native species, and the invasion by the Leiothrix caused no apparent niche shift. Aerial insects tended to be more abundant about one metre above the bamboo canopy, where they were vulnerable to the Leiothrix's foraging technique of jumping. *Parus* spp. and *C. diphone* seldom forage by jumping, and thus exploit different food resources to those used by *L. lutea*, which may have invaded a vacant ecological niche – the lower layer of deciduous broadleaved forest – in Kyushu.



Red-billed Leiothrix

Mascarene Islands

The Red-billed Leiothrix was first seen in moist lowland forests on the east coast of Réunion (La Plaine des Lianes, Grand Etang, and at Cilaos, and perhaps also La Plaine des Fougères and at La Montagne) in 1999. This fairly wide distribution suggests that the introduction is not very recent (perhaps in the 1980s), or that there were several different releases in various localities. There are no recent references to this species on Réunion, although because it is very secretive it could have been overlooked (Le Corre 2000). See also Tassin & Rivière 2001.

Hawaiian Islands

Although Caum (1933) claimed that the

Red-billed Leiothrix was first introduced to the Hawaiian Islands (Kauai) by Dora Isenberg in 1918, Fisher & Baldwin (1947) indicate that as early as 1911 37 of the nominate race (central and eastern China) were imported as cage-birds from southeastern China, followed by others from the same source in 1913, 1915 and 1917, some of which are believed to have escaped and to have become established in the wild before 1918. (According to Ali & Ripley (1968–73) the race introduced to Hawaii was *calipyga* of the Himalayas, Assam, Manipur, Burma and southeastern Xizang). In 1928–29 more were imported from the Far East by W. H. McInerny who released them on Oahu, and at the same time others were set free on Molokai, Maui, Hawaii and Kauai.

Caum (1933) recorded *L. lutea* to be present in considerable numbers on Kauai and to be apparently breeding on Molokai, Maui and Hawaii. Berger (1972) described the species as widely distributed on all the main islands, but to be less common on Kauai. Zeillemaker & Scott (1976) said the Red-billed Leiothrix occurred in exotic and native forest and scrub on Hawaii (where it was widespread and abundant); on Oahu (numerous in the Koolau and Waianae Mountains); on Maui (common in damp forests on Haleakala and in the west); on Molokai (uncommon in mountain valleys); on Lanai (uncommon); and possibly on Kauai.

Scott *et al.* (1986) found *L. lutea* to be well distributed above 1,000m on the windward side of Hawaii; widespread and common in well-watered areas of eastern Maui, where since 1977 it had greatly increased in range and numbers on northwest Haleakala; on Molokai *L. lutea* occurred mainly above 1,000m. Pratt *et al.* (1987: 266) said the species was 'Introduced (1920s) to the Hawaiian Islands. Abundant on most islands by 1940s but has been declining since. Now rare on Kauai, Oahu; still common on Molokai, Maui, Hawaii'. This status is confirmed by the AOU (1998).

Scott *et al.* (1986) drew attention to the fact that whereas in the Hawaiian Islands the lower elevational limit of *L. lutea* is around 1,000m, in Burma it occurs mainly above 1,500m. They hypothesised that the long-term survival of lowland populations is made problematical by high temperatures. This could explain the absence or infrequency of birds at lower elevations, and may also account for the near-disappearance of the species on Oahu and Kauai.

Impact: Stone & Loope (1987) say that S. Conant (in Mueller-Dombois *et al.* 1981) points out that the Red-billed Leiothrix does not seem to compete for food with the endemic Hawaiian Thrush *Myadestes obscurus* because the former feeds principally less than seven metres from the ground, whereas the latter forages in the forest canopy.

According to Lewin (1971), *L. lutea* is one of the alien species in the Hawaiian Islands implicated in the spread of the exotic Banana Poka *Passiflora mollissima*; it also causes some local damage to several soft fruit and vegetable crops (Keffer *et al.* 1976).

The Red-billed Leiothrix in the Hawaiian Islands appears (like several other naturalised species) to have acquired some immunogenetic protection or behavioural or physiological non-immunogenetic defences against bird pox and malaria or their vectors, and thus appears to be relatively unaffected by avian diseases; Shehata *et al.* (2001) found that *L. lutea* had one of the lowest rates (5.2%) of malarial infection among alien birds in their study area on Hawaii. Thus, the reasons for the large historical population fluctuations in the archipelago remain unexplained (Ralph *et al.* 1998).

ZOSTEROPIDAE (WHITE-EYES)

Japanese White-eye
Zosterops japonicus

Natural Range: From S Sakhalin I., S through Japan and many of its satellite islands to China, N Vietnam and Hainan I.

Naturalised Range: Pacific Ocean: Hawaiian Is.

Hawaiian Islands

According to Keffer *et al.* (1976), local avicultural dealers released Japanese White-eyes in the Hawaiian Islands in 1928. A year later and in subsequent years others (of the nominate subspecies from Honshu, Kyushu, Shikoku and Tsushima) were freed on Oahu where they became established (Caum 1933). In 1937 at least 252 were liberated on Hawaii, and others were released on Maui, Molokai, Lanai and perhaps Kauai, and by at least the late 1950s they had colonised all the main islands.

According to Berger (1981: 198–199) *Z. japonicus* was

> now certainly the most abundant land bird in the Hawaiian Islands. It occurs on all the main islands and is found from sea level to tree line on Maui and Hawaii. It occurs in very dry areas … and very wet areas (300 or more inches [760cm] of rain a year).

Scott *et al.* (1986) found *Z. japonicus* from sea level to 3,100m on Hawaii and up to 2,700m on Maui. Densities of over 500 birds per sq km occurred below 1,300m on Hawaii and Kauai, and at all elevations on Molokai and Lanai; densities were lowest on Maui. Distributional patterns on Hawaii, Maui, Molokai and Kauai suggest the invasion of montane forests by lowland populations.

Pratt *et al.* (1987) confirm the species' status as probably the most abundant bird in the archipelago, and add that it has even been reported far out to sea and on Johnston Atoll, southwest of Hawaii. The AOU (1998: 515) says that *Z. japonicus* is 'now widespread and common on the main islands from Kauai eastwards'.

Impact: Stone & Loope (1987; quoting S. Conant in Mueller-Dombois *et al.* 1981) said that the introduced Japanese White-eye normally feeds in the lower canopy where it does not compete with the endemic Hawaiian Thrush *Myadestes obscurus* which uses the full canopy range; the former may, however, be a significant competitor with native birds, such as the Elepaio *Chasiempis sandwichensis*, Amahikis *Hemignathus* spp., and Hawaii Creeper *Oreomystis mana* (Mountainspring & Scott 1985), and with other introduced species in lowland localities (Moulton & Pimm 1983), for the blossom nectar of Ohi'a *Metrosideros polymorpha*. *Z. japonicus* has been implicated in the dispersal of the introduced Banana Poka *Passiflora mollissima* (Lewin 1971).

The Japanese White-eye is known to be a host of both the endoparasite *Plasmodium vaughani*, which causes avian malaria, and also of bird pox, which is spread by the introduced tropical mosquito *Culex pipiens quinquefasciatus*, against which native species have no resistance. This lack of inbuilt immunity, together with interspecific competition for food or nesting sites, has contributed to the serious decline or even extermination of some endemic Hawaiian honeycreepers (Drepanididae) and of some other native species in Volcanoes National Park. Nevertheless, in their study area in the Lyon Arboretum in Honolulu on Hawaii, Shehata *et al.* (2001) found only a 4.6% malarial infection prevalence among Japanese White-eyes.

Limited local damage to some soft fruit crops by *Z. japonicus* has been recorded. However, the species also kills injurious insects.

Silver-eye
Zosterops lateralis

Natural Range: Australia, from the Cape York Peninsula S and W to S Western Australia. Also Tasmania and numerous islands in the W Pacific east of Australia as far as the Fiji Is. (A natural colonist of New Zealand in 1832, and of some of its off-lying Islands).

Naturalised Range: Pacific Ocean: Society Is; Tubuai Is.

Society Islands

Silver-eyes of the nominate subspecies (Tasmania, Flinders and Norfolk Is. and New Zealand) were first introduced (from New Zealand) to the Society Islands in about 1937 by E. Guild (1938), who released some on Tahiti. They are now widely distributed and abundant there and have spread to other islands in the archipelago as follows: Moorea (1971; very common); Huahine (1972; uncertain); Raiatea (1972; widespread); Tahaa (1973; widely distributed); Bora Bora (1971; uncommon); Maupiti (1973; only at Paumea). They may also have colonised Mehetia and Tupai. In 1973 they were unsuccessfully released on Tetiaroa (Holyoak & Thibault 1984). Pratt *et al.* (1987), who erroneously say the introduction took place in 1939, record the species' presence on Tahiti, Moorea, Raiatea and Bora Bora.

Tubuai Islands

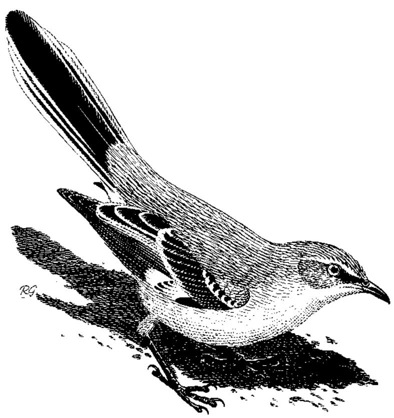
According to Pratt *et al.* (1987), Silver-eyes were introduced to the Tubuai archipelago more recently than to the Society Islands, and are now common to abundant on Raivavae, Tubuai and Rurutu.

Christmas Island White-eye
Zosterops natalis

Natural Range: Christmas I. (Indian Ocean).
Naturalised Range: Indian Ocean: Cocos (Keeling) Is.

Cocos (Keeling) Islands

The Christmas Island White-eye was introduced between 1885 and 1900 to Pulo Luar (Horsburgh Island), where until at least the late 1940s it was restricted but abundant (Gibson-Hill 1949a). It is believed, like the Island Thrush *Turdus poliocephalus*, to have since spread to some other islands in the group. In 1982 it remained abundant on Pulo Luar only, in remnants of the original forest vegetation along the lagoon shore (Stokes *et al.* 1984)



Northern Mockingbird

MIMIDAE (MOCKINGBIRDS AND THRASHERS)

Northern Mockingbird
Mimus polyglottos

Natural Range: S Canada and N USA to Mexico. Also Cuba, Hispaniola, Puerto Rico and Jamaica.
Naturalised Range: North America: West Indies. Atlantic Ocean: ?Bermuda. Pacific Ocean: Hawaiian Is.

West Indies

'A common resident throughout the Bahamas. …. Introduced to New Providence at about the turn of the 20th century, it now outnumbers the native Bahama Mockingbird [*M. gundlachii*]. An introduced population on Barbados is now extirpated' (Raffaele *et al.* 1998: 381–382).

Bermuda

Northern Mockingbirds introduced to Bermuda in 1893 died out shortly after 1914. Nevertheless, the AOU (1998: 517) claims the species is 'introduced and established … in Bermuda', where it now occurs only as a rare and occasional vagrant (Wingate 1973, Raine 2003).

Hawaiian Islands

According to Caum (1933), Northern Mockingbirds were released in Honolulu on Oahu in 1928, 'ostensibly as game birds [*sic*]'. Berger (1981) said that more were freed on Oahu in 1931–33, and on Maui in the latter year. The birds first reached Hawaii through natural dispersal in 1936, and by the late 1950s they were established on Maui (where they had first appeared in 1933), and occurred locally on Oahu, Molokai (since 1951), and Lanai, and occasionally on Hawaii (Munro 1960).

In 1959, Hawaii was recolonised, this time from Maui, and shortly afterwards Mockingbirds appear to have spread to all the larger islands and some of the smaller ones to the northwest such as Nohoa, Tern in the French Frigate Shoals (*c.* 1960) and Necker (*c.* 1966) (Berger 1981).

Zeillemaker & Scott (1976) found *M. polyglottos* to be common on Maui, uncommon on Kauai (where it may have arrived as early as 1946), Oahu, Molokai, Lanai and Hawaii, and as occurring only as a vagrant in the northwestern islands.

Pratt *et al.* (1987: 267), who erroneously date the first introduction to 1931, recorded Mockingbirds as '… on the six largest [islands]. Fairly common and widespread on Kauai, uncommon and local elsewhere. Vagrant to … Midway, French Frigate Shoals, Necker, Nihoa'. This distribution is confirmed by Pratt (1994) and the AOU (1998).

Scott *et al.* (1986) (who incorrectly say *M. polyglottos* was first released on Oahu in 1931 and was first reported on Hawaii in 1959), found that the species occurred in a wide spectrum of vegetation and elevations, favouring xeric habitats on Hawaii and Maui. Pratt (1994) said the birds had yet to penetrate into native forests.

Impact: Northern Mockingbirds are among those introduced species accused of helping the Banana Poka *Passiflora mollissima* to spread in the Hawaiian Islands (Warshauer *et al.* 1983).

Tropical Mockingbird
Mimus gilvus

Natural Range: From S Mexico to Guatemala, Honduras and El Salvador, and from Colombia, Venezuela, Guyana, French Guiana and Surinam to Brazil. Also some islands in the West Indies and off the coast of S America.
Naturalised Range: South America: Panama.

Panama
Ridgeley (1976) indicates they were first reported in Panama in 1932, where de Schauensee (1964) said that they were introduced. Tropical Mockingbirds are now said to be common throughout the former Canal Zone, and have spread east to Tocumen and Portobelo and west as far as La Chorrera and Boca del Rio in Colón and Panamá Provinces.

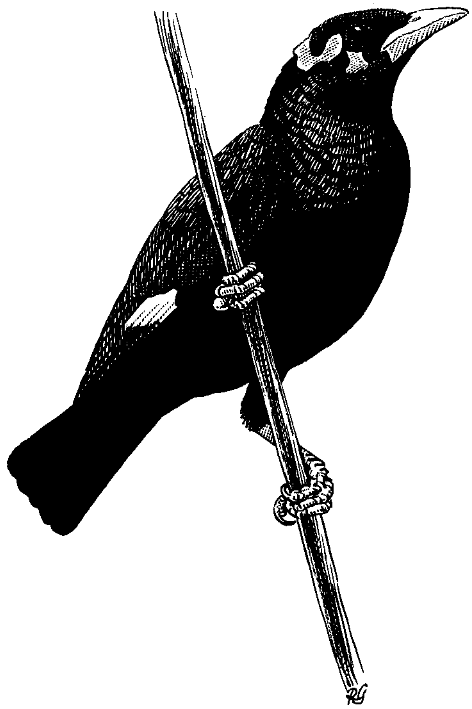
STURNIDAE (STARLINGS)

Hill Myna
Gracula religiosa

Natural Range: India, Sri Lanka, Burma, Thailand, Indochina to S Yunnan and Hainan. Also the Andaman and Nicobar Is, the Malay Peninsula, Sumatra, Borneo, Java, islands off W Sumatra, Palawan, and from Sumbawa to Alor (Lesser Sunda Is.).
Naturalised Range: North America: USA; West Indies. Indian Ocean: ?Christmas Is. Pacific Ocean: ?Hawaiian Is.

United States
In 1972, escaped Hill Mynas, introduced as cage-birds because of their skill at mimicry, became established in a narrow coastal strip of southeastern Florida from Homestead to at least as far north as Boynton Beach – a distance of around 125km – and breeding was confirmed in numerous places in Palm Beach, Broward and Dade Counties (Owre 1973, Blake 1975).

Since then the species' status in Florida has been debatable. O. T. Owre (pers. comm. 1981, 1985) wrote that since his 1973 paper 'Some species are noticeably more abundant, e.g. the Hill Myna [which] remains a common breeding bird throughout urban areas of southeastern Florida', where Troops & Dilley (1986: 140) said that 'Hill Mynas nest



Hill Myna

throughout the suburban area. Found … from Homestead to Palm Beach County. Quite numerous near Matheson Hammock, Fairchild Gardens, University of Miami, and South Bayshore Drive'. Nevertheless, James (1997) included the Hill Myna in his list of introduced species that did not have well-established breeding populations in Florida, a view with which the AOU (1998) concurred. Sibley (2000) said that the small numbers in Florida (and California) may be augmented by frequent escapes.

West Indies

Introduced to Puerto Rico probably in the late 1960s, Hill Mynas of the nominate form are uncommon and very local residents on the north and east coasts (Raffaele *et al.* 1998), from where they are casual vagrants to the islands of Mona and Vieques (AOU 1998).

Christmas Island

Hill Mynas of the nominate Malaysian subspecies were introduced to Christmas Island in about 1923, from where they disappeared within a decade (Chasen 1933). Nevertheless, the AOU (1998) claims they are still established on the island.

Hawaiian Islands

In 1960–61, eight Hill Mynas escaped from a pet shop in Honolulu on Oahu and settled in the Upper Manoa Valley, from where they later spread to Tantalus, Makiki Valley and Kahana Valley, on the northwest coast, where they became established and bred. Pratt *et al.* (1987), who said that a small colony survived in the Lyon Arboretum in Honolulu, and the AOU (1998), do not consider the species to be established.

Crested Myna
Acridotheres cristatellus

Natural Range: S and E China, Indochina, Hainan and Taiwan.
Naturalised Range: Europe: ?Austria. Asia: Japan; ?Malaysia; Philippine Is; UAE. North America: Canada; USA.

Austria

In 1983 a small colony of Crested Mynas of uncertain origin was found living in gardens, parks, orchards and pastures on the Graz-Liebenau housing estate in the outer suburbs of Graz in southeastern Austria. By 1986 the population had risen to 14, including one to three successful breeding pairs (Kresse & Kepka 1988, Sackl 1997).

Japan

Since at least 1978 Crested Mynas have been recorded on Honshu (Tokyo, Kanagawa-ken and Hyogo-ken), Kyushu (Kagoshima-ken and Izumi), and the Senkaku Islands (Iriomote-jima and Yonaguni-jima). A small breeding colony occurs around Tokyo, and birds are regularly seen in the Oi-koen–Haneda area. The population, which is largely descended from released or escaped pets, is augmented by natural vagrants from Taiwan (Brazil 1985, 1991). The OSJ (2000) lists the nominate subspecies from China as a breeding resident in cultivated fields and wooded residential areas in central Honshu (Tokyo, Kanagawa, Osaka, Hyogo).

Malaysia

Since at least 1920 escaped or released Crested Mynas (*A. c. brevipennis* from Hainan and Indochina) have been common and breeding residents in and around Georgetown on Penang Island (Gibson-Hill 1949b). Since 1978 a few have been observed along the Kelang River south of Kuala Lumpur where, however, D. R. Wells (pers. comm. 1986) was uncertain of the birds' status.

Philippine Islands

Between 1849 and 1852 Crested Mynas of the Chinese nominate subspecies were imported to the Philippines to control locusts on the island of Luzon. By 1893–96 the birds had still not spread far outside the capital, Manila (Whitehead 1899), and by 1924 had only managed to colonise a few townships away from Manila (Wood 1924). Du Pont (1971) said the species had spread south to Negros. The AOU (1998) confirms the Crested Myna's survival on Luzon.

United Arab Emirates

Although Richardson (1992) does not include this species in his list of introduced birds in the United Arab Emirates, Sackl (1997) says that a breeding population probably exists there.

Canada; United States

'Little appears to be known', wrote Phillips (1928: 55), 'as to how the [Crested Myna] arrived in Vancouver [British Columbia]; the introduction dates from about 1894 and may or may not have been accidental. It is supposed that birds escaped from some ship touching at this port …'. The species' presence was first confirmed in Vancouver in 1897 by Brooks & Swarth (1925). Soon after 1904 a small number crossed the Strait of Georgia to Vancouver Island, while occasional individuals were recorded in Washington and Oregon in the United States. By 1921, *A. cristatellus* had become the dominant terrestrial species in the city of Vancouver, and had expanded its range over an area of some 1,035 sq km including North Vancouver, across the Burrard Inlet, on Sea and Lulu Islands in the Fraser River delta, in New Westminster and in Coquitlam in the east and Ladner in the south.

By 1925, when the Vancouver population had risen to between 6,000 and 7,000, the direction of dispersal was mainly to the southeast. Two years later the city population had increased dramatically to around 20,000, and wanderers had dispersed 80km south to Bellingham in Washington, where they later became established at Lake Washington, at Juanita Bay, and near Seattle (Phillips 1928). By 1930 the birds had spread 80km inland from Vancouver as far as Chilliwack.

By the mid-1950s the population had considerably declined, and Crested Mynas were mainly restricted to Vancouver, New Westminster and to Lulu Island, with smaller numbers on Sea Island, Victoria, Nanaimo, Union Bay, Alert Bay and Courtenay on Vancouver Island. By 1959 the total population was estimated at between 2,130 and 2,500, representing a sharp decrease since the mid-1920s. By the mid-1960s the birds were largely confined to Greater Vancouver (MacKay & Hughes 1963), which remains their stronghold today (AOU 1998), where Sibley (2000) says the small population continues to decline. The birds in British Columbia are of the nominate subspecies from China.

Impact: Although Phillips (1928) recorded some damage by Crested Mynas to soft fruits such as cherries, blackberries and apples, in the early years after their establishment in Vancouver, serious depredations were not subsequently reported. The species' failure to become a significant pest has been attributed to competition for nesting sites with the introduced European Starling *Sturnus vulgaris* and a less than optimum climate and habitat that restricts Mynas to a single brood annually (Laycock 1966).

Jungle Myna
Acridotheres fuscus

Natural Range: Pakistan, India, Assam, Burma and the Malay Peninsula.

White-vented Myna
Acridotheres javanicus

Natural Range: Java.
Naturalised Range: Asia: Japan; Malay Peninsula; Singapore; ?Sumatra;. North America: ?West Indies. Indian Ocean: ?Andaman Is. Pacific Ocean: Fiji Is; Western Samoa.

Early records of introductions of these two species are very confused; for a full account see Lever 1987*:* 302–303.

Japan
The OSJ (2000: 287) lists '*Acridotheres fuscus javanicus* … resident on Java' as a breeding species in cultivated fields and parks in central Honshu. Presumably the species is the White-vented Mynah.

Singapore; Malay Peninsula
White-vented Mynas have occurred in Singapore since before 1920 (Chasen 1925). They are now widespread and very common there and have spread south to Tandjungpinang Island and in 1973 north to Johor Baharu on the mainland. D. R. Wells (pers. comm. 1986) says that since then the population has rapidly increased north of the causeway and has spread 120km up the coast from Johor Baharu.

Sumatra
Ripley (1961) says that 'Orange-billed Jungle Mynas (*A. javanicus*)' have been introduced to Sumatra; the species present is in fact the White-vented Myna, and it is probably a natural immigrant from Java.

West Indies
According to the AOU (1998), White-vented Mynahs have been introduced to the Bayamón region of Puerto Rico, where their present status is uncertain (Raffaele 1983). The species is not mentioned by Raffaele *et al.* (1998) so it has presumably died out.

Andaman Islands
Beavan (1867) records that Jungle Mynas (of the nominate subspecies from Pakistan to Burma) were imported from the latter country to Port Blair on South Andaman by Colonel R. C. Tytler soon after the establishment of a penal settlement there in 1858. From there they spread to Ross Island. Their present status in the Andamans is unknown.

Fiji Islands
According to Pernetta & Watling (1978), Jungle Mynas were introduced to Viti Levu in Fiji from India (Lyon-Field (1938) said possibly from Burma) in about 1890 to control Orthoptera (crickets, grasshoppers and locusts) in sugar-cane plantations. Numerous, but only partially successful, attempts were made to transfer large numbers from Viti Levu to Vanua Levu and other neighbouring islands (Lyon-Field 1938). Although Blackburn (1971) said that Jungle Mynas were common only on Viti Levu and Nukulau, Pernetta & Watling (1978) found them to be abundant in suitable habitats on all the main islands except Taveuni. Watling (1982: 106) said that the Jungle Myna in Fiji 'is found only on Viti Levu and its offshore islands and on Vanua Levu – although on the latter island it is very rare. … Jungle Mynahs were introduced to Viti Levu in about 1900, but not until 1938 did they become established on Vanua Levu, where they have not flourished. It was purportedly introduced to control army-worms [noctuid larvae], which can be a pest to many crops'. Pratt *et al.* (1987) say the species remains common in Fiji, where the birds favour man-modified habitats such as gardens, parks and pastures in urban and suburban districts, and lightly wooded areas, though they also frequently venture into denser forests.

Impact: Watling (1975) recorded attacks by Jungle Mynas on the plumules (emergent shoots) of commercially valuable ground-nut (Peanut *Arachis hypogaea*) crops. Competition from *A. fuscus* in Fiji has caused a change in habitat of the endemic race of the Polynesian Starling *Aplonis tabuensis vitiensis*, which now occurs only in forested localities (Pernetta & Watling 1978).

Western Samoa

Jungle Mynas were first recorded in Western Samoa on 'Upolu in 1965 (Green 1965), although both he and Dhondt (1976b), who saw them only around Apia where he reported them to be breeding, apparently misidentified them as Common Mynas *A. tristis* (Gill *et al.* 1993). Watling (1978a) recorded a few small flocks of *A. fuscus* in and near Apia, as did Child (1979). Reed (1980) found considerable numbers of Jungle Mynas on 'Upolu, where they were no longer confined to Apia, and in 1979 Muse & Muse (1982) observed hundreds of birds roosting in Apia and said they were spreading over much of northern 'Upolu. Pratt *et al.* (1987) stated that Jungle Mynas were increasing around Apia. Gill *et al.* (1993) found them over much of 'Upolu with a few also in southeastern Savai'i, where they were first recorded by Beichle (1989). How, why, and from where *A. fuscus* was introduced to Western Samoa is apparently unrecorded (Gill 1999).

Recent Expansion: Rinke (1986) said that Jungle Mynas had recently colonised Niuafo'ou in the Tonga archipelago, apparently without human assistance and probably from Fiji, and expressed concern that they might compete for nest-holes with the Blue-crowned Lorikeet *Vini australis*. Pratt *et al.* (1987) make no mention of the species in Tonga.

Black-winged Myna
Acridotheres melanopterus

Natural Range: Java, Bali, and ?Lombok
Naturalised Range: Asia: ?Singapore.

Asia: Singapore

Since about 1920 escaped Black-winged Mynas have from time to time been observed in Singapore, where successful breeding has occurred. In the mid-1980s a small population became established on St John's Island, 5km south of Singapore, where breeding has been assumed. These birds are believed to have been released by smugglers in an attempt to evade the authorities (C. J. Hails pers. comm. 1985). According to Seng (1997) the species has been recorded from Queenstown, St John's and Kusu Islands, but is now markedly declining.

Pale-bellied Myna
Acridotheres cinereus

Natural Range: Endemic to S Sulawesi.
Naturalised Range: Asia: Sarawak.

Sarawak

Between 1987 and 1994 Pale-bellied Mynas appeared at Kuching in southwestern Sarawak, west of Borneo, where the population is rapidly increasing; the birds probably arrived in Kuching by ship (Gregory-Smith 1997).

Bank Myna
Acridotheres gingianus

Natural Range: Pakistan, India, Nepal and Bangladesh.
Naturalised Range: Asia: Japan; ?Kuwait; ?Oman; ?Saudi Arabia; ?UAE.

Japan

The OSJ (2000) lists the Bank Myna as a breeding resident in cultivated fields and residential areas around Tokyo on Honshu.

United Arab Emirates; Kuwait; Saudi Arabia; Oman

Richardson (1992) records the establishment of small localised populations of Bank Mynas in the UAE; about 100 were reported in Abu Dhabi in 1972–73 with smaller numbers in Dubai in 1975–76; in 1989 the species was noted at al Ain, and in 1991 several flocks of 40 or more were counted at Digdaga, near Ras al Khaimah, providing evidence of further extensions of range (Richardson 1992). Jennings (2004) confirms continued breeding in Abu Dhabi and Dubai, and also lists breeding in Kuwait, Saudi Arabia and at Muscat in Oman.

Common Myna
Acridotheres tristis

Natural Range: From S C Kazakhstan, Turkmenistan and E Iran through mainland S Asia to W Malaya and Indochina. Also Sri Lanka.

Naturalised Range: Europe: ?Italy; Russia; ?Spain. Asia: Bahrain; Brunei; China (Hong Kong); Japan; Kuwait; Oman; Sarawak; Saudi Arabia; Sumatra; UAE. Africa: Botswana; South Africa. North America: USA. Australasia: Australia; New Zealand. Atlantic Ocean: Ascension I.; Canary Is; St Helena I.; Indian Ocean: Agaléga Is; Andaman Is; Comoros Is; Chagos Archipelago; Lakshadweep Is; Madagascar; Maldive Is; Mascarene Is; ?Nicobar Is; Seychelles Is. Pacific Ocean: Fiji Is; French Polynesia (Cook, Tubai, Society, Tuamotu, Marquesas Is.); Hawaiian Is;? ?New Caledonia;? Solomon Is; ?Vanuatu; Western Samoa Is.

All naturalised populations of the Common Myna are believed to be of the nominate subspecies *A. t. tristis,* which includes *A. t. tristoides* (Dickinson 2003). It occurs throughout the range apart from Sri Lanka.

Italy
Biondi *et al.* (1995) and Baccetti *et al.* (1997) indicate that the Common Myna has bred successfully at Castelfusano in coastal Romano, where its present state is uncertain.

Russia
A self-sustaining population of Common Mynas is established around Sochi and Gagra on the Black Sea coast of the Caucasus in southern Russia (Cramp *et al.* 1977–94; Gillings 1997). Although D. R. Wells (pers. comm. to Gillings 1997) suggested a natural origin for these birds, Mauersberger & Möckel (1987) argue that they are more likely to be derived from escaped cage-birds.

Spain
One pair was established on Mallorca in the Balearic Islands between at least 2000 and 2002, and reared four young successfully in 2001 (J. Clavell in Martí & del Moral 2003).

Bahrain
First recorded in 1977, Common Mynas are now well-established in urban areas of Bahrain, where breeding has also occurred at Badan Farm in 1990 and at Meerouge Farm in 1992, and in spring presumed breeding pairs are regularly observed at Busaytin and Arad on Muharraq Island, at Manama, around Bahrain Fort, and at Janabiyah and Hamalah. In winter, flocks assemble mainly at Badan Farm but also at Busaytin, where birds that have been feeding in fields around Dair and Ghalali villages, Muharraq, congregate in roosts (Hirschfeld & King 1992).

Brunei; Sumatra; Sarawak
Hawkins & Safford (in prep.) quote Feare & Craig (1998) as saying that Common Mynas have been introduced to Brunei and Sumatra, while Gregory-Smith (1997) says that between 1987 and 1994 they arrived in Sarawak.

China (Hong Kong)
Common Mynas were first reported in Hong Kong in 1952, when a small breeding population, believed to be derived from escaped cage-birds, became established on the Mong Tseng Peninsula (Webster 1975).

Japan
Eguchi & Amano (1999) list *A. tristis* among those alien species that have established long-term self-sustaining populations in Japan, where the OSJ (2000) describes the nominate subspecies as a breeding resident in cultivated fields and residential areas in central Honshu (Chiba, Kanagawa).

Kuwait; Oman
Common Mynas are listed as also breeding in

Kuwait and at Muscat in Oman by Jennings (2004), who says they are one of the most widespread and successful exotics in Arabia.

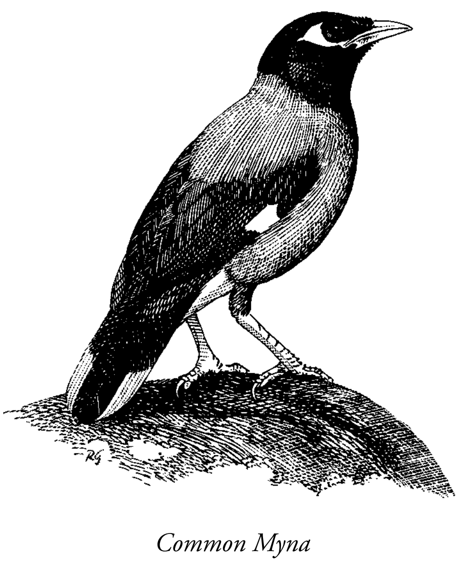
Saudi Arabia

Felemban (1993) said that in the last decade the resident population of Common Mynas had increased steadily around Jeddah, where six pairs were apparently well established on the campus of the King Abdul-Aziz University.

United Arab Emirates

First recorded in 1976 in Dubai and Abu Dhabi, where captive birds were deliberately released (F. E. Warr pers. comm. to Richardson 1992), Common Mynas now flourish in and around urban areas and are spreading annually to fresh localities (Richardson 1992). According to Gallagher & Woodcock (1980), the species was said to be then established at Al Ain. Up to 1,000 birds assemble at dusk to roost at sites in Dubai and Abu Dhabi. Common Mynas are said to be benefiting from the increase in grassland and agricultural plots (Richardson 1992).

Impact: According to Richardson (1992), *A. tristis* may be displacing native Laughing Doves *Streptopelia senegalensis* in some urban localities.



Common Myna

Botswana

Common Mynas were first introduced in Botswana in the grounds of the Grand Palm Hotel in the capital, Gabaronne, in 2001. Since the initial sightings there have been many more in the same area, from where the birds seem to be spreading and are rapidly increasing in numbers (Tyler 2001).

Impact: Tyler (2001) expressed concern that Common Mynas will have a negative impact on such native hole-nesting species as barbets (Ramphastidae: Lybiinae).

South Africa

Common Mynas imported from Mauritius, to which they are believed to have been introduced in 1762 to control injurious insects, were first introduced to South Africa, at Durban, by Leon St Guillaume in 1888. A second introduction, probably from India, occurred around 1900 (Kent 1927) or in 1902 (Van Nierop 1958). By the 1950s they had colonised most of KwaZulu-Natal (Craig 1997) and had spread to Johannesburg, Bramley (around 1938), Germiston, Pretoria and the Witwatersrand in the Transval; to the Orange Free State (Calder 1953); and to Cape Province, where they first appeared at Kimberley in 1964. The species is now naturalised throughout Natal and the Witwatersrand and in parts of the Transvaal Highveld, and has spread down the coast through Cape Province (Maclean 1993, Richardson *et al.* 2000).

If Brooke *et al.* (1986) are correct in suggesting that Mynas may not be pre-adapted to cooler regions, they may well have reached their southern distributional limits in the South African interior; any increase in temperature, however, could alter the southern limits of the species' distribution southwards and into the arid and semi-arid South African interior (Richardson *et al.* 2000). Warmer temperatures and mild winters have allowed Mynas to spread along the coast from Durban to Port Elizabeth and Cape Town (Craig 1997), though Richardson *et al.* (2000) believed that breeding populations were not yet established. The species' apparent inability to colonise parts of KwaZulu-Natal and the moist savanna of the north (Craig 1997) could be due to unsuitable patterns of human land-use (Richardson *et al.* 2000). Since Mynas occur principally in areas with an average annual rainfall of over 600mm they may be restricted to wetter localities (Richardson *et al.* 2000). Although largely commensals of man and frequently nesting on buildings and other man-made structures, Mynas are adaptable in the choice of nest-sites and also breed in tree-holes (Richardson *et al.* 2000).

Impact: 'The ecological effect of mynahs is mainly to chase other bird species away. They are very aggressive when breeding and will not tolerate smaller birds in their territory, apart from being omnivorous and usurping the niches of others' (J. Vincent pers. comm. 1985).

In some localities Common Mynas have been accused of causing damage to soft-fruit crops. In warm weather their nests can become infested with mallophagan bird lice (Kent 1927) and *Sarcoptes* itchmites that can cause severe dermatitis in humans (Liversidge 1975).

United States

The Common Myna was first recorded in Miami, Florida, in 1983, and by the middle of the decade it was said by Troops & Dilley (1986) to be rapidly increasing in numbers and to have spread from downtown Miami to Palm Beach, the Everglades and the Gulf Coast. By the late 1980s breeding had been reported in Cocoa Beach and Broward County (Stevenson & Anderson 1994). It has been increasing in numbers around shopping centres and malls in southern Florida since the early 1990s (Robertson & Woolfenden 1992), and Stevenson & Anderson recorded breeding in five counties. James (1997) considered it was soon likely to be well-established in Florida. Stevenson & Anderson (1994), the AOU (1998) and Sibley (2000) say the population is still increasing and expanding.

Impact: According to Troops & Dilley (1986), Common Mynas in southern Florida are known to compete successfully for nest-sites with native Purple Martins *Progne subis subis.*

Australia

Between 1862 and 1872 over 320 Common Mynas were released at various places in Victoria (Ryan 1906). In New South Wales, Mynas are believed to have been introduced to Sydney at around the same time as in Victoria. In or about 1883 Mynas from Melbourne, Victoria, were taken to northern Queensland to control locusts and beetles (*Lepidoderma* (*Dermolepida*) *albohirtum* and *Lepidiota frenchi*) in sugar-cane plantations. They were released at Townsville and on the Herbert and Johnstone Rivers, from where they soon succeeded in colonising other local townships but failed to control the insects, thus leading to the introduction in 1935 of the Cane Toad *Bufo marinus* (Lever 2001). In 1980 more were freed at Cairns and Toowoomba in the Darling Downs, and around 1920 the Hon A. J. Thynne released others around Biddeston (Tarr 1950).

Common Mynas were liberated, apparently without success, near Hobart, Tasmania, in the early 1900s, but after 1914 they are believed to have arrived naturally from Victoria. Mynas were not recorded in South Australia, around Adelaide, until 1957 (Condon 1962).

In New South Wales, Common Mynas had reached Ryde by about 1884 and were common in the suburbs of Sydney by 1896, but did not start to spread outside the city until the late 1930s or early 1940s. A decade later they were established and common south of Sydney Harbour, and were recorded north of the Parramatta (Tarr 1950). They were observed in the Thirroul area in 1960, were breeding at Woolongong in the following year, and by 1963 were well established at Lane Cove and North Ryde. By the middle of the following decade Mynas were firmly entrenched along the 75km of coast between Sydney and Woolongong, and had been seen inland at Marulan and Marrangaroo and north at Tweed Heads. Hone (1978) reported Mynas to be widely distributed in urban habitats in eastern New South Wales, with separate populations based on Sydney, Canberra (where some had been introduced in the late 1960s), Newcastle and in the northeast.

In the past century, Sydney and its human population have expanded greatly, thus providing the commensal Myna with a corresponding increase in suitable habitat. An important factor in the species' dispersal has been the growth in road and rail transport that has provided 'corridors' to new localities (Hone 1978).

In Victoria, Mynas had colonised Melbourne and some of the larger nearby towns by around 1900, but away from these localities spread only slowly. In Queensland, the birds were recorded in the Atherton shire in 1931, were established and common in sugar-cane plantations and at Cairns by the mid-1940s (when some were seen for the first time in the southeast) and in Townsville by the early 1960s (Lavery & Hopkins 1963).

Frith (1979) described Mynas as firmly established in urban areas of southeastern Victoria, in Sydney, New South Wales and in northern Queensland from Cairns to Townsville. By the following decade, Common Mynas were well-established in coastal northern Queensland from the Mossman–Atherton tablelands south to MacKay, and in the southeast from the Darling Downs to Brisbane; in coastal northeastern New South Wales, in the Newcastle/Sydney/Illawarra area inland to at least the Blue Mountains Plateau; and since the late 1960s in the Australian Capital Territory, where 110 were released in the Canberra suburb of Forrest in 1968–71 (Phillips 1994). Mynas also became well-established in Victoria, where they dispersed from Melbourne eastwards to Orbost, west to Geelong and Ballarat, through central Victoria, and to the Murray Valley between Cobden and Swan Hill (Pizzey 1980, Blakers *et al.* 1984). In the early 1990s, Mynas colonised the large country town of Blairnsdale in East Gippsland, Victoria (Phillips 1994). In Tasmania, Mynas were recorded near Launceston in 1967, and a small colony may persist in South Australia in northern Adelaide. The map in Barrett *et al.* (2003) shows little overall change in the species' range, but an absence from Tasmania.

Impact: In Queensland, damage by Mynas to some soft-fruit crops such as figs has been reported, and their habit of nesting in holes and crevices in buildings can make them a nuisance locally.

Because of the disturbed habitat they frequent, Mynas in Australia do not often come into conflict with native species which tend to prefer undisturbed habitats, but compete for food and nesting-sites with introduced European Starlings *Sturnus vulgaris*, House Sparrows *Passer domesticus* and Feral Pigeons *Columba livia*, which similarly favour urban habitats as commensals of man and may have contributed to the Myna's relatively slow rate of dispersal. Where Mynas do live alongside native species (on the border between urban and rural areas) such as rosellas *Platycercus* spp., lorikeets (Loriinae) and Laughing Kookaburras *Dacelo novaeguineae* (which are not only larger than Mynas but also equally aggressive), the Mynas kill the natives' nestlings and evict the adults from their nests (Phillips 1994).

New Zealand

Between 1870 and 1877 well over 90 Common Mynas were released in Canterbury and Otago on South Island and in Wellington and Hawke's Bay on North Island, but only those on the latter met with lasting success. By 1890 they were said to be abundant around Napier in Hawke's Bay, when they began also to increase on Tutira. In 1912 they were reported to be fairly plentiful in Tuparoa. Although not common around Wellington they had spread up the coast to Wanganui and New Plymouth, throughout Taranaki and eastwards to Wairarapa (Thomson 1922).

Probably in part due to competition with the also introduced European Starling *Sturnus vulgaris*, Common Mynas seem initially to have spread only slowly in New Zealand. By the 1930s they occurred in two discrete sub-populations – one in the east from Waipukurau to East Cape and the other in the west from Wanganui to the Waikato. From about 1940 they spread more rapidly and colonised the Volcanic Plateau and Auckland by about 1947, when they were still confined to only five towns in the Wairarapa; they were abundant in Hawke's Bay, and uncommon in the Manawatu south of Wanganui. Common

Mynas reached Tauranga and the Rotorua around 1950, the Bay of Islands about 1960 and Kaitaia in 1965 (Heather & Robertson 1997). Wodzicki (1965) described them as widespread and abundant in the northern half of North Island to Doubtless Bay. Kinsky (1970) found Mynas to be well-established north of about 40°S. South of Wanganui and Waipukurau Mynas were, and still are, local and rare, and in South Island they appeared only as occasional vagrants. Falla *et al.* (1979) said that Mynas were established over much of North Island, especially in the north, and were increasing on Volcanic Plateau. Heather & Robertson (1997) recorded Mynas as locally abundant in farmland, orchards and suburban gardens in northern North Island, but said that the species' southerly limit is shifting slowly northwards; they also reported that Mynas had succeeded in colonising some offshore islands such as Poor Knights, Waiheke, Kawau and Great Barrier. They seldom venture far into forests, but can be common on the forest ecotone.

Impact: Common Mynas in New Zealand prey on the eggs and nestlings of introduced Feral Pigeons *Columba livia*, native Silver Gulls *Larus novaehollandiae scopulinus* and Kelp Gulls *Larus d. dominicanus*, and also on those of small native and introduced passerines, with some of which (e.g. House Sparrows *Passer domesticus*, European Starlings *Sturnus vulgaris* and Blackbirds *Turdus merula*) they also compete for food and nesting-sites (Oliver 1955, Wodzicki 1965). Mynas have been accused of damaging fruit crops such as apricots, apples, pears, strawberries and gooseberries. In compensation, they destroy numerous injurious pests, including sheep and cattle ticks.

Ascension Island

Common Mynas were imported to control insects on Ascension in about 1815, where Stonehouse (1962) records the presence of a population in the late 1950s of some 400 individuals. Rowlands *et al.* (1998) say the species remains ubiquitous on the island. See also McCulloch 2004.

Impact: On Ascension Island Common Mynas prey on the eggs and nestlings of Sooty Terns *Sterna fuscata* (Stonehouse 1960).

Canary Islands

In spite of attempts at eradication, Common Myna have bred successfully on Tenerife since 1993 (J. Clavell in Martí & del Moral 2003).

St Helena Island

Common Mynas are believed to have been first imported to St Helena in 1815 to control cattle ticks (Gosse 1938). Brooke *et al.* (1995) and Lockwood *et al.* (1996) incorrectly say the first introduction took place in 1820, and that no introductions after 1850 were successful. Although the descendants of these birds survived until at least the 1860s (Baker 1868), the present population seems to be descended from only five birds released at the Briars by Phoebe M. Moss in 1885 (Gosse 1938). The species quickly became established and, with a population of several thousand, is now the most abundant and widely distributed land bird on St Helena (Rowlands *et al.* 1998). It has also occurred on some offlying islands. See also McCulloch 2004.

Impact: Common Mynas compete for food with, and also prey on, the eggs and young of the endemic St Helena Plover *Charadrius sanctaehelenae* (Rowlands *et al.* 1998), (classified as Endangered by the World Conservation Union) and other small birds, and are implicated in the spread of such alien vegetation as *Lantana camara* and *Juniperus bermudiana* (Cronk 1989). They also cause a considerable amount of damage in orchards (Haydock 1954). See also Lockwood *et al.* (1996).

Agaléga Islands

Sometime before 1871 – possibly by Auguste Le Duc between 1827 and 1830 – Common Mynas from Mauritius were imported to control insects and scorpions in the Agalégas (Guého & Staub 1983). Although the population suffered a sharp decline in 1912, probably as a result of a severe cyclone in the previous year, Cheke & Lawley (1983) found

Mynas still to be abundant on both Agaléga Islands in 1974–78.

Andaman Islands; Nicobar Islands

According to Beaven (1867), Common Mynas were introduced as scavengers to Port Blair on South Andaman by Colonel R. C. Tytler shortly after the establishment of a convict settlement on the island in 1858. Palmer (1899) indicates that the introduction took place before 1873. Wood (1924) says they were released around 1880 on Ross Island, where according to Hume (1873) they had greatly increased. By the turn of the century they had flown to South Andaman, where they became one of the commonest terrestrial species (Abdulali 1964). They were said by Butler (1899) to be common on Nancowry and Camorta Islands in the neighbouring Nicobars, but were not found there by Abdulali (1967).

Chagos Archipelago

Common Mynas that had escaped or been released from captivity were established in considerable numbers on Egmont Atoll in 1905, from where by 1953 they had spread to Diego Garcia. In 1954 or 1955 a shipment of a dozen birds from Agaléga was released on Diego Garcia, where a decade later *A. tristis* was one of the commonest land-birds on the island, and flocks of 40–60 were frequently reported (Loustau-Lalanne 1962, Bourne 1971, Hutson 1975).

Comoros Islands

Common Mynas are believed to have been first introduced to the island of Anjouan before 1906; Benson (1960) found the species to be established and common on Grande Comore, Mohéli, Mayotte and Anjouan. Louette (2004) reported Mynas to occur throughout all four islands except above 700–800m on Mont Karthala on Grande Comore (though they existed at 1,100m on La Grille) and above 1,100m on Anjouan.

Lakshadweep (Laccadive) Islands; Maldive Islands

Ali & Ripley (1968–74) believed that Common Mynas probably occur in the Lakshadweep and Maldive archipelagos as a result of human agency, where on some islands they are abundant. Their alien status is confirmed by Feare & Craig (1998).

Madagascar

On at least two occasions Common Mynas have been imported to control grasshoppers (Acrididae) and other insects on Madagascar – first in the late eighteenth century and again in 1875 on the east coast at Tamatave (Toamasina) by the then French Consul, Alfred Grandidier. Milon *et al.* (1973) quoted Grandidier as saying that by 1879 Mynas were abundant around Tamatave.

By 1930, Mynas were well established and plentiful between Tamatave and Brickville, and had been recorded as far north as Maroantsetra and Fénérive. By 1948 they had spread inland towards Tananarive (Antananarivo) (Milon *et al.* 1973) as far as Rogez and Mouneyres, and four years later had colonised Vatomandry, Mananjary, Manakara and Vohipeno on the coast south of Tamatave, as well as much of the intervening country. By the early 1970s Mynas were established and common in the south at Farafangana on the east coast and inland towards Ihosy. In 1957–58 several pairs were released at Ambanja in the extreme northwest, and more recently some were transferred to the nearby island of Nossi Bé (Rand 1936, Van Someren 1947) and Ile Sainte Marie off the south coast of Madagascar (Goodman 1993). On the Madagascar mainland, Common Mynahs are widespread in and around human habitation on the central plateau, and are increasing their range in the northwest, north, east and south, from sea level to 1,600m (Morris & Hawkins 1998, Hawkins & Safford in prep.).

Impact: Maillard (1862) said that Mynas were found to be eating few of the insects they had been imported to control, but had themselves become a pest in the orchards they had been introduced to protect. Nevertheless, the species' spread on Madagascar has been helped by translocations, ostensibly for insect control, and by the further release or escape of cage-birds.

Mascarene Islands

Cheke (1987), from whom much of the following account is derived, has traced the introduction of the Common Myna to the Mascarenes. (For further details and full list of references see Cheke 1987).

The earliest introduction of *A. tristis* to Réunion took place between 1755 and 1759, but the birds were subsequently eradicated because they were believed to eat sown grain. The governor, who had arranged the original importation to Réunion, obtained replacements from Tranquebar in Madras which were apparently introduced to both Réunion and Mauritius in 1762. This more or less coincides with a statement made in 1773 that the birds had greatly increased on Mauritius since their arrival some eight to nine years earlier (i.e. around 1764–65), and Bernardin de St Pierre (1773) reported Mynas to be abundant in Mauritius by 1768–69. Cheke (1987) believed that the 1762 introduction was the first made to Mauritius.

The exact date of the introduction of Common Mynas to Rodrigues is apparently unrecorded, but according to Slater (1875) they had been present on the island for several years before 1874, following a number of failed introductions.

A. tristis has remained abundant on Mauritius, Réunion and Rodrigues since its introduction (Staub 1976, Cheke 1987, Simberloff 1992, Brooke *et al.* 1995, Moulton *et al.* 1996, Showler 2002, R. J. Safford pers. comm. 2004, Hawkins & Safford in prep.). It also occurs on the larger islets (Bell *et al.* 1994).

Impact: The introduction of Common Mynas to the Mascarenes was one of the earliest recorded attempts at the biological control of an insect pest. Since 1729, when Red Locusts *Nomadacris septemfasciata* had been (presumably accidentally) introduced from Madagascar, the islands' crops had suffered heavy depredation. The disappearance of locusts around 1770 has been attributed to predation by Mynas, but manual destruction of the pests by slaves may have made a substantial contribution (Cheke 1987). Mynas in the Mascarenes have also been accused of causing damage to the crops they were imported to protect.

On Mauritius, Common Mynas are said to compete for nesting-sites with the Mauritius Parakeet *Psittacula echo*, classified as Critically Endangered by the World Conservation Union. Temple (1974) believed that competition for food with Common Mynas (and Red-whiskered Bulbuls *Pycnonotus jocosus*) was a major threat to the survival on Mauritius of the endemic subspecies of the Olivaceous Bulbul *Hypsipetes borbonicus olivaceus* (classified as Vulnerable by the World Conservation Union), and Jones (1996) considered that competition with the two aliens was preventing *H. b. olivaceus* and the Mauritius Cuckoo-shrike *Coracina typica* (also classified as Vulnerable) from spreading outside native forest; Mynas eat large insects and geckos (Gekkonidae) that are the main foods of *C. typica* (Cheke 1987, Jones 1996). On Réunion, Barré and Barau (1982) considered that Mynas (and Bulbuls) were competitors with, and predators of, *H. b. borbonicus.*

Seychelles Islands

Common Mynas were probably first introduced to Mahé from Mauritius shortly after 1762 by the governor, Count Mahé de la Bourdonnais, to control insect pests and/or as pets soon after the islands were first colonised. Newton (1867) found Mynas to be the most abundant bird on Mahé, and they remain today the commonest species there and in the lowlands and lower hills on all the main granitic islands except Aride (Hawkins & Safford in prep.) and on Bird and Dennis Islands (Skerrett *et al.* 2001).

Impact: Newton (1867) believed that competition for nesting-sites between Mynas and the endemic Seychelles Magpie Robin *Copsychus sechellarum* (now classified as Critically Endangered by the World Conservation Union) was responsible for the decline of the native species, a belief also held by Gillings (1997). It has, however, been suggested that predation by the skink *Mabuya wrightii* may be a contributory factor in the Magpie Robin's decline. Some predation of the eggs and nestlings of White Terns *Gygis alba* has also been recorded. Numbers of Mynas on Frégate have been considerably reduced to protect the Magpie Robin (Skerrett *et al.* 2001).

Fiji Islands

Although Wood & Wetmore (1926) suggest that Common Mynas may have been introduced to Fiji as early as 1876, most authorities consider they were probably first imported (with the Jungle Myna *A. fuscus*) from India between 1890 and 1900 to control Orthoptera in sugar-cane plantations. Their dispersal to other islands was probably assisted by the East Indian human population, who on their inter-island travels carried pet Mynas with them in cages from which some inevitably escaped or were released. Thus by the 1920s, *A. tristis* was abundant on several of the inhabited islands, and although many died on Viti Levu during a severe hurricane in 1931, within 20 years they had recovered to its former numbers. Pernetta & Watling (1978) found Common Mynas to be established as commensals of man in disturbed habitats on the main islands and on some of those close offshore, as well as on Vatulele and Lakeba. Pratt *et al.* (1987) referred to them only on Viti Levu and Taveuni.

Impact: In controlling Orthoptera, Mynas proved not very effective (Stoner 1923), preferring instead to eat the emergent stems of commercially valuable ground nuts (peanuts *Arachis hypogaea*), and sometimes to prey on the eggs and young of terns *Sterna* spp. and noddies *Anous* spp. On the other hand, the disappearance of some native birds from man-modified habitats, which has been attributed to aggression from Mynas and other introduced species, is more likely to be due to the natives' inability to adapt to disturbed habitats (Watling 1982).

French Polynesia (Cook, Tubuai, Society, Tuamotu, and Marquesas Islands)

Table 13 gives details of early records of Common Mynas in Polynesia. In Polynesia, *A. tristis* colonised some islands very rapidly, but a sea crossing of only a few kilometres can be enough to hinder their progress. They live near human settlements, in coconut groves, in plantations, and on the ecotone of secondary forests. They prefer open habitats and are less often found in dense woodland, and seldom ascend above 500–700m.

Impact: Introduced to control injurious insects in plantations, Mynas also remove biting parasites, especially ticks, from the backs of cattle, but also cause damage to cultivated fruits (Holyoak 1974).

Through their aggressive nature, competition for food and nesting sites, and the dissemination of avian malaria, Common Mynas have contributed to the decline of a variety of native bird species, especially such hole-nesters as lories (*Vini* spp.) and kingfishers (*Halcyon* spp.). By robbing their nests, Mynas may have been at least partially responsible for the extinction on Hiva Oa of the Red-moustached Fruit Dove *Ptilinopus mercierii tristrami*, and of the decline of the Long-billed Reed Warbler *Acrocephalus caffer mendanae* in the Marquesas, *A. c. caffer* on Tahiti, and the possible extinction of *A. c. longirostris* on Moorea (Holyoak & Thibault 1984). Through their aggressive behaviour Common Mynas have had a negative impact on the Tahitian Monarch *Pomarea nigra*. Both *A. c. caffer* and *P. nigra* on Tahiti are classified respectively as Vulnerable and Critically Endangered by the World Conservation Union.

Hawaiian Islands

According to Caum (1933: 25), the Common Myna was 'introduced from India in 1865 by Dr William Hillebrand to combat the plague of army worms [Noctuidae] that was ravaging the pasture lands of the islands. It has spread and multiplied to an amazing extent … it is now extremely common throughout the Territory'. It was introduced to (or colonised naturally) the other main islands around 1883.

Common Mynas were first recorded on Niihau in the 1870s, and on Kure and Midway in 1974; on the latter the population had increased to several hundred by 1980. All subsequent authorities, including the AOU (1998), confirm the species' near-ubiquity in suitable habitats (i.e. not in closed canopy forests) in the archipelago.

Impact: Common Mynas apparently became established in montane forests in the 1890s (Bryan & Seale 1901, Perkins 1903), but this occupation seems to have been of short duration (Bryan 1940). Although during their time in the high-elevation forest Mynas may have competed for nesting-sites with the Hawaii O-o *Moho nobilis*, Kauai O-o *M. braccatus*, and other hole-nesting species that began to decline at this time (Scott *et al.* 1986), their temporary tenure of this habitat lends credence to the belief (e.g. by Caum 1933, Munro 1944, Berger 1981) that Mynas played little if any part in the decline of native birds around the turn of the twentieth century. More recently, Byrd (1979) indicated that Common Mynas may be significant predators of the eggs of Wedge-tailed Shearwaters *Puffinus pacificus*.

In 1858 the ornamental plant Lantana *Lantana camara* was introduced to Hawaii from Mexico, and before long was being widely disseminated by Mynas (and alien Spotted-necked Doves *Streptopelia chinensis*) which avidly consumed its berries, which were ignored by native species (Fisher 1948). Elton (1927) traced an interesting sequence of events that followed. In an attempt to control *Lantana* several species of insect were imported to Hawaii, to such good effect that the exotic plant noticeably declined. This led to a corresponding decrease in the population of Mynas, which had become largely dependent on *Lantana* berries, thus enabling the recovery of the noctuids that Mynas had been

TABLE 13 Early records of the Common Myna *Acridotheres tristis* in Polynesia.

Island	*Date*	*Remarks*
Aitutaki	1973	Well distributed.
Manuae & Auotu	1973	Fairly common.
Atiu	1973	Well distributed.
Mauke	1973	Abundant near human habitation and in settlements.
Rarotonga	1905–1920	Introduced from Tahiti between 1905 and 1920, in 1922 said to be abundant; in 1973 commonest coastal bird.
Mangaia	1952–54	Very common by 1973.
Palmyra	1940s	12 released; apparently died out.
Rurutu	1921	A few seen.
Tubuai	1921	Fairly common near human settlements; in 1974 plentiful on the coast and on inland grasslands.
Bellingshausen	? 1970s	—
Scilly	1973	Not recorded by Whitney expedition in 1921. In 1973 occurred in limited numbers near settlements.
Mopelia	1973	Not recorded by Whitney expedition in 1921. In 1973 found in small numbers near settlements on main islet.
Raiatea & Tahaa	1972–73	Not found by Whitney expedition in 1921. In 1972–73 very common.
Huahine	1972–73	Not found by the Whitney expedition. In 1972–73 seen frequently.
Moorea	Early 20th century	Found to be common by Whitney expedition in 1921. Either introduced or natural colonist from Tahiti.
Tahiti	1908–1915	Well distributed by time of Whitney expedition in 1921; between 1971 and 1975 found at lower elevations and on coast.
Hao & Mururoa	*c.* 1971	Present in small numbers.
Nuku Hiva	*c.* 1971	Killed shortly afterwards.
Hiva Oa	*c.* 1918	Six introduced; within three years had multiplied to *c.* 1,000. Very common in coastal areas and occurs in lesser numbers at higher elevations.

Source: Holyoak & Thibault 1984. See also e.g. Holyoak 1974.

introduced to control. It was then discovered that *Lantana* was being replaced by other exotic shrubs that proved more difficult to control.

Mynas in the Hawaiian Islands are hosts of bird mites and harbour a parasitic ocular nematode (*Oxyspirura mansoni*) which is also present in some other alien species, and the malarial parasite *Plasmodium circumflexum* (Alicata 1969).

Mynas also feed extensively on such cultivated fruit as avocados, papayas, mangoes, guavas and especially figs.

New Caledonia

Delacour (1966) said that introduced Mynas were common in villages, gardens and cultivated land in New Caledonia, where their current status is unknown.

Solomon Islands

Common Mynas were successfully introduced to Guadalcanal, Russell, and the Olu Malau (Three Sisters) islands in the southeastern Solomons (Cain & Galbraith 1956, French 1957, Galbraith & Galbraith 1962, Long 1981). Their present status on the islands is uncertain.

Vanuatu

According to Mayr (1945), *A. tristis* is believed to have been introduced successfully to some islands in the New Hebrides (Vanuatu).

Western Samoa Islands

Beichle (1989) reported the discovery of at least 24 Common Mynas in Apia, the capital of 'Upolu, in 1988, when nest building was observed. This was the first record of the species for Western Samoa. Gill *et al.* (1993) found that Mynas had spread from central Apia as far west as Vaitele, east to Fagali'i airstrip, and from the end of Mulinu'u Point in the north, south to the hospital at Moto'otua. Censuses of mynas on 'Upolu revealed that 15% were *A. tristis*, with the remainder being *fuscus*. Six years later, in 1998, Gill (1999) found the proportion between the two species had dramatically altered, with 71% of those counted being *tristis*. One flock numbered 66 individuals. Whether the absolute numbers of *fuscus* have declined was not determined.

European Starling
Sturnus vulgaris

Natural Range: Much of the Palaearctic region, from the British Isles eastwards to W Mongolia and W Xinjiang, N to northern Scandinavia and S to CS Europe. Winters S to N Africa, the Middle East, S Asia, Nepal and N India.

Naturalised Range: Africa: South Africa. North America: Canada; Mexico; USA; West Indies. Australasia: Australia; New Zealand. Pacific Ocean: Fiji Is; Lord Howe I.; Macquarie I.; Norfolk I.; Tonga Is; ?Vanuatu.

South Africa

Cecil John Rhodes, the former Prime Minister, imported the first Starlings from England to Table Bay Harbour in April 1897. They were probably released at Groote Schuur in Rondebosch (R. K. Brooke pers. comm. 1985). Within a few years they were well established on the inhabited slopes of Table Mountain, and had been reported on the interior side of the Cape Flats in Stellenbosch. By at least 1905 they had spread to Wynberg, some 16km from Cape Town, and by 1910 had expanded eastwards across the Cape Flats to Gordon's Bay at the foot of the Hottentot's Holland Mountains. By 1949, large flocks occurred on the Cape Flats and elsewhere in the South West Cape (Winterbottom & Liversidge 1954).

Starlings also expanded northwards through the Swartland, reaching Darling around the turn of the twentieth century and Velddrift, at the mouth of the Berg River, between 1926 and 1928. Winterbottom & Liversidge (1954) recorded their then most northerly locality as Kleinvlei, 19km north of Clanwilliam, where they arrived in 1952.

By the early 1950s, Starlings were thus established in the South West Cape along the coast from Graafwater and Clanwilliam south and east to Plettenberg Bay, inland to a line running through Citrusdal, the southern border of the Cold Bokkeveld, Orchard (near De Doorns), Robertson, Montagu, Barrydale, Ladismith and the Outeniqua Mountains (Winterbottom & Liversidge 1954). This area is almost exclusively below the 600m contour and had a fairly dense European human population.

From the South West Cape Starlings began to spread slowly into the Eastern Cape, where they were first confirmed as breeding, in Uniondale, in 1954 or 1955. By around 1960, Starlings were established and breeding in Humansdorp and Port Elizabeth and in the residential suburbs of Walmer, Skoenamakers Kop, Swartkops and Redhouse. They were first noted at East London in 1966, at Gonubie Mouth and Keisammahoek in 1969, and at Kei Mouth and Seymour in 1970. 'From Cape Town', wrote Winterbottom (1978: 975), 'the Starling … has penetrated a considerable distance northward into the Karoo, even to the Orange River at its mouth. However, its establishment in the Karoo seems rather insecure and it is liable to retreat thence during a drought'. Maclean (1993) described Starlings as occurring throughout much of the Cape, in the Karoo, and in southern Natal as far as Durban. The species has also become common in the southern Orange Free State (Richardson 1992), and occurs at Alexander Bay (Frauenknecht 1998).

Although Starlings appear to be non-migratory in the Western Cape, there is evidence of some seasonal movement in the Eastern Cape. Colonisation of new areas in South Africa was not, as is usual with most other species, by mass emigration due to over-population, but rather by the arrival of a single pair that bred and then departed, followed later by the appearance of several pairs that nested at the same site; thereafter there was a simple increase in the colony proportionate to the rate of successful breeding. Colonisation has tended to be by 'leap-frogging' rather than from one township to another, with intervening areas being occupied later. Although initially slow to spread, and almost exclusively an urban species, Starlings have moved into the interior and occur throughout the Cape in areas of intensive cultivation and in villages and towns. 'No factor other than the occupation of human habitation', wrote Liversidge (1962: 15), 'is evident in the spread of the species', whose population is estimated to number several million (Richardson 1992; see also Richardson *et al.* 2000).

Richardson (1992) considered that the Starling's 'phenomenal performance' as a colonist can be attributed to a number of factors, including its pre-adaptability to living as a commensal of man; its catholic feeding habits; its reproductive strategies; and its genetic constitution. Nevertheless, the species is not preadapted to the warmer parts of southern Africa, where it is unlikely to expand its current range which is virtually restricted to the western and eastern Cape (Craig 1997). The species is, however, well adapted to cooler temperatures, and may thus be able to colonise new regions at higher elevations (Richardson *et al.* 2000). Starlings appear to be sensitive to drought conditions, and an alteration in rainfall patterns could change local movements and habitat usage (Craig 1997, Richardson *et al.* 2000).

Impact: In orchards near the Hottentot's Holland Mountains some damage to soft-fruit crops by Starlings has been reported, but in compensation various injurious insects are also eaten. Although Starlings have nowhere invaded pristine (undisturbed) habitats, they out-compete such native hole-nesting species as woodpeckers (Picidae) and barbets (Ramphastidae: Lybiinae) for breeding sites (Richardson 1992). That they have not had a more significant impact in South Africa is because they do not yet occur in the vast murmurations that are prevalent in their natural range (Oatley 2001).

United States; Canada; Mexico

As early as 1844 (Laycock 1966) and again in 1872–73, 1877, 1889 and 1892, unsuccessful attempts were made to introduce European Starlings to the United States.

The earliest successful introduction was made by an eccentric drug manufacturer, Eugene Schieffelin, who conceived the bizarre idea of introducing to the United States all the bird species mentioned in Shakespeare. Accordingly, in 1890–91 he acquired 80 pairs of European Starlings from England, which were liberated in Central Park, New York (Phillips 1928): other sources say that 60 pairs, 60 individuals or 20 individuals were released. Breeding began almost immediately, and by 1893–94 flocks up to 50 strong were being reported. By the following year Starlings had become common in many parts of New York City and had spread to Long Island, where three years later they were said to be abundant.

In 1897, further unsuccessful attempts were made to introduce Starlings to Massachusetts, Pennsylvania, New York and possibly elsewhere. The birds in Central Park, however, continued to thrive, although initially they increased and spread only slowly, dispersing no more than 40km in their first decade. Thereafter they expanded their range explosively, and by 1908 had colonised parts of Connecticut, New Jersey and southeastern Pennsylvania. By 1916 they had appeared in Ohio and in the following year in Georgia. Their rate of expansion then declined, following heavy mortality in the severe winter of 1917–18, and by around 1920 the population appeared to have stabilised (Phillips 1928). According to Kessell (1953) Starlings first reached Alabama in 1918, Kentucky in 1919, Louisiana in 1921, Illinois and South Carolina in 1925, Texas in 1926, Oklahoma in 1929, northern Mississippi and Iowa in 1930, Minnesota in 1932, Arkansas and South Dakota in 1933, Missouri in 1934, Nebraska and Wyoming in 1937; New Mexico, Colorado and Nevada in 1938; North Dakota, Montana and Utah in 1939, Idaho in 1941, California in 1942, Oregon and Washington in 1943, Arizona in 1946 and Alaska in 1952.

The method of dispersal of Starlings in the United States was much as in South Africa (see above). By 1938 they had spread to 103°W and were breeding as far west as the Mississippi and probably eastern Texas. Cooke & Knappen (1941) recorded Starlings as breeding as far south as northern Florida, as far north as the St Lawrence River in Canada, east to eastern Anticosti Island, Quebec, and west to eastern South Dakota, Nebraska and Kansas. Wing (1943) estimated that Starlings occupied some seven million sq km and numbered up to 50 million; half a century later this figure had risen to a figure given by Richardson (1992) as 200 billion [*sic*] (?200 million).

Unsuccessful attempts to introduce Starlings to Canada (Quebec) were made in 1875, 1889 and 1892. Natural emigrants from the United States first appeared in Ontario in 1914 and in the following year in Nova Scotia. Thereafter they spread to Quebec in 1917, New Brunswick in 1924, Prince Edward Island in 1930–31, Manitoba in 1931, Alberta in 1934, Saskatchewan in 1937, Newfoundland in 1943, mainland British Columbia in 1945–46 and the Queen Charlotte Islands and Vancouver Island in 1953 (Kessell 1953).

By 1952–53, Starlings were found throughout southern Canada and in the whole of the United States apart from southern Florida and northeastern New Mexico. They were breeding widely in both countries northeast of a line extending from south-central British Columbia, northeastern Oregon and northern Utah to southern Mississippi. Southwest of this line they occurred mainly as winter migrants.

Starlings may have crossed the border from Texas into Mexico as early as 1935. By the 1970s they had spread south to Guanajuato, northern Veracruz and Yucatán, from where they are still spreading southwards.

The explosive spread of the European Starling in North America has been little short of phenomenal. It is even more remarkable because, as Feare (1984) points out, it has taken place on a continent that already possesses several native bird species with similar ecological requirements, such as blackbirds (*Agelaius*), grackles (*Quiscalus*) and cowbirds (*Molothrus*). The Starling's colonisation of North America seems to have been facilitated by three principal factors; first, although in its native European range it is seldom found above 600m, in North America it appears equally at home on the Great Plains, much of which lie at between 1,500 and 2,100m; second, it competes successfully with hole-nesting species such as the Wood Duck *Aix* *sponsa*, Eastern Bluebird *Sialia sialis* and Red-headed Woodpecker *Melanerpes erythrocephalus*. In California, it has been recorded as also competing successfully with naturalised Mandarin Duck *Aix galericulata* (L. L. Shurtleff pers. comm. 2004). Finally, in contrast to introductions elsewhere, at least some of the birds imported into the United States were, or later became, migratory, thus assisting in the species' dispersal. Indeed, the movement of Starlings in North America in general mirrors that in Europe, i.e. some populations are sedentary, some are migratory, and some migrate in some years but not in others.

Although, following human settlement westward, the Starling's distribution advanced more rapidly in southern and south-central states, it extended its breeding range more rapidly in the north. Within 80 years of its introduction it was, said Feare (1984), one of the most numerous birds in North America, with a breeding range extending from Arctic Canada to sub-tropical Mexico. Although the species' distribution may now have stabilized, in some areas its population density seems still to be increasing, although in others it may be declining (Johnston & Garrett 1994). Starlings are now common residents on all of California's Channel Islands (Power 1994).

The AOU (1998: 523) described the European Starling's range in North America as breeding

> From east-central and southeastern Alaska, southern Yukon, northern British Columbia (including the Queen Charlotte Islands), southern Mackenzie, southern Keewatin, northern Manitoba, northern Ontario, northern Quebec, southern Labrador, and Newfoundland south to central Baja California, northern Sinaloa, southern New Mexico, southern Texas, the Gulf coast, southern Florida (to Key West), and Bermuda [as a natural colonist], with an isolated population in Mexico City and a breeding record from Veracruz. Winters throughout the breeding range and south to Veracruz, the Bahama Islands (south to Grand Turk), and eastern Cuba.

Sibley (2000: 416) says that in North America the European Starling 'is now found in virtually all human-modified habitats'.

Impact: Since at least the 1920s, the European Starling has been recognised as an agricultural pest, and the benefit it conveys by probing the ground for grubs, wireworms and beetles (in summer up to 90% of the species' diet may be composed of invertebrates) is far outweighed by its depredations on commercial fruits, berries, corn (maize), grain, rice and seeds. In urban areas, the accumulated guano of vast roosting murmurations damages buildings and fosters histoplasmosis. Starlings also transmit other diseases such as avian tuberculosis, toxoplasmosis, psittacosis, cryptococcal meningitis, avian malaria and Newcastle disease. Several aircraft crashes have been attributed to damage caused by Starlings being sucked into jet engines. Millions of dollars have been spent annually in attempts to control the species' numbers but with only limited success.

Various authors (e.g. Vuilleumier 1991, Robbins 1995, James 1997 and Dinsmore 2001) have drawn attention to the success of the Starling in competing for nesting sites with a wide variety of indigenous birds. Koenig (2003), however, who compared the mean densities of 27 native cavity-nesting species before and after invasion of their territory by Starlings, found that only ten of the species showed significant effects potentially attributable to Starlings, and only 50% of these were partially negative. In two of the five species that showed negative effects, evidence for a decline in one analysis was counterbalanced by an increase in the other, while in two others declines were probably due to factors other than competition from Starlings. Only sapsuckers (*Sphyrapicus* spp.) showed declines potentially attributable to Starlings that were not counterbalanced by other data. Although declines in native species may still occur if Starlings continue to increase, Koenig (2003) believed that the available data fail to support the widely held belief that Starlings have had a serious impact on populations of native cavity-nesting birds, that have so far apparently managed to survive the Starling invasion in spite of the interlopers' abundance and aggressive commandeering of sometimes limited nesting-sites.

West Indies

European Starlings were released near Annotto Bay in Jamaica in 1903 or 1904. Although Taylor (1953) records that they were not established at the release site in the 1940s, he says that in 1947 flocks of between 200 and 300 occurred in the Parish of St Ann, 55km to the west. Although initially Starlings spread only slowly they later began to disperse more rapidly, and Lack (1976) recorded them as widely distributed in lowland pastures and in some mid-elevations, but as seldom occurring in undisturbed habitats. Bond (1979), who reported Starlings at Brown's Town, in the Castleton Botanical Gardens and at Ocho Rios (all within 60km of Annotto Bay) in 1949–52, said that they occurred mostly in open farming country, chiefly in the hills. Raffaele *et al.* (1998) say that Starlings are now fairly common locally in Jamaica; their failure to become more widely established may be due to the lower rate of deforestation on Jamaica compared with other West Indian islands.

Although the AOU (1998) says that Starlings are also established on Puerto Rico, Raffaele *et al.* (1998) say they have not taken hold there.

European Starlings are fairly common breeding birds on Grand Bahama and the Biminis (as natural migrants from the United States), and have also been recorded on Cuba, the Virgin Islands (St Croix) and the Cayman Islands (Cayman Brac) (Raffaele *et al.* 1998).

Australia

Between 1856 and about 1881 well over 400 European Starlings were released in Australia in Tasmania, New South Wales, Victoria, South Australia and Queensland.

As early as 1885 large flocks of Starlings were established in the Royal Park and in the grounds of the university in Melbourne, and by 1906 the whole of southern Victoria had been overrun (Ryan 1906). In South Australia, Starlings rapidly increased, were common locally by 1894, and had spread to the Eyre Peninsula by around the turn of the century and to Kangaroo Island before 1910. Starlings were established throughout settled areas of New South Wales by the mid-1920s, and by the mid-1940s had become a serious horticultural pest in the Riverina (Tarr 1950).

Colonisation of Queensland, where Starlings were first recorded, at Stanthorpe in 1919, is believed to have been through natural dispersal from New South Wales. On Tasmania, Starlings were common in and around Hobart by the early 1900s, and had been recorded up to 32km inland.

Tarr (1950) recorded Starlings as established in cultivated regions throughout most of New South Wales, Victoria and Tasmania, and on King and Flinders Islands in the Bass Strait. In Queensland they were common along some 225km of the coast between Brisbane and Maryborough. In South Australia they were abundant on Eyre Peninsula and Kangaroo Island, but probably occurred no further north than Port Augusta.

Pizzey (1980) found Starlings to be well established in much of southern and eastern Australia and on many coastal islands from Eyre Peninsula and Kangaroo Island to about the Tropic of Capricorn in Queensland. Today, Starlings are widespread and abundant almost universally in New South Wales, Victoria, Tasmania and islands in the Bass Strait; in South Australia they occur north of Lake Eyre, and west to beyond Ooldea. Feare (1984) believed that formation of townships along the south coast of Australia is likely to enable Starlings to 'leap frog' their way into Western Australia, but apart from a very few isolated records this has not yet happened, and breeding has not been recorded (Barrett *et al.* 2003).

The preferred habitats of Starlings in Australia are settled and cultivated areas. As elsewhere, in Australia they are sedentary, migratory, and nomadic (Pizzey 1980).

Impact: Starlings in Australia damage fruit, corn, vegetable crops and newly seeded fields, and in Victoria in autumn and winter they eat vast quantities of grain on commercial poultry farms. They are vectors of parasites and diseases, contaminate buildings and kill trees with their droppings, and compete for food and nesting sites with native species – especially parrots (Psittacidae) and some waterfowl (Anatidae) (Frith 1979). In compensation, Starlings eat locusts, larvae, wireworms, blowflies, cutworms and ticks. In winter they form vast murmurations up to 20,000 strong that provide an additional source of food for native Australian Hobbies *Falco longipennis* and Brown Goshawks *Accipiter fasciatus.*

New Zealand

Between 1862 and 1883 a total of 653 European Starlings were introduced to New Zealand by local acclimatisation societies (see Lever 1992) to combat insect pests, and at least 350 more were imported by private individuals. As early as 1870 they were said in some places to have become very numerous, and Thomson (1922) recorded them as abundant virtually throughout New Zealand.

On the country's off-lying islands Starlings were introduced to the Chathams by L. W. Hood before 1900. They were first recorded on Campbell Island around 1907, on the Kermadecs before 1910, on Macquarie in about 1930, the Snares in 1948 and on the Antipodes in 1952. Oliver (1955) reported Starlings also on Three Kings, Mokohinau, Hen, Great and Little Barrier, Poor Knights, Mayor, Kapiti, Karewa, Stewart and Auckland Islands. Wodzicki (1965: 434) said that Starlings were 'widely distributed and abundant, North, South, Stewart and Raoul [Kermadecs], Chatham, Snares, Auckland, Campbell and Macquarie Islands'. Kinsky (1970) confirmed their presence on the Chathams, Kermadecs, Snares, Auckland, Campbell and Macquarie Islands, and Williams (1973) added that they nested on Three Kings, the Kermadecs, Chatham, Antipodes, Campbell, Auckland and Macquarie. Falla *et al.* (1979) said that the European Starling was one of the most familiar birds in New Zealand, occurring in most habitats, apart from dense native bush or over 1,200m above sea level. In the mid-1980s Starlings became established on Cavalli Island (Motuharakeke) off the east coast of Northland. Heather & Robertson (1997) recorded Starlings as breeding on the Kermadec, Antipodes, Snares, Auckland and Campbell Islands, and said that they had been seen on the Bounty Islands. Baker (1991) said they were also breeding on Three Kings, Chathams and Macquarie Islands.

Impact: Starlings compete advantageously for food and nesting sites with a variety of native birds. They damage many grain and fruit crops, especially pears, plums, peaches, grapes, cherries, currants and strawberries, and eat beneficial bumble bees (*Bombus* spp.) and Honey Bees *Apis mellifera.* Starlings also eat, and disseminate, the seeds and fruits of several noxious plants, and their droppings damage buildings. Their consumption in autumn of the fruits of kahikatea deprives Tuis or Parson Birds *Prosthemadera novaeseelandiae* and New Zealand Bellbirds *Anthornis melanura* of a valuable source of winter food (Heather & Robertson 1997). Turbott (1956) points to competition for nesting sites with native Sacred Kingfishers *Todiramphus sanctus.* In compensation, Starlings eat armyworms, crane fly larvae, click beetles, ticks, grass grubs, caterpillars, worms and snails. Feare (1984) said that the dispersal of Starlings in New Zealand has been assisted by the widespread provision of nesting boxes in the belief that the birds help to control insect pests.

Fiji Islands

Pernetta & Watling (1978) suggest that European Starlings may have arrived on Ono-i-Lau, a tiny islet some 370km southeast of Viti Levu, around 1930: other possible dates are 1922, the later 1920s and 1948. When first discovered, in 1951, a population of around 1,000 adults was well established and widely distributed on Ono-i-Lau, and the species was also found on Tuvana-i-Tholo and Tuvana-i-Ra to the south; on Votua (several hundred) 130km north-north-east; and on Doi (Carrick & Walker 1953, Manson-Bahr 1953). Although Hill (1952) suggested that the birds arrived as natural immigrants from the Kermadecs, some 1,200km to the south, Pratt *et al.* (1987) and the AOU (1998) say the species was introduced to Fiji – a seemingly more likely explanation; the former authors and Pernetta & Watling (1978) say the birds are common in agricultural areas and in villages on Ono-i-Lau and also on Vatoa.

Lord Howe Island; Norfolk Island

Starlings have been recorded on Lord Howe and Norfolk Islands (Barrett *et al.* 2003) since 1924 and 1913 respectively.

Macquarie Island

Starlings are listed as breeding on Macquarie Island (Barrett *et al.* 2003).

Tonga Islands

In the absence of competing Common Mynas *Acridotheres tristis*, European Starlings are common on the island of Tongatapu, especially in the capital Nuku'alofa (Dhondt 1976a, Pratt *et al.* 1987). They probably arrived in Tonga through human intervention.

Attempts to eradicate European Starlings in Fiji and Tonga were unsuccessful, but the birds have not spread as much as was initially feared, probably because the climatic conditions are unsuitable (Watling 1982).

Vanuatu

According to Cain & Galbraith (1957), European Starlings have been reported from the former New Hebrides; whether they are established there is unknown.

Asian Pied Starling
Sturnus contra

Natural Range: N and C India to Laos, Cambodia and SW Yunnan.
Naturalised Range: Asia: Japan.

Japan

This species is listed by the OSJ (2000) as a breeding resident in cultivated fields and residential areas around Tokyo on Honshu.

TURDIDAE (THRUSHES)

Eurasian Blackbird
Turdus merula

Natural Range: Palaearctic and Oriental regions, from the British Isles eastwards through Europe (N to around 63°N in Norway), Asia Minor, India, Sri Lanka and N Burma to CS China, N Vietnam, and C Laos. Also Madeira, the Azores and the Canary Is. in the Atlantic, and Morocco, Algeria and Tunisia in N Africa.
Naturalised Range: Australasia: Australia; New Zealand. Pacific Ocean: Lord Howe I.; Macquarie I.; Norfolk I.

Australia

Between 1857 and 1862 Eurasian Blackbirds from England were released on some 50 occasions in Australia, principally in Victoria (in the Melbourne Botanic Gardens, on Phillip Island south of Melbourne, at Western Port and at Gembrook: Ryan 1906) and in the Royal Park near Sydney in New South Wales (Chisholm 1926), but also at Hobart on Tasmania (Dove 1919), Adelaide and elsewhere in South Australia, and at Brisbane, Queensland. By 1864, Blackbirds were said to be 'thoroughly established' in the Melbourne Botanic Gardens, and by 1913 they were apparently 'breeding freely' elsewhere in Victoria.

By the mid-1920s, Blackbirds were established in the Botanic Gardens at Sydney (where they later died out and were reintroduced in 1940) and at Albury near the border with Victoria (Coleman 1939). A quarter of a century later they had become widespread and quite numerous in South Australia on the Adelaide Plains, around Mount Lofty, at Victor Harbour, at Coorong and near Mount Gambier northwards to Oodnatta, and in various parts of Victoria. Blackbirds first appeared on Kangaroo Island (South Australia) in 1947 (Cooper 1947), at Canberra (ACT) and on Flinders Island in Bass Strait (where they may have been originally introduced in about 1930) around 1949, at Deniliquin (New South Wales) in 1954, at Doveton in 1947 and at Dareton in 1959. By the early 1960s they occurred in citrus orchards along the Murray River in New South Wales, in the Riverina, on the central tablelands, at Baroonga, Tocumwal, Mathoura, Tooleybuc and Goodnight, in the Sunraysia district and on the coast north of Sydney. Blackbirds appeared at Broken Hill in 1975–76, at Cobar in 1976 and at Armidale in 1977 (Frith 1979).

In Tasmania, Blackbirds were first recorded as breeding in the wild around 1918 (Dove 1919); by 1937–38 they had spread to Port Davey in the southwest, and by the end of the following decade they were widely distributed. By the 1950s they occurred on the coast at Recherche, Bound Bay, Spain Bay, Point Eric, Cox Bight and Moth Creek.

Blackbirds in Australia initially dispersed only slowly from their points of release; after the Second World War, however, they began to spread more rapidly, and had soon colonised most of the southeastern mainland, Tasmania, and islands in Bass Strait, but until the early 1960s remained uncommon in much of New South Wales. Their present distribution remains largely unchanged (Barrett *et al.* 2003).

Impact: Eurasian Blackbirds can be a serious pest to such soft fruit crops as grapes, cherries and figs (Frith 1979). In Victoria, they eat the fruits of such native species as *Pittosporum undulatum* and *Exocarpos cupressiformis*, which they are spreading to new localities. Their impact on native species, such as the Bassian Thrush *Zoothera l. lunulata*, in southeastern Australia, Tasmania and islands in Bass Strait, has yet to be fully determined.

New Zealand

Table 14 shows that between about 1862 and 1868 a total of around 800 Eurasian Blackbirds from England were introduced to New Zealand, where by about 1880 the Otago Acclimatisation Society (see Lever 1992) was admitting, somewhat naively, that the birds were 'now exceedingly numerous and we regret to say are found to be rather partial to cherries and other garden fruits'. (Heather & Robertson (1997) say that around 1,000 birds were introduced up to 1875).

In about 1879 Blackbirds were first released on Stewart Island, where by around 1920 Thomson (1922: 146) recorded them as 'seen every breeding season near settlements'. According to Williams (1953), Blackbirds had dispersed naturally to Campbell Island and the Chatham and Auckland Islands by the turn of the twentieth century, the Snares in 1907 and the Kermadecs by 1910, while Drummond (1907) said they were established on the Auckland Islands. By the mid-1950s, Blackbirds had also been recorded on Three Kings, Poor Knights, Hen, Little Barrier, Mayor, Karewa, Kapiti and Solander Islands.

In Southland (South Island) Philpott (1918: 329) recorded that 'Unlike the thrush the blackbird is to be found in the heart of the big bushes. I have met with the bird wherever I have gone, and found it as common on the Hunter Mountains at 3,000 feet [900m] elevation, as in the bush near Invercargil'.

Guthrie-Smith (1921) suggested that Blackbirds (and Song Thrushes) in New Zealand dispersed from Auckland via the coast of the Gulf of Thames, the Coromandel Peninsula, down the Bay of Plenty, round the East Cape and onwards to Hawke's Bay; he found Blackbirds in the heart of forest country. Thomson (1922) saw no reason why, since the intervening strip of bush was relatively narrow, Blackbirds (and Song Thrushes) should not have spread over from the Thames Valley direct to the east coast. Although Blackbirds were rare or absent north of Whangarei in North Island, in many other places they were one of the country's commonest introduced birds (Thomson 1922). Oliver (1955) found Blackbirds to be distributed throughout both the main islands, while Wodzicki (1965) and Kinsky (1970) referred to them also on Stewart, Raoul (Kermadecs), Chatham, Snares, Auckland and Campbell Islands. Falla *et al.* (1979) recorded the species to be one of New Zealand's commonest birds, and as occurring on the main islands from sea level to around 1,400m. Today they are common and probably the most widely distributed bird in New Zealand, occurring in suburban gardens, parks, orchards, hedged paddocks, exotic plantations, scrub and native forest to at least

1,500m. They are well established on the Kermadecs, Chathams, Snares, Auckland and Campbell Islands, while a vagrant has been recorded on the Antipodes Islands. They were reported by Baker (1992) as breeding on Three Knights, Kermadecs, Chathams, Campbell, Auckland and Snares Islands. Blackbirds are uncommon only on offshore islands with pristine native bird and forest communities such as Little Barrier and Kapiti (Heather & Robertson 1997).

An important factor in the Blackbird's successful colonisation of New Zealand is likely to have been that the introduction was of the partially migratory nominate subspecies of western Europe.

Impact: Thomson (1922) reported that in New Zealand *T. merula* sometimes kills such native species as the Tui or Parson Bird *Prosthemadera novaeseelandiae*, while Smithers & Disney (1969) suggested probable competition on Norfolk Island with the endemic race of the Island Thrush *Turdus p. poliocephalus*, which is now extinct (Dickinson 2003). (For the impact of *T. merula* in orchards and on native and alien shrubs and weeds see under *T. philomelos*).

Lord Howe Island

On Lord Howe Island, where Blackbirds were first observed in 1953 and where by the end of the decade they were widely but thinly distributed, they are believed to have arrived as natural immigrants from New Zealand (McKean & Hindwood 1965). See also Barrett *et al.* 2003.

Macquarie Island

Barrett *et al.* (2003) record *T. merula* on Macquarie Island.

Norfolk Island

Williams (1953) suggests that Blackbirds were probably introduced to Norfolk Island in about 1939, where some 30 years later they were said to be abundant (Smithers & Disney 1969). See also Barrett *et al.* 2003.

Song Thrush
Turdus philomelos

Natural Range: From the British Isles and Europe through N Turkey, the Caucasus, and N Iran to W and C Siberia: winters S to S Europe, N Africa and SW Asia.

TABLE 14 Introductions of Eurasian Blackbirds *Turdus merala* to New Zealand, 1862–1868.

Year	*Number*	*Introduced by*
c. 1862	26	Nelson Acclimatisation Society (A.S.)
1865	?	Auckland A.S.
1865	A pair	Otago A.S. Released at Dunedin
1865	A pair	Canterbury A.S.
1867	6	Otago A.S. Released at Dunedin
1867	46	Canterbury A.S.
1867	*c.* 30	Auckland A.S.
1868	132	Auckland A.S.
1868	39	Otago A.S.
1868	152	Canterbury A.S.
1869	21	Otago A.S.
1871	70	Otago A.S.
1871 or 1873	62	Mr R Bills (on behalf of Canterbury A.S.)
1872	95	Canterbury A.S.
1875	117	Canterbury A.S. (40 released at Levels, Otipua, Waimate, Otaio, Geraldine, Albury and Timaru)

Sources: Drummond 1907; Thomson 1922.

Naturalised Range: Australasia: Australia; New Zealand. Pacific Ocean: Lord Howe I.; ?Macquarie I.; Norfolk I.

Australia

Between 1856 and 1880 several hundred Song Thrushes were introduced from England to Australia by various acclimatisation societies (see Lever 1992), who released them in Victoria (at Melbourne; Phillip, Sandstone and Churchill Islands; Yarra Bend; Geelong; Gembrook), New South Wales (Sydney), Queensland (Brisbane), and South Australia (Adelaide).

By around the turn of the twentieth century Song Thrushes in Victoria had spread from their points of release in the Botanic Gardens and Royal Park all over Melbourne and its suburbs (Ryan 1906), and by the late 1940s were fairly common in the city and had dispersed to Sherbrooke Forest, Macedon, Geelong (where some had been planted in 1865), Belgrave and perhaps Ararat (Chisholm 1950, Tarr 1950). Frith (1979: 187) said that the Song Thrush was 'quite common in Melbourne and is widespread in small numbers in towns and heavily developed districts in southern Victoria generally. It has disappeared elsewhere'. Pizzey (1980), who recorded Song Thrushes in Melbourne, Warragul, the Mornington Peninsula, Dandenong, Yellingbo, Macedon, Werribee, Geelong and Lorne, described the species as rather rare and local near human habitation. Barrett *et al.* (2003) indicate a very limited range centred on Melbourne.

New Zealand

Table 15 shows that between 1862 and 1880 over 479 Song Thrushes from England were introduced to various parts of New Zealand. (Thomson 1922: 142 says 'about 1872'. Since he (1926) and later authors give the date as 1862 the former is presumably a literal or was subsequently revised. Baker (1991) says the date was 1986, which is clearly an error). Although in Auckland and Otago the birds became established in native bush, they were slower to do so in the comparatively more open country of North Canterbury. In Southland (South Island) Philpott (1918: 329) found that:

> The song thrush does not appear to penetrate far into the big forests, nor to spread into unsettled areas. In the coastal forests of Fiord Country they are seldom to be heard, though plentiful enough about the settlements of Tuatapere and Papatotara. Nor does the bird favour the mountains; I do not think I have ever heard one above the bush-line (about 3,000 feet) [*c.* 900m].

In North Island, Thomson (1922) believed that Song Thrushes (like Blackbirds) dispersed east and south from Auckland (for their route of dispersal see under *T. merula*), and said (p. 143) that 'at the present day thrushes are found from one end of New Zealand to the other in enormous abundance'.

On New Zealand's offshore islands, Song Thrushes have been recorded on Poor Knights, Hen, Little Barrier, Three Kings, Kapiti, D'Urville, Raoul (in the Kermadecs, prior to 1910), the Chathams (before 1922), the Antipodes, Campbell, the Snares (about the turn of the twentieth century), Stewart, Codfish, the Aucklands and Macquarie Islands.

Today, the Song Thrush is one of the commonest and most widely distributed birds in New Zealand, occurring in a variety of habitats from farmland hedgerows, orchards, parks, and suburban gardens at sea level to subalpine scrub at 1,600m, exotic plantations and forest. The species is, however, still scarce in pristine native forest and on islands such as Little Barrier and Kapiti, where indigenous forest and bird communities remain virtually intact (Heather & Robertson 1997). Baker (1992) recorded breeding on Three Kings, Kermadecs, Chathams, Campbell, Aucklands and the Snares Islands, but not on the Antipodes or Macquarie Islands.

Impact: Since the early years of the twentieth century, Song Thrushes and Blackbirds in New Zealand have been responsible for the dispersal of native and introduced plants and for serious depredations in orchards (Philpott

1918, Thomson 1922). The cultivated fruits most affected include cherries, plums, apricots, currants, raspberries, strawberries, boysenberries, grapes, gooseberries, pears, apples and tomatoes (Dawson & Bull 1969). Non-commercial introduced plants eaten and spread in native forests and agricultural crops include Blackberry *Rubus fruticosus*, Sweet-briar Roses *Rosa rubiginosa*, Cape Fuchsia *Leycesteria formosa*, Elderberry *Sambucus nigra*, Inkweed or Pokeweed *Phytolacca octandra* and Barberry *Berberis vulgaris.* In compensation, both *T. merula* and *T. philomelos* consume large quantities of injurious insects and snails.

Macquarie Island

Barrett *et al.* (2003) say that *T. philomelos* has been recorded on Macquarie Island.

Norfolk Island; Lord Howe Island

According to Williams (1953), *T. philomelos* probably arrived on Norfolk Island around 1913 and on Lord Howe Island about 1929 – in both cases probably as natural immigrants from New Zealand. On the former, Song Thrushes were breeding in the 1960s and were 'common' in 1969 (Smithers & Disney 1969), while on the latter about 50 were present in 1959 and breeding was reported in the early 1960s (McKean & Hindwood 1965). See also Barrett *et al.* 2003.

Island Thrush
Turdus poliocephalus

Natural Range: Numerous islands in Indonesia and the Pacific Ocean from Sumatra and Java to Fiji and Samoa.

Naturalised Range: Indian Ocean: Cocos (Keeling) Is.

Cocos (Keeling) Islands

Between 1885 and 1900 Island Thrushes from Christmas Island, where the form is *T. p. erythropleurus*, were released on Pulo Luar (Horsburgh) in the Cocos (Keeling) archipelago some 950km to the west. By the late 1940s they had spread to Atas (South Island) and to Panjang (West Island), and by the 1960s were said to be abundant on all three (Gibson-Hill 1949a, Van Tets & Van Tets 1967).

TABLE 15 Introductions of Song Thrushes *Turdus philomelos* to New Zealand, 1862–1880.

Year	*Number*	*Introduced by*
1862[1]	5	Nelson Acclimatisation Society (A.S.)
1865	2	Otago A.S.
1867	30	Auckland A.S.
1867	36	Canterbury A.S.
1867	4	Otago A.S.
1868	24	Canterbury A.S.
1868	95	Auckland A.S.
1868	49	Otago A.S.
1869	48	R Bills for the Otago A.S.
1871	?	Canterbury A.S.
1871	42	Otago A.S.
1875	?	R Bills for the Canterbury A.S. (Released Christchurch Gardens, Bluecliffs, Four Peaks, Timaru)
1878	20 pairs	Canterbury A.S.
1878	8	Wellington A.S.
1880	48 pairs	Canterbury A.S.

Sources: Drummond 1907; Thomson 1922, 1926.

MUSCICAPIDAE (CHATS AND OLD WORLD FLYCATCHERS)

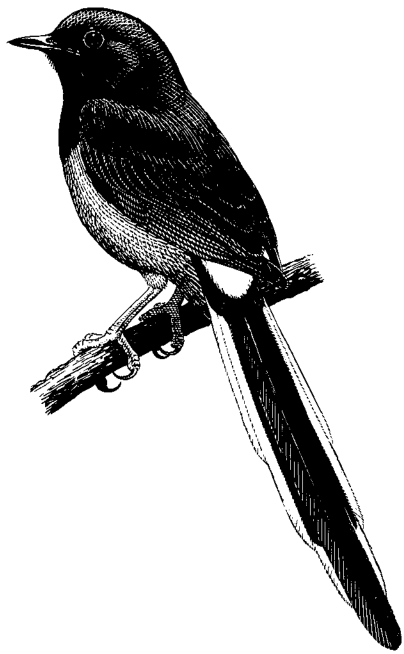
White-rumped Shama
Copsychus malabaricus

Natural Range: From India, Nepal, Sri Lanka and the Andaman Is. to Burma, Thailand, Indochina, Malaysia, Borneo, Java, and Sumatra and many Indonesian islands.
Naturalised Range: Pacific Ocean: Hawaiian Is.

Hawaiian Islands
In 1931, White-rumped Shamas of the form *C. m. indicus* (Nepal, northeastern India, southern Yunnan, northwestern Thailand and northern Indochina) were released on Kauai by Alexander Isenberg, where Richardson & Bowles (1964) found them to be a fairly common, albeit local, resident in a variety of habitats, but principally in settled lowland areas. In 1940, more were liberated in the Nuuanu Valley and on the Makiki Heights on Oahu, where some were observed at Pauoa Flats in 1948, in the upper Manoa Valley in 1949, and at Tantalus in 1950 (Harpham 1953).

Berger (1972) reported *C. malabaricus* to be fairly common in damp habitats in the upper Manoa Valley, Tantalus, the upper Nuuanu Valley, along the Koolau Range and on the slopes of the Pali. A decade later, Berger (1981) said that Shamas were common on both the windward and leeward sides of Oahu, where although they preferred areas of lush vegetation they also occurred in various other habitats, including residential Kailua. Scott *et al.* (1986), who incorrectly give the first date of introduction as 1940, observed Shamas on the edge of the Alakai Swamp on Kauai. Pratt *et al.* (1987), Pratt (1994), and the AOU (1998) confirm the presence of the species on both Kauai and Oahu, where the first-named authors describe its status as 'common'.

Impact: Shehata *et al.* (2001) found a high prevalence (23.1%) of *Plasmodium* avian malaria infection among White-rumped Shamas in the Lyon Arboretum on Oahu, where they are thus a primary reservoir for the maintenance of the disease among native passerines.



White-rumped Shama

PASSERIDAE (SPARROWS, SNOWFINCHES AND ALLIES)

House Sparrow
Passer domesticus

Natural Range: Much of the Palaearctic region, from the British Isles eastwards through Europe (N to N Scandinavia), the Middle East, Arabia, NW Africa, Libya, Egypt, Sudan, and Asia to Kamchatka, Sakhalin, Hokkaido and NW Manchuria (S of the Arctic Circle). *P. domesticus* has considerably extended its range eastwards naturally during the past 200 years.
Naturalised Range: Asia: ?Java. Africa: ?Chad; Guinea-Bissau; Kenya; Mozambique; ?Niger; Senegal [Mauretania, The Gambia, Liberia]; ?Somalia; South Africa [Botswana,

Malawi, Namibia, Zaire, Zambia, Zimbabwe]; Tanzania (including Zanzibar). North and Central America: Canada; USA [? Belize, Costa Rica, El Salvador, Guatemala,? Honduras, Mexico, ?Nicaragua, Panama]; West Indies. South America: Argentina [Uruguay]; Brazil; Chile; Peru [Bolivia, ?Colombia, Ecuador, Paraguay, ?Venezuela]. Australasia: Australia; New Zealand. Atlantic Ocean: Ascension I.; Azores Is; Bermuda; Canary Is.; Cape Verde Is; Falkland Is. Indian Ocean: Andaman Is; Chagos Archipelago;Christmas I; Comoros Is; Madagascar; Maldive Is; Mascarene Is.; ?Nicobar Is; ?Seychelles Is. Pacific Ocean: Easter Is; Hawaiian Is; Juan Fernandez Is; New Caledonia; Norfolk I; ?Vanuatu.

Countries and islands that have been colonised by the natural extension of range of naturalised populations are enclosed (above and in the following text) within square brackets. For further details see Lever 1987.

Java

Summers-Smith (1963) quotes R Meinertzhagen as saying that House Sparrows were introduced to Java sometime after 1885, where they became established in some settled areas. However, they are not mentioned by MacKinnon & Phillips (1993).

Guinea-Bissau

In early May 2001 House Sparrows were observed for the first time in Guinea-Bissau, where on 23 May two nests were found in harbour structures in the old Bissau harbour of Pidjiguiti, and where an estimated population of 10–20 birds was established over an area of approximately six hectares; no Sparrows were then seen in the Bissau city centre. The birds were believed to be a very recent arrival, probably, given the location, as ship-borne stowaways rather than as natural immigrants from Senegal (Catry & Monteiro 2003).

Mozambique

According to Da Rosa Pinto (1959), birds of the nominate subspecies were introduced to Lourenço Marques (Maputo) by a Portuguese immigrant in late 1955; they spread rapidly and by the end of the decade were thoroughly established. House Sparrows that became widespread in the Sul do Save (Da Rosa Pinto 1959) were probably natural *indicus* immigrants from South Africa (Harwin & Irwin 1966). By 1960, House Sparrows had spread 450km north to the border with Southern Rhodesia (Zimbabwe) where they were widespread and abundant (Harwin & Irwin 1966). In northern Mozambique, *indicus* birds were established in Tete before 1967, having probably arrived as natural immigrants from Salisbury (Harare) (Payne & Payne 1967).

Senegal

House Sparrows arrived, probably as ship-borne stowaways, in Dakar in about 1970. From here they subsequently spread 160km inland up the Sénégal River (Clement *et al.* 1993) to Podor, and also Kaolack and Diourbel, and northwards to Nouakchott (Ndao 1980).

[From Senegal, House Sparrows spread naturally north to Mauretania in the 1980s and south to The Gambia (Gore 1990) and Liberia (Monrovia 1989–90: Borrow & Demey 2001)]. The species has also been claimed for central Chad and the form *tingitanus* (Morocco to northeastern Libya) for northeastern Niger (Borrow & Demey 2001).

Somalia

According to Mackworth-Praed & Grant (1960), House Sparrows of the Egyptian race (*P. d. niloticus*) occurred at Berbera on the Gulf of Aden coast of Somalia, where they were 'probably introduced' from Egypt by ships via the Suez Canal and the Red Sea. The present status of the species in Somalia is uncertain, but Clement *et al.* (1993) say it may occur in Mogadishu.

South Africa

Two forms of the House Sparrow, *P. d. indicus* (southern Israel and Arabia through southern Asia to Laos) and the nominate *domesticus* (western Europe through northern Asia to northwestern Manchuria), have been introduced to East London in the Eastern Cape and to Durban, Natal, in South Africa, and various dates between 1890 and 1930 have been suggested by different authors for the earliest releases in different localities. (For full details see Lever 1987: 439–440).

'The extension of range [of the House Sparrow in South Africa]' wrote Summers-Smith (1963: 186), 'has been less spectacular than in other parts where it has been liberated.' The *domesticus* birds that were released at East London, which seem to have been mainly or entirely sedentary, interbred with *indicus*, which dispersed naturally and/or was translocated from Durban, to produce offspring with dual characteristics; these were subsequently superseded by others with the appearance of the usually dominant *indicus*, and it is birds of the latter form that have colonised the region (Harwin & Irwin 1966). 'From Durban', Summers-Smith (1963: 186) continues, 'the House Sparrow has spread over all Natal and into Transvaal and Orange Free State; from East London a spread has taken place along the coastal regions of Cape Province joining up in the north with the birds from Durban.' This expansion was initially gradual and steady rather than explosive – it took around 50 years, for example, for the whole of Natal to be colonised.

To quote Summers-Smith (1963: 188) again, 'When it is considered how sedentary the House Sparrow is in most parts of its range it is not surprising that the dispersal is rather variable. This is particularly the case when the suitable habitats are separated by even quite short distances of unsuitable country'. Indeed, the species' acquired ability in southern Africa to disperse for a considerable distance over apparently inimical terrain has, perhaps, been the most important element in its occupation of the region. Another factor has been the difference in the density of the human population (on which the species is largely dependent) between southern Africa and that pertaining in much of its natural range, where even today its distribution is somewhat discontinuous; again, the species' adaptability – through a gradual modification of the original genotype – has enabled it to become eventually a successful colonist. Yet another possible factor, referred to by Harwin & Irwin (1966), has been its readiness to associate with such nomadic natives as the Red-billed Quelea *Quelea quelea*. A possibly inhibiting element, at least in the early years of the House Sparrow's expansion, may have been competition with the indigenous Cape Sparrow or Mossie *P. m. melanurus* and perhaps the Southern Grey-headed Sparrow *P. diffusus*.

In the northern Cape Province, the Transvaal and elsewhere, the major dispersal of the species seems to have begun in the late 1940s/early 1950s. As mentioned above, it was not until half a century after the House Sparrow's introduction to Durban between 1890 and 1900 that it colonised Natal. In 1949 it crossed the Drakensberg Mountains, 930km to the northwest. By 1953 it had spread throughout the Orange Free State and the central and southern Transvaal, and in 1954 it appeared in Swaziland. Within a decade House Sparrows had spread dramatically 1,600km or more southwest to the Cape Peninsula and northwards to Great Namaqualand (Harwin & Irwin 1966).

Temperature seems unimportant in shaping the distribution of House Sparrows in South (and southern) Africa, where they occur in both warm and cool areas; they also appear to be unaffected by the amount of precipitation or by drought (Brooke 1997, Richardson *et al.* 2000).

Today, *P. domesticus* is virtually ubiquitous in South Africa wherever there are human settlements to provide food, shelter and nesting-sites (Brooke 1997, Richardson *et al.* 2000).

Impact: Opinions differ on the impact, if any, of the House Sparrow on the native *P. m. melanurus*, which it has been accused of replacing particularly in urban and agricultural localities, and the evidence is contradictory and inconclusive.

[Central Africa]

Following their introduction to South Africa over 100 years ago House Sparrows have been spreading naturally northwards. The major dispersal that led to the colonisation of other southern African countries began in the late 1940s/early 1950s. The earliest recorded appearances of *P. domesticus* are as follows: Botswana (1956 or earlier); Zimbabwe (1956); Namibia (1961); Zambia (1965); Malawi (1967); Zaire (? mid-1970s). (For full details and routes followed see Lever 1987: 441–442). Today, House Sparrows are widely distributed in southern Africa, where their range is mainly controlled by the presence of human settlements (Brooke 1997, Richardson *et al.* 2000).

Tanzania (including Zanzibar); Kenya

Summers-Smith (1963: 186) says that '*indicus* birds were introduced from Bombay to Zanzibar about 1900 and are still confined to the city'. From Zanzibar, House Sparrows crossed to the coastal mainland of Tanzania (probably by ship), while the rest of the country was apparently colonised by natural immigrants from Zambia (Summers-Smith 1963).

House Sparrows have been reported sporadically in Mombasa, Kenya, since at least 1950, and by the early 1980s they had colonised most of the town and were spreading inland (M-Y. Morel pers. comm. to J. D. Summers-Smith).

United States; Canada

House Sparrows were first introduced to the United States by Nicholas Pike, Director of the Brooklyn Institute of New York, in 1850, in the hope, according to Barrows (1889: 294), that 'they would control a plague of the "hanging worm" or measuring worm' (larva of the Snow-white Linden Moth *Eunomos subsignarius*) that was defoliating trees. These birds, liberated in 1851, did not thrive, but a second and larger shipment imported from England in 1852 was more successful, and the birds, released in the Narrows (between Staten Island and Brooklyn) and in Greenwood Cemetery, quickly became established (Palmer 1899).

Until at least well into the 1880s large numbers of House Sparrows (some 1,600 of which were imported from western Europe and were thus of the nominate subspecies) were freed in over 100 urban localities in 39 American states and four Canadian provinces. The species' spread from its points of release averaged some 40km in the first five years, 80km after 10 years, and over 160km after 15 years – a remarkable rate of expansion triggered by an equally remarkable increase in the population (Barrows 1889).

Doughty (1978), from whom much of the following account is derived, has traced the establishment and spread of *Passer domesticus* in North America. The vast growth of urbanisation and of the human population in the late nineteenth/early twentieth century, with its concomitant formation of parks and municipal gardens and the preponderance of horse-drawn transport which ensured a continual source of food through grain spilled from nose-bags and droppings, were of material assistance to the largely commensal House Sparrow.

Most introductions took place in the decade after 1864, and urban colonies established in such cities as Brooklyn, New York, Boston and Philadelphia became the source of supply both for human translocations to other states and, as the population increased, for natural dispersal.

From the early releases in the 1850s in New York, Maine, Rhode Island and Massachusetts, House Sparrows spread westwards throughout those states, and by the following decade had reached the six central mid-western states in the Mississippi drainage system and Texas and South Carolina. Colonisation of the four north-central states, of a further six in the south, of three between the Mississippi River and the Rocky Mountains, and of California, occurred during the next decade. By 1870, Sparrows had gained a toehold in some 20 states, in the District of Columbia, and in one (or perhaps two) Canadian provinces, stretching south to South Carolina, Kentucky and Texas, and west to Missouri and Iowa, reaching the latter in 1869 (Dinsmore 2001), and north to Montreal in Canada. By the mid-1880s, they occurred in some 35 states and five territories (future states), including most states east of the Mississippi River (apart from parts of Florida, where they reached

Lake City in 1882 (James 1997), Alabama and Mississippi) as well as portions of eight western states. Sparrows thus occurred in North America from southern New Brunswick, Canada, south to southern Georgia, central Alabama and Mississippi, west to eastern Arkansas, Kansas, Nebraska, north-central Iowa and southeastern Minnesota, and north to Wisconsin and upper Michigan, and to Ontario and Quebec in Canada. Large and thriving populations were also established around New Orleans, Louisiana.

In western Canada, House Sparrows are believed to have crossed the border into British Columbia, Alberta and Saskatchewan shortly after their establishment in Washington, Montana and North Dakota in the late nineteenth century. By the late 1930s they had spread along the railroads north to the limits of human settlement (Summers-Smith 1963).

House Sparrows were introduced into western states in 1871 or 1872 in California (Sibley 2000 incorrectly says that House Sparrows did not reach California until 1910) and in 1873 or 1874 at Salt Lake City, Utah (Robbins 1973). By the mid-1880s flourishing populations occurred in the San Francisco Bay area, and in the lower Sacramento and San Joaquin River valleys in California (Vuilleumier 1991), and in Salt Lake City. Today, House Sparrows occur in all parts of the western United States and Canada, but at low densities in eastern Oregon, southern Idaho and Montana, western Wyoming, Colorado, and Arizona, and most of Utah (Johnston & Garrett 1994).

The species was first recorded on California's Channel Islands (Santa Cruz and San Clemente) in 1915. It later became a breeding resident on Santa Rosa (where it was first recorded in 1927), San Nicolas (colonised between 1945 and 1959), Santa Catalina (first reported in 1928) and San Clemente before 1968. A breeding population never became properly established on Santa Cruz, and the species has now died out on Santa Rosa (H. L. Jones pers. comm. to Power 1994).

Between 1870 and 1885 House Sparrows expanded their range by around 1.3 million sq km. By 1883 about a third of the United States had been overrun, and three years later it was estimated that Sparrows were established over 2.6 million sq km of North America, including more than 370,000 sq km of Canada; in the following year a further 1.25 million sq km were occupied. Palmer (1899) reported that only Montana, Nevada, Wyoming, Alaska, Arizona and New Mexico remained uninfested; in Ohio, Illinois, Michigan and Utah House Sparrows had become an officially designated pest. By 1898, Sparrows had crossed the Great Plains to the eastern foothills of the Rocky Mountains, and by the early years of the twentieth century only central Nevada, southern California and parts of the Rockies remained uncolonised, and even here Sparrows were established locally by 1915.

Between 1910 and 1930 there is evidence of a decline in the population in eastern North America coinciding with a decline in the use of horse-drawn transportation in favour of motor vehicles. Nevertheless, Wing (1943) estimated the House Sparrow population to number up to a staggering 150 million. There is evidence for a further decline since the mid-1960s (Robbins 1995) apart from in the west where the population appears to be relatively stable (Johnston & Garrett 1994).

According to Johnston & Selander (1964), geographic morphological variations have developed among House Sparrows in North America as a result of widely differing environmental conditions; thus northern birds tend to be larger than those in the south, and birds in the arid southwest are paler than those in the west and east. (For further references see Lever 1987: 449 and Sibley 2000: 536).

According to the AOU (1998: 679), House Sparrows in North America are

> presently resident from central and southeastern British Columbia, southwestern Mackenzie, northwestern and central Saskatchewan, northern Manitoba, central Ontario, southern Quebec (including Anticosti and Magdalen islands), and Newfoundland south throughout southern Canada, the continental United States, and most of Mexico to Veracruz,

Oaxaca, and Chiapas, locally in Central America (where range expanding rapidly in recent years) south to Panama (east to eastern Panamá province).

[House Sparrows arrived in Mexico in the early twentieth century (Alvarez del Toro 1950), Guatemala in 1970 (Thurber 1972), El Salvador in 1972 and Costa Rica in 1975 (Stiles & Smith 1980). They colonised Panama in 1976, and later Belize, Honduras, and Nicaragua (Summers-Smith 1988)].

Spreading through the Americas: House Sparrows arrived in Mexico in the early twentieth century (Alvarez del Toro 1950), Guatemala in 1970 (Thurber 1972), El Salvador in 1972 and Costa Rica in 1975 (Stiles & Smith 1980). They colonised Panama in 1976, and later Belize, Honduras, and Nicaragua (Summers-Smith 1988).

'The marvellous rapidity of the Sparrow's multiplication', wrote Barrows (1889: 21à22), 'the surpassing swiftness of its extension, and the prodigious size of the area it has overspread are without parallel in the history of any bird ?'. These were achieved firstly through the species' deliberate translocation by nostalgic European settlers; secondly, because of the House Sparrow's habit of riding the paddle-boats that regularly plied the major river systems; and thirdly by dispersal along railway tracks and highways where the birds found plenty of food from the spillage from boxcars on freight-trains and from carts. They were further helped by the provision of artificial nest-boxes, the destruction of potential predators and legal protection in the late 1880s in some 20 states.

Although adult House Sparrows are preyed on by hawks, owls and cats, and their nestlings and young by grackles (*Quiscalus* spp.) and Red-headed Woodpeckers *Melanerpes erythrocephalus*, heavy and prolonged winter snow seems to be their main controlling factor.

Impact: Dr B. H. Warren, speaking to the Microscopical Society in West Chester, Pennsylvania, in 1879 (quoted by Laycock 1966) appeared to have been the first to draw attention to the threat posed by House Sparrows. His warning was echoed by Barrows (1889) and Palmer (1899: 98) who said: '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'. It was the warning given by Warren, Barrows, Palmer and other like-minded individuals, that persuaded Congress in 1900 to pass the Lacey Act prohibiting further introductions of alien animals into the United States.

House Sparrows proved a signal failure in controlling geometrids such as the larvae of the White-marked Tussock Moth *Orgyia leucostigma* and the Snow-white Linden Moth *Eunomas subsignarius.*

The US Department of Agriculture has recorded harassment by *P. domesticus* of more than 70 native bird species, mainly involving competition for food and nesting sites (Dinsmore 2001).

House Sparrows are an economic threat to farmers, consuming an estimated 2kg of grain per bird per annum. They eat corn (maize), wheat, oats, rye, buckwheat, sorghum, rice, barley, pears, plums, grapes, cherries, currants, apples, strawberries, raspberries, blackberries, tomatoes and peas. They spread cestode and nematode parasites among domestic poultry, and foul stored food. They also block gutters, downpipes and drains, and damage brickwork. The only benefit they confer is the destruction of large numbers of introduced alfalfa weevils.

West Indies

According to Raffaele *et al.* (1998), House Sparrows probably arrived in the West Indies as stowaways on grain and tourist vessels. Lack (1976) says they first reached Jamaica, at Annotto Bay, around 1903. 'The species flourished in the 1920s, declined in the 1940s and appeared to have died out in the 1960s. However, there is a 1994 sighting from south-central Jamaica' (Raffaele *et al.* 1998: 445).

In the Virgin Islands, a small population of House Sparrows was established in 1953 in the town of Charlotte Amalie on St Thomas, where Bond (1979) said they had perhaps died out. Since then the birds have recolonised St Thomas and have recently established themselves on St John (Raffaele *et al.* 1998).

From St Thomas, House Sparrows are said to have been introduced (or to have dispersed naturally) to Puerto Rico and Hispaniola. Although Raffaele & Kepler (1992) record a sight record for the species in Ponce in Puerto Rico in 1972, Pérez-Rivera *et al.* (1979) suggest an earlier arrival, as the birds were already common in 1972. They hypothesise that House Sparrows may have been illegally introduced or arrived on a grainship for the United States, the US Virgin Islands, or the Dominican Republic. The species seems to have spread slowly from Ponce (Pérez-Rivera 1980) until it began to disperse more rapidly in the early 1990s (Moreno 1997), and has now established itself throughout the coastal plain and is currently colonising towns at high elevations (Raffaele *et al.* 1998). It reached the islands of Mona and Culebra in in 1988 and 1993 respectively (Moreno 1997). On Hispaniola, House Sparrows are said by Raffaele *et al.* (1998) to be locally common in all urban areas of the Dominican Republic. Raffaele *et al.* (2003) also record its presence in St Martin and Guadeloupe.

Spanish monks are said to have introduced House Sparrows to Havana, Cuba in 1850 and again in the late 1890s. Today the species is very common and widespread (Raffaele *et al.* 1998), especially in large towns such as Havana and Camagüey.

House Sparrows were unsuccessfully introduced to the Bahamas, at Nassau on New Providence, in 1875 (Palmer 1899, Summers-Smith 1963), where they were reported by Gebhardt (1959) to have been wiped out by a hurricane in 1909. In 1956 or 1959 House Sparrows were seen again in and around Nassau, and since then others have been recorded from Grand Bahama and Eleuthera. Today, the species is locally common in the northern Bahamas and on Grand Inagua in the southern Bahamas (Raffaele *et al.* 1998), at least as far north as Walker Cay. These birds probably arrived as stowaways on ships from Florida.

Argentina

An anonymous account says that House Sparrows were first introduced (? unsuccessfully) to Argentina by European farmers around 1820. In 1872 or 1873 E. Bieckert released about 20 pairs in Buenos Aires in an unsuccessful attempt to control a psychid moth *Oiketicus kirbyi* (*O. platensis* in Summers-Smith 1963). More are believed to have been liberated shortly thereafter, and by 1898 they had dispersed up to 240km from Buenos Aires. By 1909 they had reached Chaco Province, 800km to the north, and by 1917 had spread further north still to Las Palmas and south to Cabo San Antonia (Gibson 1918). By about 1920 Sparrows were established in settled localities throughout the country, and were beginning to invade unsettled areas (Navas 1987), and by the mid-1930s they had spread westwards along the railway to Neuqüén Province in the foothills of the Andes. By 1957 they had penetrated as far south as Ushuaia in Tierra del Fuego, at 54° 51' S the most southerly township in the world, and shortly thereafter were established virtually countrywide (Olrog 1959). See also Narosky & Yzurieta (2000) and Mazar Barnett & Pearman (2001).

[Bolivia]

Dott (1986), from whom much of the following account is derived, has traced the spread of the House Sparrow in Bolivia.

Although according to Summers-Smith (1963) the species first appeared, in the south, in 1928, Eisentraut (1935) says that the first record, at Villa Montes, dates from 1930. Others were seen at three other southern localities in 1936, which suggests that, in the absence of any documented introductions, Bolivia was colonised by natural immigrants from Argentina and, perhaps, Paraguay, in the middle to late 1920s. Thereafter, they may have spread steadily northwards, but although Summers-Smith (1963) says they had reached the capital, La Paz, in west-central Bolivia, in the early 1950s, Dott (1986) stated that by that date they had not yet penetrated to central Bolivia.

Between 1969 and 1975 the distribution of House Sparrows altered dramatically, and many new and widely distributed new localities were colonised – mostly at low or mid elevations but a few at high altitude. On the sparsely vegetated and very cold high *altiplano*, the Andean plateau, Dott (1986) found House Sparrows in small numbers in 1970 and 1975 in Oruro and La Paz, both at an altitude of 3,750m, where in winter night-time temperatures fall regularly to between –10°C and –20°C. This may be the highest elevation at which House Sparrows have ever been recorded. Since it is unlikely that they could have crossed 200km of antiplano and mountain unaided, it seems probable that they arrived in La Paz and Oruro via the railway line. In the central and southern lowlands, Dott (1986) found Sparrows in 1969 to be well established and abundant, though only locally. In the humid Andean foothills and in the northern and eastern lowlands they were even more sparsely distributed. Today, they mainly occur in the tropical and semi-arid slopes of the Andes in southern and central Bolivia and in towns and villages in the lowlands.

Brazil

Summers-Smith (1963) says that House Sparrows were imported to Brazil in 1903 to kill caterpillars that were attacking ornamental shrubs in Rio de Janeiro; his map, however, shows the year as 1905 – the same date as that given by Sick (1957). Smith (1973), on the other hand, says the birds were introduced to kill mosquitoes in the city in 1906, and that in 1910 some were translocated to southern Brazil, where they quickly became established in Rio Grande do Sul.

In the mid-twentieth century House Sparrows expanded their range rapidly in Brazil, reaching Mato Grosso in 1954; Espirito Santo in 1959; Goiás (where they were released to kill noxious insects) in 1963; Piani in 1964; Minas Gerais in 1965; and Ceará in 1968. Summers-Smith (1963) recorded that by the early 1960s the southern states of Rio Grande do Sul, Santa Caterina, Parana, São Paulo, Rio de Janeiro, Espírito Santo, Minas Gerais and parts of Goiás and Mato Grosso had been colonised. The construction of roads in central Brazil since 1957 almost certainly helped to facilitate the House Sparrow's spread northwards; between 1959 and 1964 the birds extended their range 800km along the Belém/Brasília highway to Maranhão and Pará states. House Sparrows made their first appearance in Brazilian Amazonia, at Itinga, in 1973, and by 1979 were widely established (Smith 1980). See also Souza (2002)

Impact: In São Paulo state, *P. domesticus* has been found to be host to the first instar nymphs of *Triatoma sordida* – a vector of Chagas' disease which can prove fatal to man.

Chile

House Sparrows were introduced to Chile by A. Cousino in 1904, at Los Andes and Rio Blanco in Aconagua in 1915 (Hellmayr 1932) and, according to Summers-Smith (1963) at Punta Arenas on the Strait of Magellan, probably by monks from Buenos Aires, in 1918. The birds spread rapidly, and by 1951 were established from Tierra del Fuego and Chiloé Island north to Arica on the Peruvian border, which they reached around 1940 (Philippi 1964). They are today common countrywide in urban localities and farmland (Jaramillo *et al.* 2003).

Impact: Although Johnson (1967: 341–342) claimed that House Sparrows in Chile have '… ousted the indigenous Rufous-collared Sparrow [*Zonotrichia capensis*] and [Common] Diuca Finch [*Diuca diuca*] from many of their former haunts around the towns and forced them to withdraw to the countryside', Vuilleumier (1991) points out that the habitats of the two native species tend not to overlap with that of *P. domesticus.*

[Ecuador]

According to Ortiz-Crespo (1977), House Sparrows reached Guayaquil on the coast of Ecuador (presumably from Peru) in 1969.

[Paraguay]

Wetmore (1926) records the presence of House Sparrows in the capital, Asunción, in 1920, which they had probably reached as natural immigrants from Argentina. They now occur virtually throughout the country.

Peru

House Sparrows were introduced to parks in Lima in 1951, where within 20 years they outnumbered the native Rufous-collared Sparrow *Zonotrichia capensis* (Leck 1973). Summers-Smith (1963) says that in 1953 some were translocated to Callao, 12km west of Lima, where within a decade they had joined up with Sparrows that had spread north from Chile around 1950 and west from Bolivia.

Uruguay

'By the end of the 19th century the House Sparrow was advancing across the border [from Argentina] into Uruguay' (Summers-Smith 1963: 180). There is also believed to have been at least one deliberate introduction from Buenos Aires to Colonia around 1900. By 1913 House Sparrows were said to be common throughout Uruguay (Wetmore 1926). See also Narosky & Yzurieta (2000) and Azpiroz (2003).

Range in South America: By 1963, J. D. Summers-Smith recorded the establishment of *Passer domesticus* over most of the southern half of South America south of 12°-15°S, including most of Argentina, Chile, Uruguay, Paraguay, parts of Brazil, western Peru and parts of Bolivia and Ecuador. By the mid-1980s the species had extended its range northwards into northern Bolivia and Ecuador, and was continuing to spread towards Colombia and Venezuela in the northwest and north, and towards the northeast, through both natural dispersal and inter- and intra-national translocations by man. The birds' apparent reluctance to colonise parts of northern South America may be due at least in part to the need for considerable metabolic and physiological adaptation in some regions (e.g. Kendeigh 1976).

Impact in South America: In some parts of the continent House Sparrows are said to compete for food and, especially, nesting sites, with Rufous-collared Sparrows *Zonotrichia capensis*, Saffron Finches *Sicalis flaveola*, Pale-legged Horneros *Furnarius leucopus*, Bare-faced Ground Doves *Metriopelia ceciliae*, Hooded Siskins *Carduelis magellanica*, Palm Tanagers *Thraupis palmarum* and Common Diuca Finches *Diuca diuca*.

Australia

Table 16 gives details of early introductions of House Sparrows to Australia.

In 1864, only one year after the first successful introduction, the Victoria Acclimatisation Society announced that 'the Sparrow … may now be considered thoroughly established' (Ryan 1906). In South Australia, House Sparrows were reported at Magill, near Adelaide, in 1868, at Mount Gambier in 1874, and on Kangaroo Island in 1893. On Tasmania they became established at Launceston shortly after their release in 1863 or 1867. The population in Queensland is derived from natural dispersal from New South Wales, where Sparrows were established soon after their liberation. Stringent precautions, the presence of the Nullarbor Plain, and the change from horse-drawn to motorised transport prevented House Sparrows from becoming settled in Western Australia (Tarr 1950).

Ryan (1906) reported that House Sparrows had spread out over much of Victoria, southern New South Wales and South Australia, as well as occurring in Tasmania and islands in Bass Strait – as elsewhere usually following human settlement. Tarr (1950) found them to be abundant throughout New South Wales and in many parts of Victoria; in Queensland they had reached as far north as Rockhampton, while in South Australia they ranged north to Marree and west to Tarcoola; they were also common in settled districts of Tasmania and on King and Flinders Islands in the Bass Strait. A decade later, House Sparrows were well established on Kangaroo Island, and in Tasmania had spread north to Moth Creek. In Queensland they first appeared at Atherton in 1865, and before the end of the decade had expanded their range to Tolga and Kairi; by 1978 they were breeding on islands in the Torres Strait.

Frith (1979: 190) described the House Sparrow's range as extending 'from the eastern

TABLE 16 Introductions of House Sparrows *Passer domesticus* to Australia, 1850s–1897.

Date	*Number*	*Introduced to/by*	*Remarks*
? 1850s	?	Victoria	?
1862	60 (or 60 pairs)	Victoria	All died on the voyage from England.
1863	19	Melbourne, Victoria	?
1863	1 pair (?+)	Sydney, New South Wales	Imported from Melbourne, Victoria. Bred successfully; fledglings transferred to Murrurundi in 1865, where they also bred successfully.
1863	?	?	Released at Adelaide, South Australia.
1863	130 (including some Chaffinches)	Melbourne, Victoria	80 released in Melbourne Botanic Gardens and 40 at Partridge Stockade (gaol).
1863 or 1867	?	Hobart and/or Launceston, Tasmania	Imported from Melbourne, Victoria. More later imported from Adelaide, South Australia. Released at Launceston.
1864	125	J. O'Shannasy, Victoria	Released at Boroodata.
1865	6	Victoria Acclimatisation Society (A.S.)	Released at Ballarat.
1866	?	Victoria A.S.	?
1867	?	Thomas Austin, Victoria	Released in various localities in Victoria (see Lever 1987: 455).
1872	100	Victoria A.S.	Released in various localities in Victoria.
?	?	Brisbane, Queensland	All died shortly after arrival.
1897	?	?	First record for Western Australia (Perth).

Sources: Helms 1898; Littler 1901; Ryan 1906.

edge of the Nullarbor Plain throughout South Australia, except the most arid parts, throughout Tasmania, Victoria, New South Wales and Queensland to as far north as Mount Isa at least in the inland and to Cairns on the coast … it has failed to cross the deserts to colonise the Northern Territory'. Pizzey (1980) recorded Sparrows also on some offshore and Great Barrier Reef islands, on those in the Bass Strait, on Kangaroo Island, and on some smaller coastal islets. The map in Barrett *et al.* (2003) shows that while House Sparrows remain most abundant in southeastern Australia and have yet to cross the Nullarbor Plain into Western Australia, they have spread north in Queensland to the Cape York Peninsula and west across the deserts to the central Northern Territory. Overall, however, there has been some decrease in the population during the past two decades.

Impact: As early as 1868 complaints were being made about damage to fruit trees caused by Sparrows, and in 1871 an amendment to the Game Act excluded *Passer domesticus* from its protection – thus in effect declaring it a pest. When the Adelaide to Perth railway line was being constructed between 1912 and 1917 a man was employed to destroy any Sparrows that tried to follow the line and glean scraps from the railhead camps.

Particularly in Victoria, and to a lesser extent in Queensland, House Sparrows consume large amounts of food on poultry farms. Wherever cereal crops are grown they eat growing and stored grain (especially maize and wheat) and germinating seedlings, fruit (mainly cherries, apricots and plums) and vegetables (largely tomatoes and peas). They damage and deface buildings with their droppings, and block gutters, downpipes and drains with their nesting material.

(For the interaction between *P. domesticus* and *P. montanus* see the latter species).

New Zealand

Table 17 gives details of what appear to have been the only recorded introductions of

House Sparrows (of the nominate subspecies) to New Zealand. The birds were imported mainly for nostalgic reasons by immigrants from England, but also to control caterpillars and insects in the grain fields of South Island and in the orchards of North Island. They soon became established and were widely distributed by 1880. According to Thomson (1922: 167), they 'very quickly increased in all parts until they became a very serious pest'.

House Sparrows colonised, either naturally or more probably by ship, the Chatham Islands around 1880 (the map in Summers-Smith (1963: 184) indicates colonisation between 1893 and 1901, while Forbes (1893) suggests an earlier date); Campbell Island around 1907 (Summers-Smith's map indicates between 1900 and 1907), where they died out between 1946 and 1951; Great and Little Barrier, Poor Knights, Kapiti and Stewart Islands around 1930; the Snares in about 1948 (Summers-Smith's map indicates between 1907 and 1948); and Three King's, Mokohinau, Mayor, Karewa, Codfish and the Auckland Islands by 1955 (Summers-Smith's map indicates colonisation of the Aucklands between 1907 and 1946). Wodzicki (1956) suggested a recent occupation of White Island in the Bay of Plenty, where Summers-Smith's map indicates an arrival between 1925 and 1947. Wodzicki (1965: 433) described the House Sparrow as 'widely distributed and abundant, North, South, Stewart, and Chatham, Auckland, Snares and Campbell Islands'. Falla *et al.* (1979) said that House Sparrows were widespread throughout New Zealand, not always (as elsewhere) in association with man. In the north they frequent the unlikely habitats of saltings and mangrove swamps.

House Sparrows are now 'common throughout the mainland and inhabited offshore islands, and the Chathams and Norfolk Island, are recorded from the Antipodes, The Snares, Auckland and Campbell Islands' (Heather & Robertson 1997: 412). Baker (1991) records breeding on the Chathams, Campbell, Auckland and Snares Islands. They live principally in arable farmland, rural and suburban gardens and parks, and in the vicinity of grain stores.

Impact: As early as 1882 the Small Birds Nuisance Act was passed in an attempt to control House Sparrows and other small introduced pest species. Dawson (1970) estimated the average grain loss through House Sparrow depredation at between five and 20%. 'House Sparrows', wrote Heather & Robertson (1997: 413), 'are probably the most economically important bird pest in New Zealand, by causing serious damage to wheat, barley, and maize crops, and lesser damage to oats and seedling peas and brassicas. They also attack grapes, cherries, and other ripening fruit, and feed on grain products being fed to livestock and poultry'. In compensation they eat large quantities of destructive beetles, caterpillars, leafhoppers, grasshoppers and flies (Heather & Robertson 1997).

TABLE 17 Introductions of the House Sparrow *Passer domesticus* to New Zealand, 1859–1869.

Date	*Number*	*Introduced by*	*Remarks*
?1859	300	'Mr Brodie'	Soon disappeared.
1862	1	Nelson Acclimatisation Society (A.S.)	—
1864	?	Nelson A.S.	Only a single bird survived the voyage from England.
1865	72	Auckland provincial government	Two survivors released.
1866	?	Wanganui A.S.	—
1867	40	Canterbury A.S.	Released at Kaiapoi and bred in 1868.
1867	47	Auckland provincial government	Released.
1868	3	Otago A.S.	Released.
1869	11	Otago A.S.	Released.
1871	6	Nelson A.S.	Released at Stoke and soon established.

Source: Thomson 1922.

Ascension Island
House Sparrows introduced to Georgetown at Christmas 1985 continue to survive in very small numbers (Summers-Smith 1988, Clement *et al.* 1993, Rowlands *et al.* 1998). See also McCulloch 2004.

Azores Islands
According to Agostinho (1963), large numbers of House Sparrows from Portugal (? *P. d. balearoibericus*) were released at Lajes airport on Terceira in 1962, and within two years the entire island had been overrun. By 1970 the birds were breeding residents on Graciosa, São Jorge, Pico, and Faial (Le Grand 1983) and they had reached São Miguel in 1972 or 1973 and Flores a decade later. Only Santa Maria and Corvo were not yet overrun. Summers-Smith (1988) estimated the population in 1984 to number between 50,000 and 60,000.

Bermuda
D. B. Wingate (pers. comm. 1981) said that the House Sparrow was a 'deliberate introduction in 1870 and 1874 "for house fly control in the towns". The first introduction of a few birds was to St Georges by the mayor Mr W. C. J. Hyland. The second involving about 50 birds was to Hamilton. Both introductions were imported from New York, USA [where the birds are of the nominate form] …. The Sparrow rapidly increased to abundant before 1900 … it is now the most abundant land bird on Bermuda'.

Until after the Second World War Bermuda relied exclusively on horse-drawn transport, and this, as in North America, undoubtedly contributed to the House Sparrow's successful establishment in Bermuda, where it is now common and ubiquitous (Raine 2003).

Impact: House Sparrows in Bermuda have largely displaced the endemic race of the Eastern Bluebird *Sialia sialis bermudensis* as a cavity-nester on the islands.

Canary Islands
According to Langley (2004), House Sparrows are becoming established in the Canary Islands. They are a recent arrival, probably by ship, to Gran Canaria, where they first bred in 1998 (Martí & del Moral 2003).

Cape Verde Islands
Bourne (1966) suggested that House Sparrows may have reached the Cape Verde islands as stowaways on ships from Europe between 1922 and 1924, when a dozen were collected on São Vicente. By 1965 they were common in central Mindelo and the Porto Grande on São Vicente, but apparently had spread to no other islands. In 1983 Summers-Smith (1984) found them to be restricted to the town and impoverished farmland in the south. On São Vicente, *P. domesticus* has hybridised with the Spanish Sparrow *P. hispaniolensis*, which arrived, presumably naturally, but possibly by ship. House Sparrows remain restricted to São Vicente, where they are common in Mindelo and its environs, at Ribeira da Vinha, and at oases in the interior. (Hazevoet 1995).

Falkland Islands
Hamilton (1944) states that about 20 House Sparrows arrived in the town of Stanley on East Falkland on board a whaling factory ship from Montevideo, Uruguay, in October 1919, and in later years they were probably joined by more from other visiting vessels. Although Bennett (1926) claimed that by 1924 they had spread throughout the archipelago, Hamilton (1944) found them only in Stanley. By about 1960 House Sparrows had dispersed 96km westwards to Darwin and 48km northwest to Teal Inlet (Cawkell & Hamilton 1961). Woods (1975) recorded them at Goose Green Patch – also on East Falkland.

In 1958–59 small group of House Sparrows became established on West Point and Carcass Islands off West Falkland; their origin is uncertain, but they may have arrived by ship or as storm-borne waifs from South America or on inter-island boats from Stanley, or alternatively as natural dispersers. Although by 1980 the West Point colony numbered around 50 individuals (R. Woods pers. comm. 1985) it is believed to have since died out. Today, House Sparrows are numerous only in Stanley.

Andaman Islands; Nicobar Islands

Abdulali (1964) says that about half-a-dozen House Sparrows of the form *indicus* were imported to Ross Island by O. H. Brookes in 1882, followed by 20 more in 1895; Abdulali (1964) found them to be quite common at Port Blair on South Andaman, with some also at Choldhari. From the Andamans House Sparrows may have spread naturally to the Nicobar Islands.

Chagos Archipelago

House Sparrows were first recorded by the Percy Sladen Trust expedition of 1905 on the islands of Salomon and Peros Banhos, to which they were said to have been introduced from Mauritius (Bourne 1971). Hutson (1975) found them to be still common on both these islands.

Comoros Islands

House Sparrows were first recorded on Grande Comore in 1879, in settled areas of Mohéli in 1903 (Grote 1926) and on Pamanzi in 1943 where, according to Summers-Smith (1963), they were introduced by occupying troops, and are of the Sudanese race *rufidorsalis*. Watson *et al.* (1963) recorded Sparrows as common on Grande Comore and as present in settled localities on Mohéli and on Pamanzi. Summers-Smith (1963: 185) said that 'on Mohéli they are present in every village, while on the Grand Comoro they are found in only one; C. W. Benson … could not detect any difference between the islands …'. Louette (2004) and Hawkins & Safford (in prep.) say that House Sparrows occur in many (perhaps most) towns on the islands of Grande Comore and Mohéli, but that the populations may fluctuate. House Sparrows have not been recorded on Anjouano. On Mayotte, where they are also established, the House Sparrows' range is increasing, but they are currently restricted to Dzaoudzi, Mamoudzou and to the adjacent coastal area from Koungou to Dembeni and Mbouzi islet (Louette 1999, 2004, Hawkins & Safford in prep.). See also Sinclair & Langrand (2003).

Christmas Island

Hawkins & Safford (in prep.) record the presence of House Sparrows on Christmas Island.

Madagascar

On Madagascar, House Sparrows are confined to an area of around 50km around Tamatave on the east coast (Hawkins & Safford in prep.). Their date of arrival and origin are apparently unrecorded. In 2004 F. Hawkins saw one in Antananarivo, which represents a significant extension of range (R. Safford pers. comm. 2004).

Maldive Islands

According to Ash (1984a), House Sparrows of the form *P. d. indicus* were a recent immigrant in the Maldives, where they occurred only on Malé. Whether they arrived naturally from southern India or by ship is unknown.

Impact: Ash (1984a) expressed his concern should *P. domesticus* spread to other islands in the archipelago on which millet *Panicum* sp. is grown.

Mascarene Islands

Clark (1859) says that British soldiers brought House Sparrows from India (*P. d. indicus*) to Mauritius in about 1856 or 1857, and that they were released in the barracks at Port Louis, where by 1859 they were well established and rapidly increasing. They were numerous throughout the island by 1910 (Meinertzhagen 1912) and remain so (Staub 1976, Cheke 1987), including in forest clearings and on small islets (Hawkins & Safford in prep.), but especially in parks, gardens, and urban areas (Jones 1996).

House Sparrows that had escaped from an aviary were recorded as breeding on Réunion in 1845 by Henri (1865). During the next few years the birds spread throughout St Denis, and are now widespread and abundant on the island (Staub 1976, Barré & Barau 1982, Cheke 1987) in villages but are less common at higher elevations (Hawkins & Safford in prep.).

Bertuchi (1923) reported the presence of Sparrows on Rodrigues in 1916, although

Cheke (1987) believed they may have been introduced earlier. They are common and widely distributed today (Cheke 1987), including in forest clearings and on most islets (Hawkins & Safford in prep.). They have also been seen on Île Coco (Showler 2002).

Impact: A. S. Cheke (pers. comm. to Jones 1996) pointed out that the decline and subsequent extinction on Mauritius of the Java Sparrow *Lonchura oryzivora* in the mid- and late nineteenth century respectively coincided with the establishment of *P. domesticus.*

Seychelles Islands

Gaymer *et al.* (1969) found House Sparrows to be established and common on the islands of Alphonse and D'Arros. According to Skerrett *et al.* (2001), they are of the form *indicus* (Israel to Laos) . Penny (1974: 110–111) said 'It occurs and breeds on Desroches, Resource, St Joseph, D'Arros and probably other islands …'. Skerrett *et al.* (2001) and Hawkins & Safford (in prep.) record it as also occurring on Rémire, Desnoeufs, Marie-Louise, Bijoutier, St François and Alphonse, and as breeding on Ressource, Var and St Joseph. It has also been recorded on the granitic group of islands.

Although the origin of House Sparrows in the Amirantes is uncertain, Skerrett *et al.* (2001) point out that the Asian form of the Indian House Gecko *Hemidactylus brookii* (see Lever 2003) exists in the Seychelles only on Desroches (where it was introduced prior to 1909), and it is likely that it and *P. domesticus* were stowaways on vessels from India. Alternatively, House Sparrows could have arrived in the Amirantes via Mauritius, the source of other introductions to the Seychelles.

Easter Island

In 1928 House Sparrows were introduced from Chile to Easter Island, where they quickly became established; the reason for the introduction is unknown (Philippi 1964, Sick 1968, Vuilleumier 1991, Jaramillo *et al.* 2003).

Hawaiian Islands

The earliest reference to House Sparrows in the Hawaiian Islands that Thrun (1909) was able to trace was to 'a further supply' in 1859, signifying an earlier introduction that presumably failed. In 1871 nine Sparrows from New Zealand were released in Honolulu on Oahu, where by the end of the decade they were said to be numerous. As late as 1902, however, they were not reported from outside Honolulu, and it was not until 1917 that they began to appear on other islands, presumably as a result of further importations and/or translocations (Caum 1933). Peterson (1961), Summers-Smith (1963), Zeillemaker & Scott (1976) and Berger (1981) reported them to be common on all the main inhabited islands (but less so on Kauai and Niihau) and to occur as vagrants on Kure and Midway atolls. They live principally in settlements, ranch paddocks, feedlots and camping grounds (Scott *et al.* 1986). Pratt *et al.* (1987: 312) describe House Sparrows as 'common to abundant in cities and towns' and the AOU (1998:679) says they have spread 'throughout all main islands'. According to Johnston & Selander (1964), House Sparrows in the Hawaiian Islands differ markedly in their plumage from European and North American mainland populations.

Impact: Three out of a flock of nine House Sparrows on Oahu were found to be infected with the malarial parasite *Plasmodium cathemerium* – the first record for this species from any Pacific Island (Berger 1981).

Juan Fernandez Islands

House Sparrows arrived in the Juan Fernandez archipelago in about 1943, probably as stowaways on a ship from Valparaiso in Chile, and are established on Más á Tierra and Más á Fuera Islands (Summers-Smith 1963, Philippi 1964, Vuilleumier 1991, Jaramillo *et al.* 2003).

New Caledonia

Palmer (1899) reported the presence of House Sparrows on New Caledonia, where they soon became established in settled areas (Leach 1928, Delacour 1966, Long 1981).

Norfolk Island

Williams (1953) says that House Sparrows colonised Norfolk Island in about 1939; the map in Summers-Smith (1963: 184) indicates a date between 1913 and 1939. It seems probable that they arrived as stowaways on a ship from Australia or New Zealand. Smithers & Disney (1969) found them to be abundant in villages, around homesteads and in neighbouring pastures – a status confirmed by Heather & Robertson (1997). See also Barrett *et al.* (2003).

Vanuatu

Cain & Galbraith (1957) record the presence of *P. domesticus* in the New Hebrides; how and when the species arrived and its present status, are unknown.

Summary: Summers-Smith (1963, passim) summed up the results of House Sparrow introductions worldwide and the future of naturalised populations.

> The outstanding thing about these introductions has been their extraordinary success. The main reason for this has been the lack of competition from native species. No bird of any other genus has exploited and adapted man-made urban habitats to anything like the extent of the House Sparrow and thus there were no real competitors …. It is interesting that the House Sparrow appears to have been less successful in other parts of the world [this was written before the species' major African expansion]. Here is the one place where members of the genus *Passer* were already established …. In North and South America the pattern of spread appears to have been very similar: first the cities and larger towns were occupied and from these the birds infiltrated to the villages and populous farming areas. The main factor responsible was most probably the transportation of grain …. In North America, the limit in the north is already the limit of cultivation … to the south it is probable that the bird will continue to spread southwards in Central America.
>
> In South America … consolidation of that area of the sub-continent already occupied [and] a further extension of range on the west coast [appears likely] …. It seems improbable … that the House Sparrow will for long be denied entry to Western Australia but extensions in other parts of Australia appear unlikely. Further spread is to be expected in South Africa despite competition from related species …. In the last hundred years its range has more than doubled [to some 32 million sq km] and at present it occurs on about a quarter of the earth's surface ….

Eurasian Tree Sparrow
Passer montanus

Natural Range: Most of Eurasia (except S Iran, the Middle East and India) S of the tundra and taiga zones, from W Europe eastwards to China and Japan, S to Malaysia and Indonesia.

Naturalised Range: Europe: France (Corsica); Italy (Sardinia); Malta. Asia: Borneo (Brunei, Sabah, Sarawak); ?India; Lesser Sunda Is; Molucca Is; Pescadores Is.; Philippine Is; ?Singapore; Sulawesi. North America: Canada; USA. Australasia: Australia. Atlantic Ocean: Canary Is. Indian Ocean: ?Christmas I. Pacific Ocean: Mariana Is; Marshall Is; Federated States of Micronesia.

France (Corsica)

Ivanov & Summers-Smith (1997) say that Tree Sparrows colonised the island of Corsica during the twentieth century, though whether as natural immigrants or as ship-borne stowaways cannot be determined.

Italy (Sardinia)

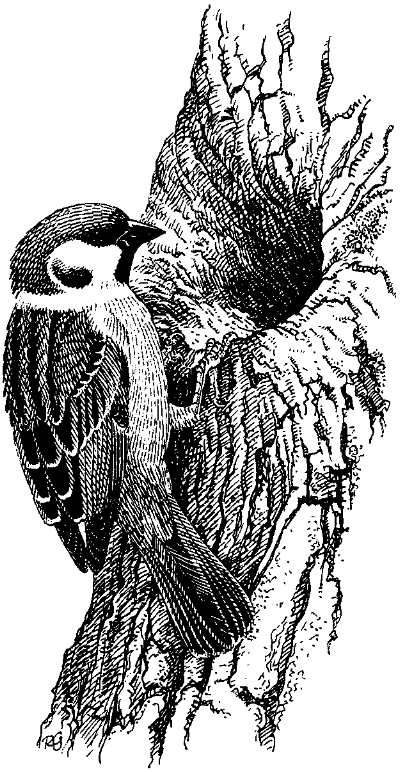
According to Voous (1960), the Eurasian Tree Sparrow on the island of Sardinia was introduced by man; this is likely to have been by ship from Naples (J. D. Summers-Smith pers. comm. 1985), where the nominate subspecies occurs in the city centre, during the twentieth century (Ivanov & Summers-Smith 1997). This introduction is not referred to by either Baccetti *et al.* (1997) or Bertolino (1999).

Malta

Ivanov & Summers-Smith (1997) say that *P. montanus* colonised Malta during the twentieth century, though whether naturally or through the intervention of man is uncertain.

Borneo (Brunei; Sabah; Sarawak)

Although *Passer montanus* is said by C. Vaurie (in Peters 1962) to have occurred on the island of Borneo as early as the 1950s, no specific localities are mentioned. Gore (1964) reported a small group in the port of Sandakan in Sabah, where a breeding colony became established in the docks area and from where the birds spread to other parts of the town. Smythies (1981) recorded Tree Sparrows in Sarawak in 1965, and Gore (1968) found some on Labuan Island off Sabah in 1966. Harrison (1974) saw the species in Brunei in 1969. These birds probably arrived as stowaways on ships from Singapore and/or Hong Kong (Medway & Wells 1976, Summers-Smith 1988).



Eurasian Tree Sparrow

India

Raju & Price (1973) reported a small isolated population of Tree Sparrows, believed to be of the race *malaccensis* (Himalayan foothills to southeast Asia), in the Eastern Ghats in Andra Pradesh. The origin of these birds is uncertain, but they may well represent an introduction by man. Price (1979) estimated the population at under 500, and believed it was declining.

Lesser Sunda Islands; Moluccas Islands

C. Vaurie (in Peters 1962) says that Tree Sparrows (*malaccensis*) have been successfully introduced to the island of Ambon in the Moluccas and Lombok in the Lesser Sunda Islands; on the latter, Summers-Smith (1988) says they may be natural immigrants from Bali. Dickinson (2003) confirms that the subspecies is *malaccensis.*

Pescadores Islands

According to Horikawa (1936) and Hachisuka & Udagawa (1951), Tree Sparrows from Formosa (Taiwan) were released on the Pescadores Island in the Formosa Strait between Taiwan and mainland China by a Chinese named Rosuirin in about 1728. The form in the Pescadores, where Tree Sparrows are established on the islands of Yü-weng Tao, P'eng-hu Yao, Pa Chao Hsü and Ta Hsü, is said by Peters (1962) to be *dilutus* (Iran and Pakistan to Mongolia). The form native to Taiwan is, however, *saturatus* (Dickinson 2003).

Philippine Islands

Between 1893 and 1896 Tree Sparrows were recorded in Manila on the island of Luzon and in Cebu City on Cebu by Whitehead (1899), who believed they had been imported from China before about 1850. Delacour & Mayr (1946) found them to be well established and common in many settled localities on both islands. According to Parkes (1959), the subspecies on Luzon is *saturatus* and was imported from Japan or Taiwan and that on Cebu is *malaccensis* and came from the Malay Peninsula. Du Pont (1971) said that the latter had also occurred on the island of Negros. Clement *et al.* (1993) say that now all inhabited islands have been colonised. Dickinson (2003) confirms that the form occurring in the southern Philippines is *malaccensis* and that in the north *saturatus.* See also Ivanov & Summers-Smith 1997.

Singapore

Although Robinson & Chasen (1927) suggest that Tree Sparrows may have been introduced to Singapore after its settlement by the East India Company in 1819, Ward (1968) believed that the species might have already been established in the region prior to European colonisation, having spread southeastwards down the Malay Peninsula, perhaps on coastal trading vessels, in the sixteenth and seventeenth centuries. It is today a common and ubiquitous resident (Seng 1997).

Sulawesi

Tree Sparrows (of the race *malaccensis*) (Peters 1962) have been introduced to Sulawesi, where Stresemann (1936) said they were then restricted to the southern peninsula: since then they have become established in numerous localities (Escott & Holmes 1980). Dickinson (2003) confirms that the form in Sulawesi is *malaccensis.*

United States; Canada

For much of the history of the Eurasian Tree Sparrow in the United States I am indebted to Flieg (1971).

In 1870 Carl Daenzer released 12 pairs of Tree Sparrows of the nominate form (Merrill 1876), which had been imported from Germany by a bird-dealer named Kleinschmidt, in Layfayette Park in southern St Louis, Missouri. The birds soon became established, apparently because the presence of breweries started by German immigrants provided an abundant supply of grain. In 1877 the larger and more aggressive alien, the House Sparrow *Passer domesticus*, arrived in St Louis, and forced Tree Sparrows to disperse outside the city limits, where they re-established themselves in Tower Grove Park and the Missouri Botanical (Shaw's) Garden. Here they remained until the 1890s when encroachment by man and *P. domesticus* compelled them to move again, this time to several suburban districts including parts of St Charles and St Louis Counties and to Creve Coeur Lake, from where they subsequently spread 50km westwards to Washington on the Missouri River.

By the early twentieth century Tree Sparrows had crossed the Mississippi River into western Illinois, and by 1922 they occurred in Madison, Jersey, Calhoun, St Clair, Jersey and Monroe Counties. In 1925 they first appeared in Fulton County, Kentucky, 220km southeast of St Louis. As in the case of the House Sparrow they are believed to have travelled on the paddleboats that plied the Mississippi River.

During the late 1930s, Tree Sparrows increased their range in Illinois, and after the Second World War began to occur more frequently outside an 80km radius of St Louis. In the 1950s the centre of the population gradually moved from Horseshoe Lake, which they had colonised in 1938–39, to Grand Marias State Park, East St Louis. By the end of the decade, when they occurred mainly in east-central Missouri and western Illinois, Tree Sparrows were dispersing slowly to the north and northeast.

Between 1959 and 1962 Tree Sparrows extended their range north from St Louis 175km up the Mississippi River to Quincy and south to Modoc, and 140km northeast up the Illinois to Cass County, Virginia; by the end of the decade they were established along the Illinois for 100km between Hardin and Beardstown, and eastwards to Sangamon County. Although on the Missouri River they had still spread no further west than Washington, some places from which they had disappeared had been recolonised. Almost a century after its introduction, the Tree Sparrow's expansion of range was still closely associated with major river systems.

Between the 1970s and 1990s the Tree Sparrow spread into several western midwestern states, including Iowa in 1987, Minnesota in 1990 and Wisconsin, Indiana and Michigan in the 1990s (Lang 1992, Svingen 2000).

The AOU (1998: 679) described the Eurasian Tree Sparrow's distribution in North America as '… east central Missouri and western Illinois, with stragglers reported in southern Manitoba, southern Ontario [Canada], Minnesota, Wisconsin, southeastern Iowa … Indiana … and western Kentucky …'.

Flieg (1971) found that the Tree Sparrows' expansion of range had followed a well-defined pattern; when flocks disperse in spring the birds scatter and settle over a wide area, those occurring in the most densely populated localities spreading furthest to find enough space for each breeding pair. The relatively low-density populations in urban areas and in southern Missouri required little if any more space for breeding than for overwintering.

The preferred habitat of Eurasian Tree Sparrows in North America is agricultural land, rich in food, nesting sites, shelter and roosting places. In autumn and winter the birds form flocks several hundred strong, from which in spring mated pairs disperse to breed. The species' distribution in North America is discontinuous because of an absence of unbroken suitable habitat.

St Louis & Barlow (1988) found that the introduced populations in the United States were less variable genetically than the ancestral German stock, presumably a result of the founding event. The smaller body size of North American *P. montanus* in comparison to German birds may be either a result of interspecific interactions or of flight habits, or a combination of both. It could also be a consequence of the founder effect (E. F. J. Garcia pers. comm. 2005). Significant disparity in bill morphology between North American and German birds may reflect differences in diet between the two populations. North American birds seem to be just as variable morphologically as German ones, despite their lower genetic variation (St Louis & Barlow 1991).

Australia

In 1863 between 30 and 40 Tree Sparrows (*P. m. saturatus*), imported from China by G. W. Rusden on behalf of the Victoria Acclimatisation Society (see Lever 1992), were liberated in the Melbourne Botanic Gardens and in the Partridge Stockade (prison), and in the same year a further 20 were freed in the St Kilda district of Melbourne; in 1864 another 40 (including some *malaccensis* from Java) were released at St Kilda and Ballarat, a few more possibly in 1870, and 70 in 1872. In 1864 the Victoria Acclimatisation Society announced that the species was 'thoroughly established'. Some sent later from Melbourne to Sydney, New South Wales, soon became settled, but others despatched to Tasmania apparently disappeared (Ryan 1906).

By the turn of the twentieth century Tree Sparrows had spread south from Sydney to Junee in New South Wales, and by the outbreak of the First World War they were fairly common around Wangaratta in Victoria (200km northeast of Melbourne) and in most of the townships in the Riverina in New South Wales (Hobbs 1961). By the early 1930s, Tree Sparrows had spread 240km north of Junee and 640km northeast from Melbourne. Although as late as the mid-1950s they were still most abundant around Melbourne, by the late 1940s they were starting to disperse along the Melbourne to Sydney railway (Tarr 1950). In the second half of the following decade they became established in several new localities in New South Wales and in some towns in northern Victoria.

Pizzey (1980) recorded Tree Sparrows as established from Melbourne and towns of central and northeastern Victoria to southern New South Wales, northeastwards to Sydney, Newcastle and the Hunter River Valley. In Victoria, they occurred as far west as Dimboola (300km northwest of Melbourne) and in New South Wales 300km west of Sydney. Summers-Smith (1988) recorded them as far north as Wellington in New South Wales. Chapman (2000) reported the eradication in 1998 of a breeding colony of Tree Sparrows in Darwin in the Northern Territory, which had probably been introduced accidentally from southeast Asia.

The Tree Sparrow in Australia has not been as successful a colonist as the House Sparrow, and its populations seldom approach those of the latter. The habitat preferences of the two species vary sharply interspecifically from one part of their range to another. The species' range in Australia remains largely unchanged (Barrett *et al.* 2003).

Impact: Tree Sparrows in Australia are spreading much more slowly than House Sparrows, and are probably suffering from interspecific competition with their larger and more aggressive congeners; in general, *domesticus* is closely associated with man, while *montanus* is more usually found in suburban and rural areas. The interaction of both species with native birds is uncertain.

In suburban localities both species are significant pests of horticultural crops: in rural districts both compete for food with domestic poultry and eat large quantities of growing and stored grain (Frith 1979).

Canary Islands

In 1989, Tree Sparrows were found to be breeding on Gran Canaria (Ivanov & Summers-Smith 1997). These birds may have been natural immigrants from Iberia (E. F. J. Garcia pers. comm. 2005) or perhaps arrived by human agency (Trujillo Ramirez 1993).

Christmas Island

Barrett *et al.* (2003) refer to a record of this species on Christmas Island.

Mariana and Marshall Islands; Federated States of Micronesia

Tree Sparrows, probably of the form *saturatus* (Summers-Smith 1988), introduced to the Mariana Islands were reported by Ralph & Sakai (1979) to be common on Saipan and Rota and uncommon on Guam. Pratt *et al.* (1987: 313) said they were 'Introduced (probably [by the Japanese] in the 1940s) to the Mariana Is. (common on Guam; uncommon Saipan, Tinian, Rota) and Kwajalein (Marshall Is.) … and after 1978 to Yap [Federated States of Micronesia]'. Clements (2003) records them as common but local in most urban localities.

Spanish Sparrow
Passer hispaniolensis

Natural Range: SW Europe, N Africa, W Asia Minor and the Balkans; Levant, Cyprus and E Turkey to S Kazakhstan, Xinjiang and Afghanistan. Some winter in NE Africa and SW Asia.

Naturalised Range: Asia: Kuwait. Atlantic Ocean: Cape Verde Is; ?Canary Is.

Kuwait

A small colony of this species has bred annually at the Mohammed Al-Ajmi Farm at Abdali, and occasionally at other places, since before 2003 (Gregory 2004).

Canary Islands

Spanish Sparrows arrived in the Canaries (possibly as ship-borne stowaways) in the early nineteenth century. From 1820 to 1830 they were restricted to Fuerteventura and Lanzarote, from where they spread to Gran Canaria before 1856; they arrived on Tenerife between 1871 and 1887 – perhaps as a deliberate introduction around 1880 (Lack & Southern 1949). By the early twentieth century they were abundant in Santa Cruz on La Palma, and by 1949 had spread to Gomera (Cullen *et al.* 1952). They occur today on all the islands except La Graciosa (Martí & del Moral 2003). Martí & del Moral 2003 imply natural colonisation of the archipelago.

Impact: On some islands in the Canaries Spanish Sparrows have driven the indigenous Rock Sparrow *Petronia p. petronia* from settled areas. They are also a pest of growing crops, but are regarded by the human inhabitants as a culinary delicacy.

Cape Verde Islands

Spanish Sparrows were first recorded in the Cape Verde Islands (São Nicolau and São Thiago) in 1865. By 1898 they had apparently spread from here to Brava, Fogo, Boa Vista and Maio (Fea 1898–99; Alexander 1898). They may have arrived naturally but possibly by ship. They are now established on all the inhabited islands except perhaps Santa Luzia (Hazevoet 1995).

PLOCEIDAE (WEAVERS AND ALLIES)

Village Weaver
Ploceus cucullatus

Natural Range: Africa S of about 15°N apart from E Ethiopia, E Somalia, N Angola, Namibia, W Botswana and W South Africa.

Naturalised Range: Europe: ?France; ?Germany; ?Italy; ?Spain; Portugal. North America: West Indies. South America: ?Venezuela. Atlantic Ocean: ?Canary Is.; ?Cape Verde Is. Indian Ocean: Mascarene Is.

France; Germany; Spain
Breeding attempts by Village Weavers in France have been recorded at Lake Saclay near Paris by Le Maréchal (1985) and elsewhere (and in Germany) by Pezzo & Morellini (1999), and also in Spain, where breeding has occurred in the Llobregat delta, southwest of Barcelona (J. Clavell in Martí & del Moral 2003, Guerrero *et al.* 1989), but the species' establishment is unconfirmed (Lahti 2003).

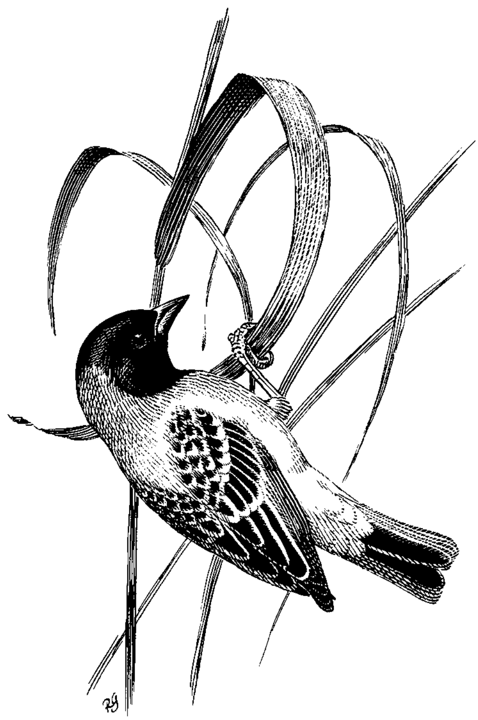
Italy
Breeding by Village Weavers has been attempted in Trentino in northern Italy (Frapporti 1983), and occurred in 1992 in Bonifaca di Maccarese west of Rome (Biondi *et al.* 1995). Pezzo & Morellini (1999) reported a breeding attempt at Montepulciano Lake in Sienna in central Italy, where they suggest the species may be becoming established.

Portugal
In 1996 three male Village Weavers were seen in the Barroca Marsh east of Lisbon, where breeding was strongly suspected (Leitão & Costa 1996), and in the following year a small colony of five nests was discovered; in this area the species is currently confined to rice-fields, and Costa *et al.* (1997) believed that their principal limiting factor is the extent of cultivation of this crop; they point out, however, that large-scale rice cultivation occurs in the Ribatejo Valley to the north, where the species could expand its range.

Village Weavers are recorded by Vowles & Vowles (1994) as breeding in the Arade River valley in the Algarve in extreme southern Portugal.

Costa *et al.* (1997) and Langley (2004) list *P. cucullatus* as an uncommon but increasing breeding species in Portugal.

West Indies
Exactly when Village Weavers of the nominate subspecies were introduced to Hispaniola is uncertain, but they may have been imported as cage-birds by Spanish slavers from West Africa at any time after 1512. According to the historian Moreau de Saint-Méry (*Description de la Partie Française de Saint-Dominique*, 1797–98. Vol I: 300; Vol II:



Village Weaver

426: quoted by Wetmore & Swales 1931), some had previously been imported from Senegal and elsewhere in West Africa to the town of Cap Française in Haiti, where Fitzwater (1971) said a large colony had become established in 1783 near Tron Caiman.

In 1927 a small population of Weavers was discovered at Cul-de-Sac in Haiti, and by about 1930 the species had become a local resident in various parts of Haiti, especially near Port d'Estere; a few years later a small breeding colony was found north of Trouin (Wetmore & Lincoln 1933). The species remained at low densities and maintained its restricted distribution on Haiti (Lahti 2003) until the early 1960s, when the population increased dramatically and the birds began to spread east into the Dominican Republic.

Although *P. cucullatus* has occurred on Martinique in the Lesser Antilles since before 1963, breeding was not confirmed until 1980 (Pinchon & Benito-Espinal 1980), and a few years later the species was well established around Prêcheur (Barré & Benito-Espinal 1985).

Bond (1979: 224) described the range of the Village Weaver as '… in Haiti in particular the Cul-de-Sac plain, including Port-au-Prince. Has in recent years become widespread in Hispaniola … and [on] Saona Island' off the southeast coast of the Dominican Republic. Raffaele *et al.* (1998), who say the species was introduced during the early colonial era and was first recorded on Haiti in 1796, say it is now widespread and common on Hispaniola and Saona Island. On Martinique, where the same authors say it was introduced in the 1970s, they recorded it as locally very common in the north of the island. The AOU (1998) adds Catalina Island (near Saona) to the species' range in the West Indies. Lahti (2003) considered that the population on Hispaniola is declining.

Impact: The population explosion on Haiti in the 1960s resulted in massive depredations of the rice crop of up to 35% and many trees were killed by defoliation for nesting material (Fitzwater 1971, Barré & Benito-Espinal 1985, Raffaele *et al.* 1998).

Venezuela

In recent years Village Weavers have been found breeding near Lake Maracaibo, 800km south of the Dominican Republic and 1,200km east southeast of Martinique (R. Restall pers. comm. to Lahti 2003). Whether the species is established in Venezuela is unknown.

Canary Islands

Singing males were recorded on Tenerife in 1997 and 1999 but the species is probably not established there (J. Clavell in Martí & del Moral 2003).

Cape Verde Islands

Bannerman & Bannerman (1968) say that Village Weavers of the nominate subspecies were introduced to Praia on São Thiago before 1924, but later apparently died out. A breeding attempt on São Vicente in 1993 by a small number of birds (<10) was recorded by Hazevoet (1995), but reproduction was not confirmed.

Mascarene Islands

In about 1886 Village Weavers from South Africa (*P. c. spilonotus*) were released at Cap Malheureux on Mauritius, from where they dispersed rather slowly (Carié 1916). By the 1950s they were found to be increasing (Newton 1958), and they are now very widely distributed below about 300m (Cheke 1987), especially in the lowlands, but do not occur in forests, tree plantations or on most off-lying islets (Hawkins & Safford in prep.).

Although not appearing in the literature before Guérin (1940–53), some Village Weavers are known to have escaped from a cage on a vessel loading sugar cane at Bois Rouge on Réunion, a plantation owned by Adrien Bellier (Albany 1974, A. Barau pers. comm. to Cheke 1987). This could only have occurred during the brief period when there was a jetty there around 1880 (A. Barau pers. comm. to Cheke 1987). Staub (1976) and Barré

& Barau (1982) recorded them as common in lowland areas. Today they occur in the lowlands in coastal regions, inland savannas and sugar cane plantations, locally ascending to higher elevations such as Plaine des Cafres, but absent from forests and montane heath (Barré *et al.* 1996, Hawkins & Safford in prep.). See also Simberloff (1992), Moulton *et al.* 1996 and Jones (1996).

Impact: By the 1950s on Mauritius (Benedict 1957) and the early 1980s on Réunion (Lahti 2003), Village Weavers had become a serious agricultural pest, especially of seed crops. Barré & Barau (1982) regarded the species as the worst avian pest on Mauritius.

The disappearance from Mauritius shortly after 1922 of the Yellow-crowned or Cape Canary *Serinus canicollis* could have been due at least in part to competition from Village Weavers (C. Jones 1996).

Peters (1962) suggested that Village Weavers of the nominate subspecies probably occurred on São Tomé in the Gulf of Guinea as a result of human intervention, and Christy & Clarke (1998) said that *P.c.nigriceps* (Angola, Zambia, Namibia, Botswana and Zimbabwe) had probably been introduced quite recently. Dickinson (2003), however, lists only one weaver, the endemic Giant Weaver *P. grandis* on São Tomé.

Golden-backed Weaver
Ploceus jacksoni

Natural Range: SE Sudan, W and S Kenya, Uganda, and N and C Tanzania.
Naturalised Range: Asia: UAE.

United Arab Emirates
This species was first recorded at Khalidiya Spit in Abu Dhabi in about 1992 and in the following year at Zabeel Fish Ponds, Dubai. It has since bred annually at these two sites, where the populations number up to 10 pairs and around 50 individuals respectively (Anon 2004, Jennings 2004).

Lesser Masked Weaver
Ploceus intermedius

Natural Range: Sub-Saharan Africa from S Sudan, Ethiopia and Somalia to N Angola and Mozambique.
Naturalised Range: Asia: Japan; UAE.

Japan
This species is listed by the OSJ (2000) as a resident breeder in Chiba, east of Tokyo, in central Honshu, where it frequents open woodland, cultivated fields, and parks.

United Arab Emirates
A breeding colony of around 100 (in 1989) Lesser Masked Weavers has been established in Al Jazeerah Park, Sharjah, following a mass release in about 1984 (Richardson 1992). Jennings (2004) confirms breeding near Dubai.

Streaked Weaver
Ploceus manyar

Natural Range: Pakistan to Thailand and S Vietnam. Also Sri Lanka, Java, Bali and Bawean.
Naturalised Range: Asia: Bahrain; ?Saudi Arabia; ?UAE.

Bahrain
'Present in small flocks all year round in a reedbed at Janabiyah where they must breed' (Hirschfeld & King 1992: 13).

Saudi Arabia; United Arab Emirates
Jennings (2004) records breeding by this species in Saudi Arabia (Riyadh) and in the United Arab Emirates (Dubai and Abu Dhabi).

Red Fody
Foudia madagascariensis

Natural Range: Madagascar, and satellite islands of Nosy Be, Île Sainte Marie and Juan de Nova.

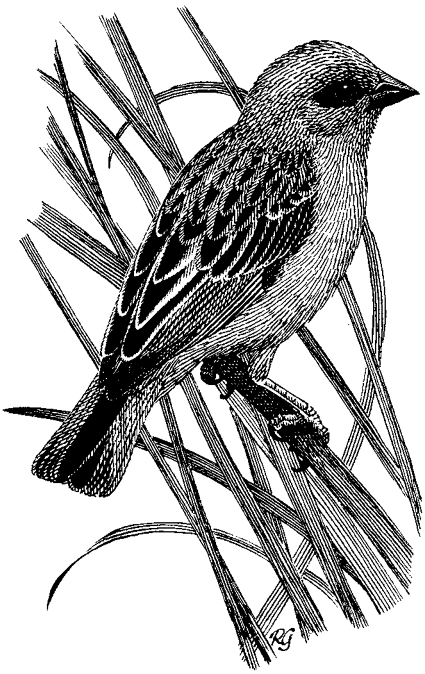
Naturalised Range: Asia: Bahrain. Atlantic Ocean: St Helena I. Indian Ocean: Agaléga Is; Chagos Archipelago; Comoros Is; ?Îles Glorieuses; Mascarene Is; Seychelles Is.

Bahrain

Red Fodies, believed to be descended from released cage-birds, have been recorded since around 1984 in Manama, Bahrain, where the population now numbers some 500 pairs (Anon 2004, Jennings 2004).

St Helena Island

The reference to a flock of 'canaries' from Madagascar in 1758 by Gosse (1938) may have referred to this species, as may another to 'rose linnets' in 1776 by Forbes (1813). Baker (1868), however, says that the species had been introduced not long after his visit. It is believed that, as in the case of *Geopelia striata*, Red Fodies were imported to St Helena on French ships homeward bound from Mauritius (Rowlands *et al.* 1998).



Red Fody

By the 1830s 'red linnets' were abundant on St Helena, and flocks of over 100 were frequently seen at a time when wheat was being widely cultivated (Melliss 1870). The population had become markedly reduced by the early twentieth century, partly due to the capture and sale of birds as pets (Rowlands *et al.* 1998). The numbers had recovered somewhat by the middle 1950s (Van Bruggen 1958), and since the late 1980s have gradually increased (Rowlands *et al.* 1998). St Helena and the Chagos Archipelago are the only islands on which Red Fodies occur outside the Malagasy region (Hawkins & Safford in prep.). See also McCulloch (2004).

Impact: Haydock (1954) reported Red Fodies to be an agricultural pest on St Helena.

Chagos Archipelago

Red Fodies were first reported on Diego Garcia in 1884 (Finsch 1887), when they were said to be abundant. Bourne (1971) found them on Île du Coin and Perhos Banhos in 1957, and Hutson (1975) said they were well established on Diego Garcia but scarce on Perhos Banhos and Salomon, and that a few occurred on Île Grande Barbe. Chagos (and St Helena) are the only islands outside the Malagasy region on which *F. madagascariensis* is established (Hawkins & Safford in prep.).

Comoros Islands

Red Fodies were first seen on Mohéli in 1864 and Mayotte in 1888 (Milne-Edwards & Oustalet 1888), from where they dispersed to Grande Comore and Anjouan probably after 1907. Benson (1960) believed that they could have arrived as natural colonists from Madagascar. Today they occur over most of all four islands (but not above 1,100m on Anjouan) apart from in closed forest, and on satellite islets of Mohéli and Mayotte (Hawkins & Safford in prep.). See also Sinclair & Langrand (2003).

Îles Glorieuses

Benson *et al.* (1975) suggested that Red Fodies may have arrived in the Îles Glorieuses as natural colonists from Madagascar rather than as an introduction, where Probst *et al.* (2000) and Hawkins & Safford (in prep.) record them on Grande Glorieuse.

Mascarene Islands

According to de Querhoënt (1773; quoted by Cheke 1987), Red Fodies were already abundant on the island of Mauritius, where Moreau (1966) said they had been established from before 1775, having presumably been imported as cage-birds on slaving vessels, perhaps in the 1760s (Cheke 1987). Simberloff (1992) and Moulton *et al.* (1996) say that the date of introduction was 1773.

Although it is possible that *F. madagascariensis* may have been introduced to Réunion as early as the 1770s (Cheke 1987), the earliest reference to the species on the island seems to be by Maillard (1862). Simberloff (1992) and Moulton *et al.* (1996) say the species was introduced in 1806.

Red Fodies were first recorded on Rodrigues in 1916 (the date given for their arrival by Simberloff 1992) by Bertuchi (1923), where Cheke (1987) believed they may have arrived 20–30 years earlier (i.e. *c.*1886–96), while Moreau (1966) and Showler (2002) suggest an introduction after 1865.

Today, Red Fodies are widely distributed in a variety of habitats (Jones 1996) on all three islands (on Réunion up to 2,000m) and on numerous offshore islets such as Flat Island, Mauritius (Hawkins & Safford in prep.).

According to Long (1981), this species may have been introduced to the Cargados Carajos islands or have colonised them naturally from Madagascar.

Impact: As early as the 1770s de Querhoënt (1773) was referring to damage to crops caused by *F. madagascariensis* on Mauritius.

Carié (1916) and Newton (1959) could find no evidence of competition between Red Fodies and the endemic Mauritius Fody *F. rubra*, classified as Critically Endangered by the World Conservation Union. However, Temple *et al.* (1974) believed that there could be some seasonal rivalry for food.

On Rodrigues, competition from Red Fodies, coupled with widespread destruction of native forest in the 1960s, may be contributing to the decline of the endemic Rodrigues Fody *F. flavicans* (Moreau 1966), classified as Vulnerable by the World Conservation Union.

Seychelles Islands

Red Fodies were introduced to Mahé around or before 1860 (Newton 1867), although it has been suggested that they may have colonised the Seychelles naturally before 1768 (see Skerrett *et al.* 2001). From Mahé they spread naturally (or were introduced) to Praslin before 1904 (probably in 1902), Frégate before 1939, Cousin between 1941 and the late 1950s, and Cousine in 1958 (Crook 1961). Today, Red Fodies are abundant and widespread, especially in settled areas, on all but the smallest granitic islands, but less ubiquitous on coralline islands such as Bird, Denis, Platte, Rémire, D'Arros and St Joseph (Skerrett *et al.* 2001, Hawkins & Safford in prep.). It is said that they were originally released by a farmer on the land of a disputatious neighbour as an act of retribution.

Moreau (1966) and Penny (1974) say the Red Fody has been introduced to, or has colonised naturally from other islands, most of the cultivated Amirantes, where it was first recorded on Desroches in 1882, and the Farquhar Group. Prŷs-Jones *et al.* (1981) observed the release of 20–30 Red Fodies on Assumption Island in 1977, and Roberts (1988) saw 25–30 there in 1986. In 1976, C. J. Feare (pers. comm. 1985) found this species on Cerf, Providence and St Pierre in the Providence Group.

Guého & Staub (1983) recorded the relatively recent introduction of *F. madagascariensis* to the Agalégas, where it now occurs on Île du Nord and Île du Sud (Cheke & Lawley 1983, Hawkins & Safford in prep.).

Impact: On some islands *F. madagascariensis* has largely displaced an earlier introduction, the Common Waxbill *Estrilda astrild* (Penny 1974). Crook (1961), however, considered that competition with the rare Seychelles Fody *F. sechellarum* had played no part in the contraction in range of this endemic species, since each occupies a separate ecological niche.

Competition between Red Fodies and the also introduced Red-crested Cardinal *Paroaria coronata* has resulted in the elimination of the latter species on the Agalégas (Guého & Staub 1983).

Northern Red Bishop (Orange Bishop)
Euplectes franciscanus

(Formerly considered as conspecific with *E. orix*, the Southern Red Bishop, but now regarded as a separate species: AOU 1998, Dickinson 2003).

Natural Range: From Senegal to Ethiopia, Uganda, Somalia and NW Kenya.
Naturalised Range: Europe: ?Portugal. North America: ?USA; West Indies.

PORTUGAL
Individuals of this species were seen by Leitão & Costa (1996) in 1991 and 1996 at Barroca Marsh and at Zambujal, Sado Estuary, and a few are seen throughout the year at Barrinha de Esmoriz, where Costa *et al.* (1997) believed that breeding had probably occurred.

UNITED STATES
Johnston & Garrett (1994) say that this species is frequently seen in rank and weedy areas of the Los Angeles basin in southern California, and has been documented as breeding along the Los Angeles River in Los Angeles County in 1991 (Garrett unpublished data).

WEST INDIES
In 1982 Barré & Benito-Espinal (1985) saw a group of four males at Carère on the island of Martinique, where they believed the species was established and spreading in the vicinity of Duclos. Bon-Saint-Côme (1984) reported a flock of about 50 near Lareinty and several pairs at Gaigneron.

Raffaele & Kepler (1992) say that this species (under the name *E. orix*) was first noted on Puerto Rico in 1971, when six birds were observed in Rio Piedras, San Juan. Moreno (1997) believed the source of these birds was Senegal (*E. f. franciscanus*).

Raffaele *et al.* (1998: 446) say of this species that it was:

> Introduced to Puerto Rico probably in the 1960s, it is uncommon locally from San Juan to Arecibo. The species is rare elsewhere in the lowlands. First recorded on Martinique in 1983, Orange Bishop now breeds there and on Guadeloupe. It is uncommon and local on both islands, though flocks of 30–40 birds are sometimes observed. The species was recently reported for the first time from Jamaica and St Croix in the Virgin Islands. Introduction of this species in the West Indies was likely the result of pet birds escaping or being released.

Impact: Raffaele (1989) said that on Puerto Rico *E. franciscanus* causes some damage to rice seedlings.

Yellow-crowned Bishop (Golden Bishop)
Euplectes afer

Natural Range: Senegal to Sudan, Ethiopia, Uganda, and Kenya south to Tanzania, Zaire, Angola, Zambia, and South Africa.
Naturalised Range: Europe: ?Italy; Portugal; Spain. Asia: ?Japan. North America: West Indies.

ITALY
Biondi *et al.* (1995) recorded probable breeding of this species in 1992 in Vasche di Maccarese on the coast west of Rome.

PORTUGAL; SPAIN
In the early 1990s Yellow-crowned Bishops were found to be breeding at Barroca Marsh, east of Lisbon (Leitão 1993), where the species is now established and is expanding its range in a habitat of rice-paddies with

ditches bordered by thick vegetation (Costa *et al.* 1997). *E. afer* has also been recorded at Barrinha de Esmoriz (Jão Loureiro pers. comm. to Costa *et al.* 1997); in the Mondego Valley (C. Pachec pers. comm. to Costa *et al.* 1997); and in the Algarve in the Arade River valley, where breeding was reported by Vowles & Vowles (1994) in the Vilamoura area (Ministro *et al.* 1996), and in the rice-paddies at Lagoa where it also probably breeds (Costa *et al.* 1997).

According to Langley (2004), this species (probably an immigrant from Portugal) is becoming established in Spain. A population of 100–200 pairs is established in the rice fields and reedbeds of the lower Guadalquivir valley, Sevilla, and probable breeding is reported from northern Huelva province and the Miño estuary in Pontevedra (Martí and del Moral 2003). Flocks of up to 20 have been reported from the island of Mallorca, where the species has bred and may also be becoming established.

Japan

Brazil (1985) says that this species has bred in the wild in Chiba, Kanagawa and Hyogo Prefectures; whether it is established is uncertain.

West Indies

Yellow-crowned Bishops (said by Moreno (1997) to be of the nominate subspecies, which occurs throughout much of sub-Saharan Africa) were first observed on Puerto Rico, in Cartagena Lagoon, in 1971 (Raffaele & Kepler 1992).

Raffaele *et al.* (1998: 446) say of this species that it was:

> Recently introduced, it is uncommon and very local on Puerto Rico in marshes around San Juan, at Cartagena Lagoon and east of Ponce and introduced to Jamaica at Caymanas Pond and near Hellshire sewage ponds … It was first reported from Puerto Rico in the 1970s and from Jamaica in 1989. Both introductions likely resulted from the escaping or release of caged pets.

ESTRILDIDAE (WAXBILLS, GRASS FINCHES, MUNIAS AND ALLIES)

Red-cheeked Cordon-bleu
Uraeginthus bengalus

Natural Range: Senegal to Ethiopia, Uganda and Kenya, S through Tanzania to S Zaire and N Zambia.

Naturalised Range: Atlantic Ocean: ?Canary Is. Pacific Ocean: Hawaiian Is.

Canary Islands

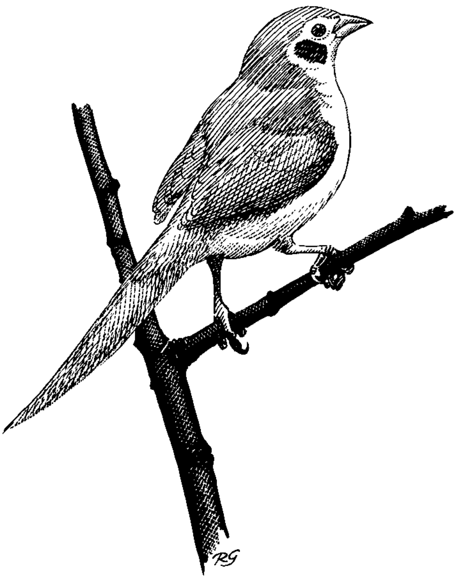
This species is recorded frequently in Fuerteventura, where a pair bred successfully in 1998 (J. Clavell in Martí & del Moral 2003).

Hawaiian Islands

In 1965 some Red-cheeked Cordon-bleus were released or escaped on Oahu (Donaghho 1966), where between 30 and 50 were counted at Diamond Head in 1976–77 (Pyle 1977). Zeillemaker & Scott (1976) recorded them as rare and local in dry lowland areas on Oahu, where Pyle (1977) considered them to be apparently established and breeding. Subsequently, Red-cheeked Cordon-bleus were released on the northern slopes of Hualalai on Hawaii (Berger (1981), where Scott *et al.* (1986) found them in very low densities below 1,100m on the Puu Waawa Ranch. Pratt *et al.* (1987) said the species was established on Puu Waawa and possibly in the Kapiolani Park on Oahu. Pratt (1994) and the AOU (1998) record Red-cheeked Cordon-bleus as occurring in very small numbers locally only in the Puanahulu area on Hawaii.

Blue-breasted Cordon-bleu (Blue Waxbill)
Uraeginthus angolensis

Natural Range: Zaire, Angola, Zambia, Zimbabwe, Botswana, Malawi, E and S Tanzania; Transvaal and Natal, South Africa.



Red-cheeked Cordon Bleu

Naturalised Range: Atlantic Ocean: ?Principe I.; ?São Tomé I. Africa: Zanzibar.

Principe I.; São Tomé I.

Snow (1950) and Peters (1968) record the introduction in the first half of the twentieth century of the nominate subspecies of *U. angolensis* (southwestern Zaire, northern Angola and northwestern Zambia) to these Portuguese islands in the Gulf of Guinea, where their present status is unknown.

Zanzibar

Clement *et al.* (1993) say that *U. angolensis* has also been 'introduced' (translocated?) to Zanzibar.

Orange-cheeked Waxbill
Estrilda melpoda

Natural Range: From Gambia to Zaire, N Angola, NE Zambia, N Cameroon and Chad.
Naturalised Range: Europe: Spain. Asia: Japan. North America: West Indies. Atlantic Ocean: Bermuda. Pacific Ocean: Hawaiian Is.

Spain

The earliest regular reports of the Orange-cheeked Waxbill in Spain date from 1990, when birds were observed at the mouth of the River Mijares north of Valencia on the Mediterranean coast. Since then the population has increased, and it now breeds in citrus orchards at Onda and in marshes at Almenara in Castellón Province, where it lives in dense riverine vegetation. A population of 50–100 pairs is established in the lower Guadalquivir valley, Sevilla, and breeding has also been reported from Málaga province (Martí and del Moral 2003).The population probably originated in escaped or released cage-birds, but seems to be increasing without further outside reinforcement (Castany & López 1997, Langley 2004).

Japan

The OSJ (2000) says that this species occurs as a resident breeder in clear-cut areas in forests and in grasslands around Tokyo, Honshu.

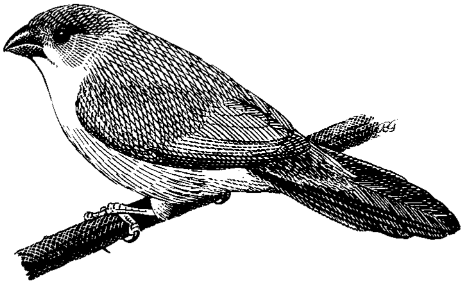
West Indies

Orange-cheeked Waxbills were first reported on Puerto Rico by Gundlach (1874), when they were uncommon and restricted to the western coast from Añasco to Cabo Rojo. The birds are likely to have come as pets from Angola (where the subspecies is *E. m. melpoda*) on Puerto Rican slave ships between 1815 and 1845. On arrival at the port of Mayagüez some probably escaped or were released and became established (Moreno 1997).

As late as the 1930s, however, the birds were confined to southwestern Puerto Rico (Danforth 1936). Further introductions in the 1950s and 1960s reinforced the population, which in the 1970s spread throughout the island's coastal plain (Pérez-Rivera 1979, Raffaele 1989, Moreno 1997), Raffaele *et al.* 1998). There are also recent records from Guadeloupe and Martinique (Raffaele *et al.* 1998). See also AOU 1998.

Bermuda

Escaped or released Orange-cheeked Waxbills were first observed in Bermuda, in marshes in Devonshire and Paget Parishes, in 1975 (AOU



Orange-cheeked Waxbill

1998). Breeding was confirmed in 1982 (AOU 1998), and by the middle of the decade the birds had spread eastwards to Tucker's Town and St George's (D. B. Wingate pers. comm. 1984, 1985). Raine (2003) lists the species as a rare resident.

Hawaiian Islands

In late December 1965 30 Orange-cheeked Waxbills (almost certainly escaped pets) were seen along the Na Laau trail on the Ewa slope of Diamond Head on Oahu. Between 1967 and 1969 more than 20 were observed annually, and the population appeared to be increasing (Blake 1975, Pyle 1977, Berger 1981). Zeillemaker & Scott (1976) described the species as local and uncommon in dry lowland residential and community parklands on Oahu.

Pratt *et al.* (1987) said the species was generally rare and local on Hawaii (in the Puu Waawa area) and in scattered localities on Oahu (Diamond Head, Kapiolani Park and Kaneohe). Pratt (1994), who refers to other introductions on Hawaii and Maui, listed the species as no longer occurring on Hawaii by 1992, while the AOU (1998) says that Orange-cheeked Waxbills occur in small numbers only on Oahu, with recent sight reports from Maui.

Red-tailed Lavender Waxbill
Estrilda caerulescens

Natural Range: Senegal to Central African Republic.

Naturalised Range: Pacific Ocean: Hawaiian Is.

Hawaiian Islands

In about 1965 some Red-tailed Lavender Waxbills escaped from captivity or were released on Oahu, where they became established in the Kapiolani Park/Diamond Head area, and by 1976–77 had increased to between 30 and 50 (Berger 1981).

Zeillemaker & Scott (1976) described the species as local and uncommon in dry lowland residential and community parkland on Oahu, where Pyle (1977) confirmed it was apparently established and breeding. Ashman & Pyle (1979) reported that in the previous year some were found to be established on a small section of the Puu Waawa Ranch on Hawaii, where Scott *et al.* (1986) found them only on the northern slopes of Hualalai, and said they were uncommon below 1,100m in dry woodlands and savannas. Pratt *et al.* (1987) said the species was established in the Puu Waawa area on Hawaii, and probably at Diamond Head on Oahu, but added that since 1980 it had been declining in that area. Clement *et al.* (1993) said it was unlikely to survive in the Hawaiian Islands, and Pratt (1994) listed it as surviving only on Hawaii, where the AOU (1998) said it was becoming increasingly common on the Kona coast.

Common Waxbill
Estrilda astrild

Natural Range: From Sierra Leone, Guinea, and Liberia eastwards to Sudan and Ethiopia and southwards to South Africa.

Naturalised Range: Europe: ?Italy; Portugal; Spain. North America:? West Indies. South America: Brazil. Atlantic Ocean: Ascension I; Bermuda; Canary Is; Cape Verde Is; ?Principe I; São Tomé I; St Helena I. Indian Ocean: Amsterdam I.; Juan de Nova I.; Mascarene Is; Seychelles Is. Pacific Ocean: Hawaiian Is; ?New Caledonia; Society Is.

Italy

Biondi *et al.* (1995) record the breeding of

Common Waxbills at Vassche di Maccarese west of Rome in 1992, but whether the species is established is unknown.

Portugal

For the history of the Common Waxbill in Portugal I am mainly indebted to Reino & Silva (1996a, 1996b).

In 1964 about 100 birds, believed to be descended from some that had escaped from an aviary, were reported around Lagóa de Óbidos on the west coast of Portugal (Xavier 1968), from where they later spread along the Tagus, Sado and Mondego valleys. Successful breeding was first recorded in 1965. Another introduction appears to have occurred in the Algarve in southern Portugal before 1977.

After 1980 the species spread into many other parts of Portugal, and the valleys of the Tagus and Sado were fully occupied. There was a corresponding expansion of range in the Algarve. Central coastal Portugal was almost continuously occupied, and the species became locally established further north.

In the second half of the 1980s Common Waxbills were recorded for the first time in the Guadiana valley (Guerrero *et al.* 1989), and had become nearly continuously established along the northwestern coast.

In the early 1990s, *Estrilda astrild* spread into Alentejo, with further records in the valley of the Guadiana and on the southwest coast, where its distribution was almost continuous. In northwestern Portugal the coast had become fully occupied and there were increasing records inland (Campinho *et al.* 1991). Since then the species has colonised the Lima and Homem valleys in the Peneda-Gerês Mountains. It is now locally common along the entire coast from the Minho River in the northwest south to the eastern Algarve, but in the east it is less continuously distributed. It is common and widespread in the south (Costa *et al.* 1997), but is local and scarce in the north, occurring principally along the Minho, Lima, Cávado, Ave and Douro valleys.

The source of the Portuguese population may have been Guinea-Bissau and/or the Cape Verde Islands (former Portuguese colonies) or possibly, due to its links with Portugal, Brazil (De Lope *et al.* 1997).

Spain

Common Waxbills spread over the border from Portugal into Spain in 1977 (Guerrero *et al.* 1989). By 1995 they were distributed mainly along the Guadiana River where they were first recorded breeding in Extremadura in 1986. First breeding was reported in Andalucía in 1990, in Galicia (where they have been recorded since at least 1989: R. Costas pers. comm. to Reino & Silva 1996a) in 1994 and during the early 1990s in both Catalonia and Valencia. The two latter east coast populations are thought to derive from subsequent introductions and not from those of Portuguese origin (Martí & del Moral 2003). A small population has inhabited the Albufera marshlands in Mallorca since 2001.

The Spanish *Atlas* (Martí & del Moral 2003) reveals an expanding population of the order of 2,800 to 12,000 pairs. The largest numbers inhabit the valleys of the Guadiana and its tributaries in Extremadura, the Galician coastlands and valleys, and the Costa del Sol and Guadalquivir valley in Andalucía. Smaller populations are reported from around Barcelona and Valencia. Breeding has been reported to date from 21 provinces.

West Indies

Blake (1975) lists the Common Waxbill as an introduction to Puerto Rico, probably after about 1960. Although it is not mentioned by Raffaele *et al.* (1998) the AOU (1998) says it is established on the island. R. J. Safford (pers. comm. 2004) lists the species as also introduced to the island of Trinidad.

Brazil

According to Mitchell (1957) and Sick (1993), Common Waxbills may have been first introduced by slaving vessels early in the reign (1822–31) of Emperor Dom Pedro I. Sick (1968) says they were definitely in Brazil before 1870, and that they continued to arrive on vessels from West Africa until at least 1889.

Sick (1993) records that in about 1918

Common Waxbills were established in Lins de Vasconcelos and that in 1924 they were not uncommon in Santa Teresa (Guanabara); they now occur also on islands in Guanabara Bay, as well as in various localities in Rio de Janeiro and in Niterói and Petrópolis. Sick (1993) lists the following places and earliest known dates of arrival: Vitória, Espírito Santo (after 1940); Salvador, Bahia (after 1953); Recife, Pernambuco and Manaus, Amazonas (1967); Brasília, Federal District (1964); Campo Grande, Mato Grosso and Minas Gerais (1968); Nova Lima (1950); Belo Horizonte (1967); Londrina, Paraná (1973); Florianópolis, Santa Caterina (1928–30); Blumenau (1940–45); Porto Alegre, Rio Grande do Sul (before 1965); and Belém, Pará (1977). The species has also been introduced to Ilha Trinidade.

Clement *et al.* (1993) say that today *E. astrild* occurs locally in seven main areas, where Sick (1996) records it only in the vicinity of some cities. Within Brazil, it has been widely transported by human agency. See also Souza (2002).

Ascension Island

Common Waxbills were introduced to Ascension Island by British Royal Marines guarding Napoleon Bonaparte in 1815. Stonehouse (1962) estimated the population at 300–400. Their present status is unknown.

Bermuda

In 1973 (AOU 1998) Common Waxbills that had been released or escaped from captivity became established on St Luke's farm in Southampton Parish, where by the end of the decade there was a population of about 50–60. A change in husbandry from grass to vegetables caused them to decline, and Raine (2003) lists them as rare.

Canary Islands

Perez (1983) and Trujillo Ramirez (1993) record the introduction of Common Waxbills to Gran Canaria in or before 1970, where large populations, probably descended from escaped cage-birds, are established. Birds were also present in the 1970s in Tenerife but are not yet established there, although the species is still recorded on the island (Martí & del Moral 2003).

Cape Verde Islands

Bannerman (1949) says that in 1865 a ship carrying a consignment of Common Waxbills from Angola (where the form is *E. a. jagoensis*) to Europe was wrecked on the island of São Vincente, where several hundred birds escaped. A century later, Bannerman & Bannerman (1968) found them to be abundant on São Vincente and Sãnto Antão, where some had been present in 1924. They now survive only on Santiago, where they are widespread and locally abundant in cultivated and irrigated fields and valleys (Hazevoet 1995).

Impact: Bannerman & Bannerman (1968) record damage caused by Common Waxbills to tomatoes in the Cape Verdes.

Principe Island; São Tomé Island

Common Waxbills are said to have been introduced by man to both São Tomé and Principe in the Gulf of Guinea, where Peters (1968) says they occurred only on the former. Although Bourne (1955, 1966) states that the race present is *jagoensis* (western Angola and the Cape Verde Islands), Dickinson (2003) indicates the presence of an endemic form.

St Helena Island

The date of introduction of the Common Waxbill to St Helena is not recorded, but is believed by Rowlands *et al.* (1998) to have been during the governorship of J. Skottowe (1764–82). The earliest reference to the species appears to be the presence of birds imported from South Africa by at least 1813 (Beatson 1816), when it was described by Barnes (1817: 107) as being 'as numerous as sparrows in England'.

Widespread trapping of birds for sale to passing ships helped to control, and even reduce, the population (Melliss 1870), and by the 1950s/1960s flocks numbered no more than 20–25 (Basilewsky 1970). By 1971 flocks had increased to between 30 and 50 (Rowlands *et al.* 1998), but declined again in 1973, perhaps as a result of eating contaminated grain (Loveridge 1977). By 1989, however, flocks of 200 or more were to be seen, when the species was the most abundant bird of the arid zone; elsewhere it occurs principally in grassland and on the fringes of flax plantations, but is virtually ubiquitous (Rowlands *et al.* 1998). The form present is the nominate one (southern Botswana and much of South Africa: Haydock 1954). The species' presence on St Helena is confirmed by McCulloch (2004).

Lockwood *et al.* (1996) noticed a tendency towards morphological overdispersion among Common Waxbills (and other finches) on St Helena, and hypothesised that this pattern of overdispersion may be due to increased species richness in this group: 23 out of 31 passerine species introduced to St Helena are finches.

Amsterdam Island

Roux & Martinez (1987) record the introduction of Common Waxbills from Réunion in the Mascarenes to La Roche Godon Station on Amsterdam in the Southern Indian Ocean, where by 1981–82 the population had increased to around 60–80. In 1984–85 *E. astrild* occurred over some 125ha in the northeast sector and had been reported up to 3.6km from the station and up to 250m above sea level, and the population was said to be still increasing.

Juan de Nova Island

Bertrand (2000) and Hawkins & Safford (in prep.) say that *E. astrild* has been successfully introduced to Juan de Nova off the west coast of Madagascar.

Mascarene Islands

J. Desjardins (quoted by Oustalet 1897) described a Common Waxbill on Mauritius, where although Vinson (1964) suggested it had been introduced in about 1764, Staub (1976) believed the species was not introduced until around 1800. At an apparently unrecorded date, claimed to be 1700 by Simberloff (1992) and Moulton *et al.* (1996), *E. astrild* was introduced to Réunion, and perhaps in about 1862 to Rodrigues (Newton 1865). Today, the species is widely distributed on Mauritius and Rodrigues, and on some offlying islets (Bell *et al.* 1994, Jones 1996, Hawkins & Safford in prep.), particularly in open woodland and cultivated areas at all elevations (Showler 2002). On Réunion it occurs in non-forested localities (including heathland) throughout the island up to 2,000m (Barré *et al.* 1996, Showler 2002). The form occurring on Mauritius and Réunion is probably the nominate one (R. J. Safford pers. comm. 2004).

Impact: According to Cheke (1987), the introduced Red Avadavat *Amandava amandava* became rare on Mauritius after the arrival of *E. astrild*, presumably due to interspecific competition. In the late eighteenth century the Common Waxbill was said to be an agricultural pest on Mauritius.

Seychelles Islands

As early as 1788 Common Waxbills were said to be very common on the island of Mahé, to which they may have been introduced as pets from Africa by the first settlers some 20 years previously (Newton 1867). They have since been largely displaced by the arrival in 1860 of another seed-eating exotic, the Red Fody *Foudia madagascariensis*, coupled with a decline in the cultivation of seed crops and by the drainage of pastures for plantations (Crook 1961). Common Waxbills are now locally common only in marshy grasslands along the west coast of Mahé and on the grassy plateau of La Digue (Hawkins & Safford in prep.), but also occur on Alphonse in the Amirantes (Skerrett *et al.* 2001). In the late nineteenth century they were also present on Desroches and perhaps elsewhere.

Another version of the species' introduction to the islands (quoted by Skerrett *et al.* 2001) is that it coincided with the freedom granted to slaves in 1833; planters subsequently found it hard to recruit labour because former slaves were growing their own rice on La Digue, and one former slave owner deliberately introduced the birds there to destroy the rice.

Hawaiian Islands

In 1981, Ord (1982) identified between 18 and 24 Common Waxbills on Oahu, where Pratt (1994) gives the date of arrival as before 1965 and Shehata *et al.* (2001) as in the early 1990s. Pratt *et al.* (1987) said that *E. astrild* was locally common in the Pearl Harbor and Kahuku area and appeared to be spreading. The species' presence on Oahu is confirmed by the AOU (1998).

For research by Lockwood *et al.* (1993) on ecomorphological analysis see below under Society Islands.

Impact: In their study area in the Lyon Arboretum in Honolulu, Shehata *et al.* (2001) found only a 2.8% prevalence of malarial infection among 36 Common Waxbills.

New Caledonia

Mayr (1945) records the introduction of *E. astrild* to New Caledonia, where Delacour (1966) found large numbers in gardens and on cultivated land. The species' survival was confirmed by Holyoak & Thibault (1984), but its present status has not been determined.

Society Islands

Common Waxbills were introduced to Tahiti between 1908 and 1919 (Guild 1938). They became common in coastal localities, especially around Pamatai and Punaauia, but less common in inland valleys (Holyoak 1974), where they have been partially displaced by the also introduced Red-browed Finch *Neochmia temporalis.* More were released on Tahiti by Eastham Guild in 1938 (Guild 1938).

Pratt *et al.* (1987) record Common Waxbills as common on Tahiti, where the AOU (1998) confirms their survival. They may also occur in coastal Moorea.

Common Waxbills in the Society Islands live in unwooded and grassy habitats, gardens, thick vegetation in plantations, thickets and the ecotone of coastal coconut groves; in the hills they occur up to 750m (Holyoak 1974).

Lockwood *et al.* (1993) carried out an ecomorphological analysis of the introduced passeriformes on Tahiti and tested for community patterns reported for congeners on Oahu, Hawaii. Although both islands are similar in size, distance from the equator, and number of introduced passeriformes, a marked disparity was found in rates of introduction success – 63% for Oahu and only 17% for Tahiti. Possible explanations for this disparity include unfavourable environmental conditions, differences in the timing of the introductions, differences in the taxonomic diversity between the various introduced species, and differences in habitat diversity between Tahiti and Oahu. In spite of different rates of introduction success, Lockwood *et al.* (1993) found the same pattern of morphological overdispersion on both islands. This pattern is consistent with the hypothesis that interspecific competition has influenced the assembly of these communities.

Black-rumped Waxbill
Estrilda troglodytes

Natural Range: From Senegal to W Ethiopia, Uganda and W Kenya.

Naturalised Range: Europe: ?Gibraltar; ?Portugal; Spain. Asia: Japan. North America: West Indies. Atlantic Ocean: Canary Is. Pacific Ocean: Hawaiian Is.

Gibraltar

Small parties of Black-rumped Waxbills were recorded almost annually in Gibraltar from 1975 to 1981 (Cortes *et al.* 1980, E. F. J. Garcia pers. comm. 2005) but there have been only two records of single birds subsequently. The birds are believed to have been wanderers from Spain.

Portugal

Black-rumped Waxbills have been reported at Ponte de Lima, in the Coimbra area, and in a number of places in the Algarve, where Costa *et al.* (1997) consider that hybridisation may occur with the also introduced Common Waxbill *E. astrild.*

Spain

Breeding birds have been widely reported from Andalucía, especially since 1985, from Málaga and Córdoba provinces and especially in Sevilla province, where several hundred pairs occur along the Guadalquivir valley (Martí & del Moral 2003). There is also a population, estimated at some 50 pairs, in coastal Catalonia.

Japan

The OSJ (2000) lists this species a breeding resident along rivers and in marshes around Tokyo on Honshu.

West Indies

Raffaele & Kepler (1992) noted the Black-rumped Waxbill in Rio Piedras and Carolina on Puerto Rico in 1971. Raffaele *et al.* (1998: 447) say that 'This is a widespread, but uncommon exotic on Puerto Rico. An escapee, probably in the 1960s, it occurs spottily along the entire coastal plain'. The AOU (1998) and Hinze (2002) confirm the species' presence on the island.

Barré & Benito-Espinal (1985) reported that Black-rumped Waxbills had been established since at least the late 1960s on Basse-Terre and Grande-Terre, Guadeloupe. On both islands they exist sympatrically with the also introduced Red Avadavat *Amandava amandava*; the greater abundance of *troglodytes* compared to *amandava* on Basse-Terre and vice versa on Grande-Terre may be a result of interspecific competition and/or the more recent arrival of *troglodytes* on Grande-Terre from Basse-Terre. Raffaele *et al.* (1998: 447) say that the Black-rumped Waxbill was 'First observed on Guadeloupe in 1975, it is now locally common and has been found breeding'.

According to Raffaele *et al.* (1998: 447), *E. troglodytes* '… was recently introduced on Martinique where it is presumably uncommon and local. There are recent records from St Thomas and the Virgin Islands …'.

Moreno (1997) believed that the origin of the Puerto Rico (and presumably other West Indian) populations was Senegal or Mali.

Impact: On Guadeloupe, Black-rumped Waxbills (and other alien Estrildidae) may be out-competing the less aggressive and less prolific native Black-faced Grassquit *Tiaris bicolor* (Barré & Benito-Espinal 1985).

Canary Islands

A population is becoming established in Tenerife and the species is also breeds on Gran Canaria (De la Puente & Lorenzo 2001).

Hawaiian Islands

Black-rumped Waxbills were released or escaped on Oahu around 1965. They became established and slowly increased in the Kapiolani Park–Diamond Head region (Berger 1981). Zeillemaker & Scott (1976) recorded them as local and uncommon in dry lowland residential and community parkland, where Pyle (1977) listed them as apparently established and breeding.

Pratt *et al.* (1987: 328) say that the above population has since died out, and that 'All birds of this species reported elsewhere on Oahu have … turned out to be misidentified Common Waxbills. A 1975 report of … nine Black-rumped Waxbills in N. Kohala, Hawaii, may also be erroneous; neither species has been reported on Hawaii since'. Nevertheless, Pratt (1994) lists *E. troglodytes* as still present on Hawaii, while the AOU (1998) says it survives in small numbers on both Hawaii and Oahu.

Red Avadavat
Amandava amandava

Natural Range: Pakistan, India, S Nepal, Burma, Thailand, Cambodia, S Vietnam, Java, Bali, C Lesser Sunda Is. and S Yunnan.
Naturalised Range: Europe: Italy; Portugal; Spain. Asia: Bahrain; China (Hong Kong); ?Israel; Japan; ?Philippines; Saudi Arabia; Singapore; Sumatra; UAE. Africa: Egypt. North America: West Indies. Atlantic Ocean: ?Canary Is. Indian Ocean: Mascarene Is. Pacific Ocean: Fiji Is; Hawaiian Is.

Italy

Since 1983, Red Avadavats have become

established in a number of discrete subpopulations in Italy (see map in Baccetti *et al.* 1997: 307), including Treviso (Mezzavilla & Battistella 1987), the valley of the Laguna di Venezia (Baccetti *et al.* 1997), central Tuscany (Massaciuccoli, Lucca, Fucecchio, Pistola and elsewhere) (Sposimo & Tellini 1995), Lazio and Molise, Laghi Pontini (Norante 1977), Puhlio (Siponto, Foggia) (Baccetti 1997), Sicily (Palermo) (Gatto 1988) and Marche (Geronzi 1977). Between 80 and 90 breeding pairs out of a population of 300 individuals occur along the River Sile near Treviso (Cramp *et al.* 1977–94, De Lope 1997). See also Biondi *et al.* 1995.

Portugal

Although not mentioned by Cramp *et al.* (1977–94) or De Lope (1997), Red Avadavats seem to have become established in two areas of Portugal – in the Eastern Alentejo, along the Guadiana River in the Elvas/Campo Major region close to the Spanish border (Costa *et al.* 1997), near where the species was first observed in Iberia (Equipos del CMCC 1974), and at the Barroca Marsh east of Lisbon (Leitão & Costa 1996). The species has also been recorded at Barrinha de Esmoriz (Jão Loureiro pers. comm. to Costa *et al.* 1997), the Sado valley, Baixo Alentejo (Costa *et al.* 1997) and in the Algarve where it is regularly recorded around Faro, Silves and Portimão (Vowles & Vowles 1994). Costa *et al.* (1997) believed that the maximum number of birds at Barroca Marsh was 10–15 in 1994 and at least 100 in the Elvas area in 1995. At Barrinha de Esmoriz the species occurs in small numbers only in winter (Jão Loureiro pers. comm. to Costa *et al.* 1997).

Spain

Red Avadavats were first recorded in Spain, in Arganda near Madrid, in 1973 (Equipos del CMCC 1974, De Lope 1997). Since 1978 the main centre of the Spanish population has been Extremadura, along 130km of the Tajo and Guadiana rivers (De Lope 1997). Other populations occur in Andalucía, especially along the Guadalquivir river in Sevilla province and along the Costa del Sol. There are also records, including at least occasional nesting, from Toledo and the east coast. Habitats occupied include wetlands where reed *Phragmites* sp. and reedmace *Typha* sp. predominate, meadowland, irrigated crops, and rush *Juncus* sp. and sedge *Carex* sp. (Cramp *et al.* 1977–94, De Lope 1997). The Spanish *Atlas* (Martí & del Moral 2003) suggested a minimum population of 675 pairs, with indications of a considerable recent decline in the core population in Extremadura, which may be attributable to destruction of riverside habitats. Other Spanish populations seem to be increasing and spreading and it is probable that several thousand individuals are present in Spain.

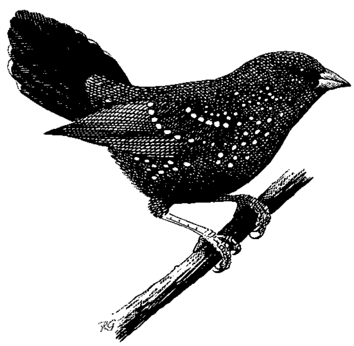
Impact: According to De Lope (1997), none of the Iberian populations of *A. amandava* appear to compete with native species that might inhibit further dispersal.

Bahrain

'First observed in 1981. This species has been present since 1989 in a reed bed at Janabiyah, where they almost certainly breed. … small groups have been seen in sorghum fields at Muharraq and Bahrain island' (Hirschfeld & King 1992). Jennings (2004) records breeding in Manama.

China (Hong Kong)

Webster (1975) reported that flocks of up to 35 Red Avadavats were regularly seen on the Mai Po marshes and at Long Valley, where breeding was suspected. They could, however, be



Red Avadavet

natural immigrants from the Chinese mainland. See also Viney *et al.* 1996.

Israel

According to Clement *et al.* (1993), Red Avadavats have been introduced to Eilat in southern Israel; their current status there is unknown.

Japan

Red Avadavats that had escaped from captivity became established in the wild in the Gihu, Aiti, Tokyo, Saitama and Tiba prefectures on Honshu in the 1930s (Kaburaki 1940), from where they spread to Kyushu and Shikoku. According to Brazil (1985) the principal sites were at Oi-koen and Tamagawa near Tokyo, and south of Kanto, where flocks up to 200 strong were reported. Today they are widespread in Honshu (mainly Tokyo, Osaka and Hyogo: OSJ 2000) and Kyushu, principally in reedbeds, marshes, estuaries and along rivers. Breeding has been recorded from Yamagata-ken south to Kagoshima-ken, and Shikoku and Okinawa (Brazil 1991).

Philippines

Delacour & Mayr (1946) and Du Pont (1971) say that escaped Red Avadavats became established around Manila, on Luzon. Their present status is uncertain.

Saudi Arabia

Clement *et al.* (1993) say that *A. amandava* has also been introduced to Riyadh in Saudi Arabia, where its presence is confirmed by Jennings (2004).

Singapore

The AOU (1998) lists *A. amandava* as introduced to and established in Singapore.

Sumatra

Delacour (1947) says that Red Avadavats have been introduced to Sumatra; according to Peters (1962) the form is *A. a. punicea* which occurs on Java, so a natural arrival must be a possibility.

United Arab Emirates

'Reported nesting in Sharjah in 1988, with fledglings seen. … heard singing at Ramah in 1992, and … at Zabeel, Dubai, in 1992' (Richardson 1992), where its presence is confirmed by Jennings (2004).

Egypt

Although Red Avadavats were established in the delta region between 1905 and at least 1924 they eventually died out. Safriel (1975) reported their reappearance southwest of Ismâ'ilīya on the Suez Canal. Clement *et al.* (1993) say they occur in the northern Nile valley and the Nile delta.

West Indies

Raffaele & Kepler (1992) first reported Red Avadavats in San Juan and Dorado, Puerto Rico, in 1971, where Raffaele *et al.* (1998) say they were probably introduced in the late 1960s and where the species is locally common in the lowlands. According to Moreno (1997), the race occurring on Puerto Rico is the nominate one from Pakistan, India and Nepal.

Introduced to, and recorded for the first time on Guadeloupe (Pointe-à-Pitre, Grande Terre) in 1965 and on Martinique (Baie de Fort-de-France) in 1970, Red Avadavats soon became established on the latter from Le Lamentin southwards to Rivière-Salée and the Usine Petit Bourg. On Guadeloupe they have colonised most of Grande Terre and much of Basse Terre, and are now common on both Guadeloupe and Martinique (Pinchon & Benito-Espinal 1980, Barré & Benito-Espinal 1985, Raffaele *et al.* 1998).

According to Raffaele *et al.* (1998), a flock of Red Avadavats was observed in the Dominican Republic in 1997.

Impact: On Guadeloupe, Red Avadavats may compete advantageously with the less aggressive and less prolific native Black-faced Grassquit *Tiaris bicolor*. (See also under Black-rumped Waxbill).

Canary Islands

Although Red Avadavats have been recorded as breeding in Tenerife (Martín & Lorenzo

2001) the species has yet to become established there.

Mascarene Islands

Red Avadavats were first recorded on Mauritius in the middle of the eighteenth century, but had died out by around 1900 (Cheke 1987). Although there appear to be no documented introductions of *A. amandava* to Réunion (Cheke 1987), Simberloff (1992) and Moulton *et al.* (1996) quote Barré & Barau (1982) as claiming that the introduction occurred in 1700. The species is still found on Réunion, but is not common (Cheke 1987, Moulton & Sanderson 1997, R. J. Safford pers. comm. 2004).

Fiji Islands

Red Avadavats are believed to have been introduced to Fiji before 1906, where they became established in Suva on Viti Levu. Pernetta & Watling (1978) recorded them as common in suitable habitats on the main islands. Watling (1982: 132) found the species to be '… naturalised on Viti Levu and Vanua Levu [where] it is common. … The subspecies is probably *A. a. flavidiventris* [Yunnan, Burma, Thailand, and the Lesser Sunda Islands]'. Pratt *et al.* (1987: 315) say it is 'common to abundant on Viti Levu and Vanua Levu'.

Impact: Although Mercer (1966) said that Red Avadavats in Fiji cause damage to rice seedlings, Watling (1982) found that although Jungle Rice *Echinochloa colenum* is eaten, cultivated varieties were seldom consumed.

Hawaiian Islands

It is believed that Red Avadavats were imported to Oahu as pets in the first decade of the twentieth century. Escaped birds became established near Pearl Harbor, where Caum (1933) reported them as uncommon. Thirty years later Ord (1963) estimated the population at around 100. The Hawaiian Audubon Society (1975) recorded a small population on the Waipio Peninsula in Pearl Harbor. Berger (1981: 209) said the species 'has now begun to increase its range on Oahu'. Pratt *et al.* (1987: 315) say it was 'common but very local in the Pearl Harbor area, Oahu; occasionally seen on the windward side. Reported 1983 in North Kohala District, Hawaii, and in 1984 on Kauai, but not known to be established as yet on those islands'. Pratt (1994) lists the species as also occurring on Maui. The AOU (1998) says that Red Avadavats have now become established on both Hawaii and Kauai.

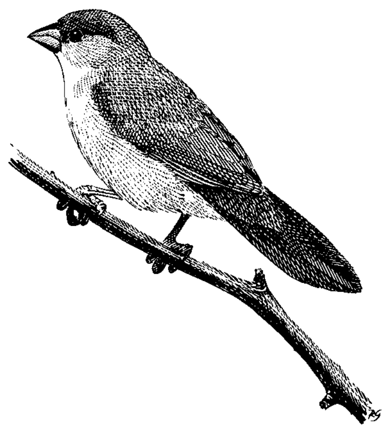
Red-browed Finch
Neochmia temporalis

Natural Range: E to SC Australia (including the Cape York Peninsula) and Kangaroo I.
Naturalised Range: Pacific Ocean: Marquesas Is; Society Is.

Marquesas Islands; Society Islands

Table 18 gives details of the introduction of Red-browed Finches of the nominate subspecies (Australia apart from the Cape York Peninsula) to the Marquesas and Society Islands. Pratt *et al.* (1987) recorded the species as common on Tahiti, Moorea, Nukuhiva, Uakuka and possibly Hivao.

Red-browed Finches in the Society Islands and Marquesas frequent lawns, thickets, and shrubs – especially in groves of *Casuarina* trees – and woodland borders. On Nukuhiva they are found up to 800m and to 700m on



Red-browed Finch

TABLE 18 Introductions of the Red-browed Finch *Neochmia temporalis* to the Marquesas and Society Islands, before 1899–1975.

Island	*Date of Introduction*	*Status*
Tahiti	Before 1899	Very common in early 1980s
Moorea	First seen 1921	Widespread and abundant in 1980s
Mohotani	First seen 1975	—
Nukuhiva	First seen 1958	Said to be common in 1975
Uahuka	Seen near Hane in 1971–75	—
Uapou	?	Present in small numbers in 1974–75
Hivaoa	To Atuona in 1936	Common in 1971–75
Tahuata	Apparently not recorded until 1975	?

Source: Holyoak & Thibault (1984).

Tahiti. Although in the Marquesas they are mainly confined to the coast, on Tahiti they are more often found up to six kilometres inland.

Bronze Mannikin
Lonchura cucullata

Natural Range: From Senegal to Ethiopia, S to E Angola and E South Africa.
Naturalised Range: North America: West Indies.

West Indies

Bronze Mannikins may have been imported, probably as cage-birds, from West Africa to Puerto Rico on Spanish slave-ships at any time between 1530 (or even earlier) and 1820 (Cory 1889). They were reported to be widespread and abundant throughout coastal Puerto Rico in 1864 (Gundlach 1874), and were said by Bowdish (1903) to be locally common elsewhere. By the late 1920s they were common in the coastal lowlands, especially in the southwest around Cabo Rojo, where flocks numbering several hundred were recorded (Wetmore 1927). Bond (1979) said they were particularly common in San Juan, and had spread to Vieques Island. Raffaele *et al.* (1998: 449) said that the Bronze Mannikin is 'A common resident on Puerto Rico, probably introduced during the early colonial era. A small flock was reported in the late 1970s from St Croix in the Virgin Islands. It is less common with increased elevation and is rare over 300m'. The AOU (1998: 683) records the species as 'common in coastal lowlands, but rare in hill country' on Puerto Rico. Moreno (1997) assigned Puerto Rico birds to the nominate subspecies.

Impact: On Puerto Rico, Bronze Mannikins are said by Gundlach (1874) and Raffaele (1989) to cause significant damage in rice paddies.

Vagrants: Bronze Mannikins on Anjouan, Mayotte, Grande Comore, and Mohéli in the Comoros Islands (Benson 1960), and on Fernando Póo in the Gulf of Guinea (Fry 1961), are likely to be natural immigrants from east and west Africa respectively rather than introductions by man.

Indian Silverbill (White-throated Munia)
Lonchura malabarica

Natural Range: C and NE Saudi Arabia, N Oman and SE Iran to India and Sri Lanka.
Naturalised Range: Europe: France. Asia: Bahrain. North America: West Indies. Pacific Ocean: Hawaiian Is.

There has been some confusion over the correct identity of this species. Several authors, e.g. Scott *et al.* (1986), Lever (1987), Pratt *et al.* (1987), Raffaele *et al.* (1998) and the AOU (1998), say that its natural range includes Africa. It is, however, the African Silverbill *L. cantans* that occurs in both Africa and Asia. Moreno (1997) points out that *L. malabarica* is distinct from *L. cantans.*

France

Langley (2004) records the establishment of this species in the Var estuary at St Laurent near Nice, where the species has been present since 1988. He saw a flock of 40 outside Nice airport, and estimated the total population at over 100.

Bahrain

'Apparently first recorded in 1978 and a nest was found at Jurdab in February 1988. It now seems to be well-established in semi-desert areas in northwestern Bahrain, notably around Hamad Town where parties of juveniles have been seen. It is a common cagebird imported from the Indian subcontinent. ... There seems to be a westward colonisation of Indian Silverbills through central Arabia which might also be a result of wild birds spreading. The species has even been recorded in Israel in recent years' (Hirschfield & King 1992: 13).

Indian Silverbills that appeared in the 1980s and established a small population between Elat and the Sea of Galilee in southern Israel (Mendelssohn 1999) are likely to be natural immigrants from Saudi Arabia.

West Indies

'Introduced to Puerto Rico, probably in the 1960s, it is common in metropolitan San Juan, occurring locally west to Dorado. It is abundant on the southwestern coast. There are recent records from the Virgin Islands (St Croix)' (Raffaele *et al.* (1998: 448). The species was first recorded on Puerto Rico in 1971 by Raffaele & Kepler (1992).

Hawaiian Islands

In 1967, 104 Indian Silverbills were imported as cage birds to the island of Hawaii, where they were first observed in the wild in 1972 (Berger 1975b). Berger (1981: 209–210) 'found a large population on ... Kohala Mountain during 1974. This species later was found at Pohakuloa; flocks totalling 'hundreds of birds' were seen in North Kohala (Mahukona) and South Kohala (Waikoloa) during 1978. ... During 1978, some 40 Silverbills were found ... below Ulupalakua, Maui [Walters 1979] ... and several were seen on Lanai [Hirai 1980] during 1979'. The species was subsequently reported from Kahoolawe (Conant 1983), Oahu (Conant 1984), Molokai (1981), Molokini (1983), Oahu (1984) and Kauai (1985).

Pratt *et al.* (1987: 317) said that Indian Silverbills from Hawaii had 'spread to Kahoolawe, Lanai, Maui (Makena area), Molokai, Oahu (dry se end), and Kauai (Poipu). Abundant in N and S Kohala and N Kona districts, Hawaii. Recent arrival on n. islands, status unknown'. Pratt (1994) lists the species as occurring on all the main islands. The AOU (1998) says it is established on Hawaii, Maui, Lanai and Molokai, with sight reports from Kauai, Oahu and Kahoolawe.

Scaly-breasted Munia
Lonchura punctulata

Natural Range: N Pakistan, India, Nepal, Sri Lanka, Bhutan, Assam, Bangladesh, Burma, Thailand, S China, Taiwan, Hainan, Indochina, Philippines, S Malay Peninsula, Sumatra, Java, Bali, Lesser Sunda Is, W Kalimantan, Sulawesi.

Naturalised Range: Asia: Japan; ?Saudi Arabia; Singapore; ?UAE. North America: West Indies. Australasia: Australia. Indian Ocean: Mascarene Is. Pacific Ocean: Hawaiian Is; Federated States of Micronesia (Republic of Palau).

Japan

Scaly-breasted Munias – probably escaped or released pets – were first recorded on Okinawa in the Ryukyu Islands in the early 1970s, though nesting was not reported until 1984. The species is now a well-established breeding bird at more than 15 localities (Brazil 1985, 1991). The OSJ (2000) lists the race as *topela* (southeastern Burma to Hainan).

Saudi Arabia; United Arab Emirates

Jennings (2004) lists breeding by this species in Dubai and Abu Dhabi (UAE) and in Jeddah, Saudi Arabia.

Singapore

Although Ward (1968) considered that Scaly-breasted Munias, which are abundant in gardens in Singapore, are descended from escaped or released pets, they could equally well be natural colonists from the southern Malay Peninsula.

West Indies

According to Raffaele *et al.* (1998: 449), Scaly-breasted Munias have been:

> Introduced to Cuba, Jamaica, the Dominican Republic, Puerto Rico and Guadeloupe. Introduced to Puerto Rico in the 1960s [where first recorded in 1971 by Raffaele & Kepler (1992)], it is common from Ceiba to Vega Baja and occurs less frequently throughout the island, though primarily in the lowlands. First recorded in the Dominican Republic in 1978 and from St Croix, Virgin Islands, in the 1980s, these were likely both range expansions from Puerto Rico. Its present status in the Virgin Islands is unknown, while in the Dominican Republic, it is locally common. The species was first observed [on Basse Terre] on Guadeloupe in 1984 [Barré & Benito-Espinal (1985)] where it now breeds and is locally common. Nutmeg Mannikin [=Scaly-breasted Munia] is decidedly uncommon and local on Cuba in the vicinity of Guantánamo where it is known to breed. Flocks of up to 40 birds were recently reported on Jamaica where the bird's range is expanding and includes Rio Cobre, St Catherine, Windsor and the west end [of the island]. The species is uncommon and local on Martinique where it was first recorded around 1995.

Moreno (1997) identified the birds on Puerto Rico (and presumably on other islands) as the nominate subspecies (Pakistan, India, Nepal and Sri Lanka).

Impact: On Guadeloupe, Puerto Rico and in the Dominican Republic, Scaly-breasted Munias are a pest of sorghum and rice crops; on Guadeloupe, experimental rice cultivation has in some places suffered over 90% depredation, and it seems likely that widespread damage could be caused to cereal crops (Barré & Benito-Espinal 1985).

Competition with Scaly-breasted Munias (and other introduced Estrildidae) may be having a negative impact on the less-prolific and less-aggressive native Black-faced Grassquit *Tiaris bicolor* on Guadeloupe.

Australia

Scaly-breasted Munias first appeared in Australia along the banks of the Brisbane River in southern Queensland in 1937, having possibly escaped or been released from captivity around 1930 (Tarr 1950). From Brisbane they spread 65km northwest to Esk by 1955–56, 100km north to Noosaville by 1961, and subsequently 160km south through *Eucalyptus* forests to the cane fields and swampy grasslands of the Tweed, Richmond and Clarence Rivers of northern New South Wales.

In 1951 and 1954, Scaly-breasted Munias that had escaped from aviaries became established around Townsville, Ingham and Rockhampton in northern and central Queensland. In the latter year they appeared in Innisfail and Mackay, and by 1961 had spread 450km north to Cairns and Cooktown. They first appeared in Atherton in 1964, and were said to be one of the most common birds in the coastal towns of northern Queensland (Lavery & Hopkins 1963).

Scaly-breasted Munias were first observed in Sydney, New South Wales, in 1947. Frith (1979) found them to be fairly common locally but said they had not yet penetrated the inhospitable sandstone scrub and *Eucalyptus* forests to the north, leading to the apparently suitable habitats of the Hunter and other rivers. They were first recorded inland at Mudgee by Kurtz (1980), who also reported them to be well dispersed on the Cumberland Plain, and as present in several localities in northern, central and southern coastal regions.

In South Australia, Watmough (1981) found small groups of birds at Felixstow and Paradise in 1978 and 1979 respectively.

Scaly-breasted Munias in Australia increased and spread rapidly, in some places becoming very abundant. Slater (1974) described their range as stretching from Sydney to Cooktown in northern Queensland; Pizzey (1980) said they were then locally common and in some places abundant coastally from Moruya, 250km south of Sydney in southern New South Wales, 3,000km northwards to Cooktown, and 300km inland from Brisbane. Clement *et al.* (1993: 418) say they are 'now well established and occur almost continuously along east coast from Sydney to Cooktown …'.

The form established in Australia was identified by Peters (1968) as *L. p. topela* (Burma, Thailand, China, Taiwan, Hainan and Indochina).

Impact: The Scaly-breasted Munia's establishment in Australia has sometimes been assumed to have been at the expense of the native Chestnut-breasted Mannikin *L. castaneothorax* and other indigenous Estrildidae (Pizzey 1980). However, Frith (1979) points out that to some extent the various species occupy different habitats. He attributes the alien's success to an exploitation of a wider range of habitats that include both urban and rural localities; a more catholic diet; and a year-round breeding season that includes multiple broods and larger clutches of eggs.

Mascarene Islands

The Scaly-breasted Munia was first certainly recorded on Mauritius by J. Desjardins in 1829 (Oustalet 1897), although as Cheke (1987) points out de Querhöent (1773) refers to the presence of a bird that could have been this species. Today, *L. punctulata* occurs throughout the island, including fragmented forest and off-lying islets (Jones 1996; Hawkins & Safford in prep.).

On Réunion, Scaly-breasted Munias were well established when listed by Maillard (1862). Although the date of introduction is unknown (Cheke 1987; Hawkins & Safford in prep.), Simberloff (1992), quoting Barré & Barau (1982), and Moulton *et al.* (1996) claim the date was 1700. On Réunion, the species occurs mostly in coastal regions and in suitable bush or grassland habitats inland (Hawkins & Safford in prep.).

Scaly-breasted Munias on Mauritius (and presumably on Réunion) show characteristics of *L. p. nisoria*, *subundulata*, or *fretensis* (R. J. Safford pers. comm. 2004). See also Sinclair & Langrand (2003).

Hawaiian Islands

Scaly-breasted Munias of the form *topela* (Burma, Thailand, China, Taiwan, Hainan and Indonesia) were imported to the island of Hawaii in 1865 (Caum 1933). According to Berger (1981: 211):

> The species seems to be highly erratic, indicated by its seasonal and annual distribution: it is present in large numbers in certain areas during one year and scarce or even absent in others. … I have found [it] from sea level to at least 7,500 feet [2,300m] and in dry regions where the rainfall averages 20 inches [50cm] or less annually … [and] in extremely wet areas.

See also Richardson & Bowles (1964) and Scott *et al.* (1986).

Today, Ricebirds (as the species is sometimes known in the islands) are common and widespread in a broad range of habitats, including residential areas, agricultural land and pastures, forest and woodland borders, lowlands and thick bush, in both wet and dry localities from sea level to 2,300m, on all the main islands, where it is the most abundant and widely distributed finch (Pratt *et al.* 1987, AOU 1998).

Impact: Caum (1933) and Munro (1944) reported Scaly-breasted Munias as serious pests in rice paddies and in sorghum fields in Hawaii. Since these crops have been replaced by sugar cane and pineapples, Berger (1981) was able to say they were no longer an agricultural nuisance. They are, however, among those species that are known to spread introduced grasses, herbs and shrubs (Stone 1985).

Federated States of Micronesia (Republic of Palau)

Ralph & Sakai (1979) reported *L. punctulata* to have become established and common on Yap Island, and Marshall (1949) found the species on Babelthuap Island, where he believed it had been recently introduced. Although Pratt *et al.* (1987: 318) recorded it as 'formerly present at Palau (Koror): last seen in 1940s', a decade later Ripley (1951) saw a flock on that island. Peters (1968) identified the subspecies as *cabanisi*, which is endemic to the Philippines, so a natural arrival on Palau cannot be discounted. See also Clements (2003).

Javan Munia
Lonchura leucogastroides

Natural Range: S Sumatra, Java, Bali, and Lombok.
Naturalised Range: Asia: Singapore; ?Sumatra.

Singapore

C. J. Hails (pers. comm. 1985) said that this species is the most abundant munia on Singapore Island, where it was apparently first introduced in 1922 and is now widely distributed, mainly in wooded gardens, scrubland, woodland clearings and along the banks of reservoirs.

Sumatra

Clement *et al.* (1993) suggest that this species may have been introduced to Sumatra.

Black-headed Munia
Lonchura malacca

Natural Range: From India and Sri Lanka to Indochina and SW Yunnan and Taiwan. Also the Malay Peninsula, Java, Sumatra and the Philippines.
Naturalised Range: Europe: ?Portugal; ?Spain. Asia: Japan; Moluccas Is. North America: West Indies. Pacific Ocean: Hawaiian Is; Mariana Is; Federated States of Micronesia (Republic of Palau).

Portugal

Vowles & Vowles (1994) have recorded this species as breeding in the Arade River valley in the western Algarve, and João Loureiro (pers. comm. to Costa *et al.* 1997) reported probable breeding at Barrinha de Esmoriz. Black-headed Munias also occur at Barroca Marsh, east of Lisbon (Leitão & Costa 1996).

Spain

Breeding birds were reported in 1999 in Girona and in 2002 in Barcelona (J. Clavell in Martí & del Moral 2003).

Japan

Kaburaki (1934, 1940) said that Black-headed Munias of the race *atricapilla* (India to Yunnan) were introduced to Japan 'before the Restoration' (i.e. prior to 1871), and that they were established in the vicinity of Tokyo until at least the late 1930s. The OSJ (1981) recorded breeding on Honshu northwest of Osaka, at Niigata and Tokyo. M. A. Brazil (pers. comm. 1985) believed they had also been breeding since 1970 on Okinawa in the Ryukyu Islands, where flocks of up to 70 birds now occur in several localities. The species is also well established in Honshu, and has been recorded north to Niigata-ken; it has also probably bred on Kyushu (Brazil 1985, 1991, Clement *et al.* 1993). The OSJ (2000) claims it is monotypic (but see Dickinson 2003).

Moluccas Islands

According to Ripley (1961), Black-headed Munias have been successfully introduced to the island of Halmahera, where Peters (1968) identified the race present as *jagori* (Philippines, Borneo, Sulawesi, Muna, Butung).

West Indies

Raffaele *et al.* (1998: 449–450) record that the Black-headed Munia was

> Introduced to Puerto Rico [first recorded by Raffaele & Kepler (1992) in 1971] probably in the 1960s, it is uncommon around the entire coast. First recorded from Hispaniola and Martinique in the 1980s and Cuba and Jamaica in the early 1990s, the

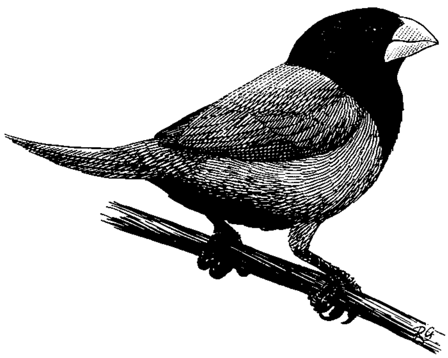
> species was already present in relatively large numbers when discovered on each of these islands. It is now locally common on Cuba in the southern Havana Province and at a number of localities along the south coast of Hispaniola where it frequents agricultural areas. It is uncommon and very local on Jamaica (Caymanas and on the north coast near Priory and St Ann) and Martinique.

While the populations on Puerto Rico, Jamaica, and Martinique are probably derived from escaped or released pets, those on Cuba and Hispaniola may have resulted from natural dispersal (Raffaele *et al.* 1998). The AOU (1998) records the species as only occurring on Puerto Rico. Moreno (1997) assigned the birds on Puerto Rico primarily to the nominate subspecies (southern India and Sri Lanka), with a single specimen of *L. m. atricapilla* (India to Yunnan).

Impact: Black-headed Munias in the Caribbean are a potential pest to various grain crops (Raffaele *et al.* (1998) and in rice fields.

Hawaiian Islands

Black-headed Munias were imported to Oahu as cagebirds between 1936 and 1941, probably from Calcutta, India, where the form is *atricapilla.* They were first recorded as breeding in the wild, near West Loch in Pearl Harbor, in 1959 (Udvardy 1960). Ord (1967) estimated the population at between 400 and 500, and in 1972 around 900 were counted in the West Loch area, where they frequented mainly kiawe or mesquite *Prosopis chilensis* thickets and open grassland between sugarcane plantations. Elsewhere they are found on golf courses, grassy roadside verges and weedy headlands of cane fields.



Black-headed Munia

In 1970 Berger (1981) found Black-headed Munias of the nominate subspecies (southern India and Sri Lanka) in Honolulu. The Hawaiian Audubon Society (1975) reported that the species' stronghold appeared to be the grassy lowlands of the Waipio Peninsula in Pearl Harbor, from where it seemed to be slowly spreading inland; by 1977 the birds had been observed 24km north of Pearl Harbor, and also at Laie on the north coast of Oahu – the latter almost certainly resulting from a separate introduction. Zeillemaker & Scott (1976) described *L. malacca* as local and uncommon in dry lowland agricultural land and pastures only on Oahu.

In 1976, Black-headed Munias were found by Pratt (1977) to be well established on Kauai, where in the following year between 40 and 50 were counted near Poipu Beach.

Pratt *et al.* (1987: 318) say of the species that it was 'Abundant on Oahu (Pearl Harbor and central valley but spreading), common but local on Kauai (Koloa area). Reported from Hawaii (Honaunau) but not known to be established'. Pratt (1994) says that in 1992 it occurred on Oahu and Kauai. The AOU (1998) says it may possibly also be found on Hawaii.

Impact: Were Black-headed Munias to increase in numbers and become widely established in the Hawaiian Islands, they could become a serious agricultural pest.

Mariana Islands

Ralph & Sakai (1979) reported that *L. m. ferruginosa* has also been successfully introduced to the island of Guam, where it was abundant. Pratt *et al.* (1987) confirm the species' establishment on Guam.

Federated States of Micronesia (Republic of Palau)

Ripley (1951) discovered Black-headed Munias of the endemic Javan form *ferruginosa* to be established on the islands of Babelthuap and Koror, and suggested the possibility of a hybrid population. Ralph & Saki (1979) found they were then still abundant on Babelthuap, where Pratt *et al.* (1987: 318) said they were 'well established at Palau (Koror complex, s. Babelthuap …)'.

White-cowled Mannikin
Lonchura hunsteini

Natural Range: Endemic to New Ireland and New Hanover, Bismarck Archipelago.
Naturalised Range: Pacific Ocean: Federated States of Micronesia (Republic of Palau).

Federated States of Micronesia (Republic of Palau)

According to Pratt *et al.* (1987: 319) this species was 'Introduced (1920s) to Pohnpei, where abundant in the northern and eastern parts of the island'. Dickinson (2003) confirms its presence on Pohnpei.

Impact: Pratt *et al.* (1987) say that the White-cowled Mannikin, which is usually seen in huge flocks, is a major agricultural pest.

Chestnut-breasted Mannikin
Lonchura castaneothorax

Natural Range: New Guinea, and from NW to coastal E Australia.
Naturalised Range: Pacific Ocean: Marquesas Is; New Caledonia; Society Is.

Marquesas Islands; Society Islands

Table 19 gives details of introductions of the Chestnut-breasted Mannikin to the Marquesas and Society Islands.

Pratt *et al.* (1987: 319) reported *L. castaneothorax* as 'Introduced to the Society Islands (Bora Bora, Raiatea, Moorea, Tahiti) in the 1800s and now common. Also in the Marquesas (Hivaoa, Tahuata, Mohotani)'. Thibault (1989) said that Chestnut-breasted Mannikins had been established for several decades on Eiao and Hatutaa in the Marquesas.

New Caledonia

Chestnut-breasted Mannikins of the nominate subspecies have been introduced from northern Australia to New Caledonia, where they became common in gardens and on cultivated land (Delacour 1966, Pizzey 1980).

Java Sparrow
Lonchura oryzivora

Natural Range: Java and Bali.
Naturalised Range: Asia: ?Burma; China (including Hong Kong); India; Indonesia; Japan; East Malaysia; West Malaysia; Philippines; Singapore; South Vietnam; Sri Lanka; Taiwan; Thailand. Africa: Tanzania (including Zanzibar and Pemba Is). North America: West Indies. Atlantic Ocean: St Helena I. Indian Ocean: Christmas Is; ?Cocos (Keeling) Is. Pacific Ocean: Fiji Is; Hawaiian Is.

Burma

Java Sparrows became established in the wild in Tenasserim before 1890 (Blandford 1890) and Arakan before 1912 (Hopwood 1912). Their descendants may possibly survive in Tenasserim and in western Burma (Clements *et al.* 1993).

China (including Hong Kong)

Since Java Sparrows are known to have been imported to Japan from China from at least the seventeenth century, their introduction to the latter must have been at an early date; they have for many years been naturalised in various parts of (mainly coastal) southern China, where Swinhoe (1860) saw them at Amoy (Xiamen) in southern Fukien Province. Others were recorded in 1891 as far north as Shanghai, and in 1892 in the south near Shantou in northern Guangdong. La Touche (1925, 1934) found *L. oryzivora* in scattered localities along the Kiangsu coast north of Shanghai, and in the south in Fukien, Shantou and Guangdong. Clement *et al.* (1993) list it as ranging in eastern China from Kiangsu south to Kwangsi and Hong Kong.

In Hong Kong, where they are still a favourite cage bird, Java Sparrows seem first to have been reported in the wild by Swinhoe (1861). Nowadays, small numbers are seen almost annually. See also Viney *et al.* 1996.

India

Java Sparrows became established in the wild at Madras before 1910 and in Calcutta by 1931 (Law 1932), where according to Clement *et al.* (1993) they still survive.

Indonesia

Java Sparrows seem to have been first reported on Sulawesi, on the southern peninsula and on the eastern end of the northern Minahassa Peninsula, by Stresemann (1936); they still survive there.

According to King *et al.* (1975), Java Sparrows have been introduced to the Moluccas and Lesser Sunda Islands; on the latter, they have occurred on Lombok since at least 1933 (Kuroda 1933–36), where they are still established (Dickinson 2003). Keffer (1972) says they are also to be found on Kangean Island north of Lombok, and according to Dickinson (2003) they may occur as an introduced species on Sumbawa Island.

According to Keffer (1972), Java Sparrows are also established in Kepulauan Riau, south of Singapore.

Many years ago Java Sparrows were introduced to (or possibly colonised naturally) Sumatra, where their present status is uncertain. Keffer (1972) lists them as also occurring on Billiton Island off Sumatra.

Japan

During the period of the Tokugawa Shōgunate (1598–1867), Java Sparrows, imported from China, were widely kept as pets in Japan. Kuroda (1937) quotes a description of *L. oryzivora* in the seventeenth century *Honho Shokkan* ('Handbook of Japanese Foods'), and also states that in the *Wakum Sho* ('Dictionary of the Japanese Language'), published in the following century, the species is referred to as a recent arrival from overseas. Although Brazil (1985, pers. comm. 1985) says that flocks of 200–300 Java Sparrows sometimes occur in

TABLE 19 Introductions of the Chestnut-breasted Mannikin *Lonchura castaneothorax* to the Marquesas and Society Islands, late 19th century–1973.

Island	*Date of Introduction*	*Status*
Tahiti	Late 19th century	Became widespread
Moorea	Established before 1921	Became widespread
Tetiatroa	1973	Not found by Holyoak (1974)
Maiao	?	Population of under 200 in 1973
Huahine	?	Present in 1972
Raiatea	?	Present in 1972
Tahaa	?	Present in 1972
Bora Bora	Late 19th century	Numerous 1971–72
Maupiti	?	A few seen 1973
Mopelia	?	A few seen 1973
Makatea	?	Several dozen pairs 1973
Nukuhiva	First seen in 1971	?
Uahuka	First seen in 1971	?
Uapou	First seen in 1971	?
Hivaoa	Probably 1936	Next reported in 1957 (King 1958)
Tahuata	First seen in 1975	?
Fatuiva	Probably 1955–60	Present in 1975

Source: Holyoak & Thibault (1984).

southern Honshu (and perhaps also on Okinawa), they may not breed annually. Clement *et al.* (1993) say they occur in Honshu and southern Kyushu; in the former, Brazil (1991) lists them as numerous but local and says that the main breeding populations occur near Tokyo and Osaka; the OSJ (2000) adds Hyogo.

West Malaysia

On the Malay Peninsula, Java Sparrows were probably introduced to Kuala Lumpur before 1910, and perhaps at the same time to Georgetown on Penang Island and to Alor Star on the mainland. By the late 1930s they seem to have been established locally in several localities on or near the west coast, including Kangar (Perlis State), Alor Star (Kedah), Georgetown (Penang Island), Ipoh (Perak), Kuala Lumpur (Selangor), Seremban (Negri Sembilan) and Malacca (Medway & Wells 1976).

In Kuala Lumpur the Java Sparrow is a largely urban species; before the Second World War it thrived on a diet of rice and grain, but declined after the invasion of the Japanese when these foods were in short supply. After the cessation of hostilities it staged something of a comeback – especially in settled areas; only in the northern states of Perlis and Kedah, however, do Java Sparrows live and breed in open country, paddy fields, scrub, and grassland; elsewhere they are found solely in settled areas, where the population is probably augmented by the recruitment of escaped pets (Medway & Wells 1976).

East Malaysia

Java Sparrows have probably occurred in the wild in Borneo (principally in the north) since before 1860. They are said to have been imported to Labuan Island, off the coast of Sabah, by the Governor, the Hon. Hugh Low. They were reported by Sharpe (1889) in some places to be abundant but had not yet spread to the mainland. They were also found on the coast of Sabah at Tuaran and Kinabalu by Gore (1968).

Impact: On Labuan Island, Java Sparrows have been damaging crops (in particular rice) since the late nineteenth century (E. J. H. Berwick pers. comm. to Long 1981).

Philippines

L. oryzivora has been established in the wild in the Philippines since before 1933 (Kuroda 1933–36; Riley 1938). By the mid-1940s it occurred around Manila on Luzon (Delacour & Mayr 1946), and has since colonised many other Filipino islands, including Guimaras, Mindanao, Panay, Samar, Cebu, Pan de Azucar, Calagnaan and Negrosi (Clement *et al.* 1993).

Singapore

Java Sparrows were imported from Java to Singapore Island in the 1840s, where Ward (1968) believed that between about 1850 and 1950 they were fairly common in the wild (being described as the commonest bird on the island in the 1920s), but that thereafter they declined due to loss of habitat. Seng (1997) described them as rare and liable soon to become extinct.

South Vietnam

Since the 1920s, Java Sparrows have been established in residential suburbs of Saigon, on the south coast in Nha Trang, and in Phan Rang (Delacour & Jabouille 1927, 1931). Wildash (1968) found the species to be widely distributed throughout the country, to which large numbers continue to be imported as pets.

Sri Lanka

Since before 1870, Java Sparrows have occurred in the wild in Colombo, where the population is constantly reinforced by escaped cage birds. A few other small colonies exist elsewhere on the island (Henry 1955, Long 1981).

Taiwan

Java Sparrows occurring in the wild in Taiwan are believed to be descended from birds released as an offering to the dead – a practice known as *hojo* (Horikawa 1936) – reinforced by more recent escapes of this popular cage bird.

Thailand

At some date prior to 1938, Java Sparrows were introduced to Bangkok, where they became established in the wild (Riley 1938; Long 1981), and where they still survive (Clement *et al.* 1993).

Tanzania (including Zanzibar and Pemba Islands)

Vaughan (1932) quotes Sir Richard Burton as saying, in *Zanzibar: City Island and Coast* (1872), that Java Sparrows from Massachusetts were imported to Zanzibar around 1857. This seems unlikely, since the first record of the species' introduction to the United States (where it has now died out) was not until 1878 (Phillips 1928).

L. oryzivora first appeared on the Tanzanian mainland and on Pemba Island (possibly from Zanzibar) probably in the 1930s (Riley 1938) and certainly before 1957 (Mackworth-Praed & Grant 1952–73). The species is now well established in the Old Town on Zanzibar (pers. obs. 2001) and on Pemba (Van Perlo 1995).

Impact: On Pemba Island, Java Sparrows are a pest in rice fields (J. G. Williams, pers. comm. to Long 1981).

West Indies

Blake (1975), Bond (1979), and Raffaele & Kepler (1992) recorded the Java Sparrow in the wild in San Juan, Puerto Rico, in 1965. Raffaele (1989) said it was well established there in the San Juan metropolitan area, and was particularly abundant in the Old Town and the Isla Grande Reserve, but appeared to be declining. Raffaele *et al.* (1998: 450) said the species had been introduced

> … probably in the 1950s or early 1960s, it is fairly common in the San Juan metropolitan area [See also AOU 1998]. This species was introduced to Jamaica around 1903 near Castleton and Thomasfield where it was recorded until 1946 and then appeared to die out. There are recent reports from Jamaica, likely a new introduction.

Moreno (1997) was unable to discover the origin of the birds introduced to Puerto Rico.

St Helena Island

L. oryzivora was introduced to St Helena in or before 1775, when it was already said by J. R. Foster to be 'numerous' (Hoare 1982). Brooke *et al.* (1995) incorrectly give the date of arrival on St Helena as 1790. F. Duncan (Anon. 1805) reported an increase in the population, perhaps as a result of protective legislation enacted in 1796 (Janisch 1908). By the 1860s, Java Sparrows were said by Mellis (1870) and other authorities to be common and increasing, especially in the north but also in the interior when corn was ripening. By the early 1950s the population had suffered a marked decline (Haydock 1954), perhaps because of a reduced production of cereal crops (Lever 1987). By the late 1950s the population had recovered, but in the early 1960s the birds around Jamestown again declined, this time as a result of eating poisoned grain (Loveridge 1977). The species remained relatively scarce throughout the island between the early 1960s and mid-1980s.

Since the late 1980s, Java Sparrows have been common again around Jamestown, but are only seen occasionally on coastal cliffs (Rowlands *et al.* 1998). In 1997, Rowlands *et al.* (1998: 194–195) found the species to be '… locally very common with a patchy distribution. … abundant in Castle Gardens [Jamestown] … and in large groups, many places'. It is found mainly in human settlements at up to 600m above sea level. In Jamestown, 2,859 were counted in a single roost in 1995 (Rowlands *et al.* 1998). See also McCulloch (2004).

Lockwood *et al.* (1996) investigated the morphological dispersion of the introduced terrestrial avifauna on St Helena, where they found that although introduced finches tend towards morphological overdispersion not all passerines do so; they hypothesise that the pattern of overdispersion found among finches is a result of increased species richness.

According to Forbes (1813), Java Sparrows were imported to St Helena from Batavia (Java) and China.

Impact: Forbes (1813: 197), quoted by Rowlands *et al.* (1998), said that as early as 1776, Java Sparrows '... from their wonderful increase, are become a great annoyance to farmers', and Martin (1835: 530) reported that they were causing '... great destruction to farmers' crops'. Today, they also eat grain intended for domestic poultry.

According to Rowlands *et al.* (1998) Java Sparrows on St Helena tend to dominate other passerines with which they associate.

Christmas Island

L. oryzivora is believed to have first been introduced to Christmas Island between 1913 and 1923 (Chasen 1933). By the 1940s the birds were fairly common in unsettled north coastal areas (Gibson-Hill 1947), and by the mid-1960s were seen in flocks of up to 50 (Watson *et al.* 1963, Van Tets & Van Tets 1967). The naturalised population is frequently reinforced by further escaped cage birds.

Cocos (Keeling) Islands

Holman (1846) said that Java Sparrows were first imported to the Cocos Islands before 1828. Wood-Jones (1909) reported them to be common, and in 1941 Gibson-Hill (1949a) found the species to be abundant on Pulo Tikus (Direction) and to occur in lesser numbers on Pulo Luar (Horsburgh) and Pulo Selma (Home) Islands. Stokes *et al.* (1984), however, believed the birds have since died out.

Fiji Islands

Watling (1982: 132) states that the Java Sparrow was first collected in Fiji by the artist–naturalist William Belcher in 1925 ... '[it] is restricted to south-east Viti Levu, the Savusava area of Vanua Levu and several pockets in Taveuni. It is found only in [wet] agricultural and suburban habitats .... Within its restricted range, it is a common bird, but for some reason has been unable to spread further'. This distribution is confirmed by Pratt *et al.* (1987).

Hawaiian Islands

Phillips (1928: 56) said that Java Sparrows were introduced to the Hawaiian Islands 'at least 25 or 30 years ago, but apparently did not prosper'; Caum (1933) suggests the dates of introduction as around 1865 and again about the turn of the century. It was not until 1964, however, that the birds were reported in the wild, in Honolulu, on Oahu. Breeding was first recorded in 1968–69 on the slopes of Diamond Head, Honolulu, where some birds may have been released in 1967 (Throp 1969). 'The increase in numbers and the range of expansion since that time', wrote Berger (1981: 212), 'have been phenomenal'. By 1972 the population had increased to more than 60, and within a further two years had spread into the upper Manoa Valley. In the following year, the Hawaiian Audubon Society (1975) reported that the birds had dispersed from Kapiolani Park to Makiki and Kalihi, and Zeillemaker & Scott (1976) listed the species, whose population had increased to 231, as local and rare in dry lowland residential and community parkland on Oahu; by 1984 it was apparently gaining a foothold on Hawaii.

According to Pratt *et al.* (1987: 319), Java Sparrows were 'abundant and spreading from Honolulu area on Oahu; less numerous but increasing on Keauhou–Kona area of Hawaii and on Kauai'. Pratt (1994) lists the species as occurring in 1992 on Oahu, Hawaii, Maui and Kauai. The AOU (1998: 683) says that *L. oryzivora* was 'now widespread on Oahu, common on the Kona coast of Hawaii, and in small numbers on Kauai and Maui'.

Shehata *et al.* (2001) found Java Sparrows to be one of only five introduced species to be free of malarial infection in their study area in Honolulu.

White-rumped Munia
Lonchura striata

Natural Range: India to E China and Taiwan.
Naturalised Range: Asia: Japan.

Japan

Since the 1980s, flocks of up to 65 individuals, descended from escaped or released cage-birds, have been observed in Okinawa, where successful breeding has been recorded in at least seven locations (Brazil 1985, 1991).

VIDUIDAE (INDIGOBIRDS AND ALLIES)

Pin-tailed Whydah
Vidua macroura

Natural Range: From Senegal to Ethiopia and Cape Province, South Africa.
Naturalised Range: North America: West Indies. Indian Ocean: ?Mascarene Is.

West Indies
Raffaele & Kepler (1992) reported the first sighting of this species on Puerto Rico, at Río Piedras, in 1971. 'Probably introduced in the 1960s to Puerto Rico, Pin-tailed Whydah occurs uncommonly and locally around the entire coast and, to a lesser extent, inland well into the mountains' (Raffaele *et al.* 1998: 450). Moreno (1997) believed the birds were imported from Senegal.

In its native range, *V. macroura* is a brood parasite of other birds, principally waxbills of the genus *Estrilda*. On Puerto Rico, it presumably parasitises the also introduced *E. melpoda* and *E. troglodytes.*

Mascarene Islands
This species was apparently introduced to the island of Réunion as a cage bird in about 1990 (Crestey 1997, Probst 1997, Le Corre 2000, R. J. Safford pers. comm. 2004). No information on its present status and distribution appears to be available.

Eastern Paradise Whydah
Vidua paradisaea

Natural Range: From E Sudan to S Angola and Natal.
Naturalised Range: Asia: Japan.

Japan
The OSJ (2000) lists *V. paradisaea* as a resident breeding species in rice-fields and reclaimed land around Tokyo on Honshu.

PRUNELLIDAE (ACCENTORS)

Dunnock
Prunella modularis

Natural Range: Europe (including the British Isles) eastwards to E Turkey, the Caucasus and N Iran. Winters S to N Africa and the Middle East.
Naturalised Range: Australasia: New Zealand.

New Zealand
Between 1867 and 1875 a total of 47 Dunnocks (then known as Hedge Sparrows) from England (where the form is *P. m. occidentalis*) was released by the Auckland Acclimatisation Society (see Lever 1992); the first nests were found in 1873 and the birds soon became established. More Dunnocks were acquired and released by other acclimatisation societies as follows: Canterbury (89 between 1867 and 1875); Otago (98 between 1868 and 1871); Hawke's Bay (an unknown number in 1876); and Wellington (50 between 1880 and 1882). The birds apparently flourished, spreading rapidly and widely throughout New Zealand (Thomson 1922), although they had yet to penetrate undisturbed bush and occurred mainly in suburban gardens and shrubby groves up to 900m (Philpott 1918). Some places, especially in Auckland and Northland, were not colonised until the 1930s (Heather & Robertson 1997).

Wodzicki (1965: 433) found that Dunnocks were 'widely abundant and common, [on] North, South, Stewart and Raoul [Kermadecs], Chatham and Auckland Islands'. Kinsky (1970) reported them to occur also on Kapiti and other nearby offlying islands, and also on the Snares (by 1948), and Campbell Island (probably before 1907). Falla *et al.* (1979) reported Dunnocks to be well established in a variety of habitats, including coastal mangrove swamps, saltmarshes, parkland, gardens, exotic forests, and subalpine scrub, up to 1,600m above sea level. They have since spread to most of New Zealand's offshore islands, including Three Kings, Little Barrier, Hen, Solander, Codfish, and the Antipodes.

Dunnocks now breed throughout New

Zealand, including the Chathams, Antipodes, Auckland, and Campbell Islands, and are vagrants on the Snares and uncommon on well-forested islands such as Little Barrier and Kapiti. Although in its native range *P. modularis* is partially migratory, there is no evidence for long-distance movement in New Zealand (Heather & Robertson 1997).

Impact: Both Thomson (1922) and Williams (1969) said that Dunnocks were the one introduced species in New Zealand that was wholly beneficial. Their consumption of injurious invertebrates such as flies and aphids (the purpose for which they were introduced; Baker 1991) more than compensates for their occasional depredations of small fruits and seeds.

FRINGILLIDAE (FINCHES AND HAWAIIAN HONEY-CREEPERS)

Chaffinch
Fringilla coelebs

Natural Range: From the British Isles eastwards to C Siberia, S to the Crimea, Caucasus, Asia Minor, Levant, Turkey, Iraq, Iran and NW Africa. Also on the Balearic Is., Corsica, Sardinia, Cyprus, Azores, Madeira and Canary Is. Winters S to N Africa, SW Asia and the Middle East.

Naturalised Range: Africa: South Africa. Australasia: New Zealand. Pacific Ocean: ?Norfolk I.

South Africa

The endemic British subspecies of the Chaffinch *F. c. gengleri* was introduced to the Groote Schuur Estate by Cecil Rhodes in 1898. It has not spread far and remains confined to gardens and exotic plantations (e.g. Cluster Pine *Pinus pilaster* and oak *Quercus* sp.) on the lower slopes of Table Mountain on the northern Cape Peninsula. It became most numerous in Newlands and Kenilworth but occurred from Sea Point to Plumstead, Tokai, and Hout Bay (Siegfried 1962).

Frauenknecht (1998), who said that the importation numbered 200 birds, estimated the population, which is subject to marked fluctuations, at 1,500–2,000, and said it occurs from Kloof Nek to Tokai and from Constantia Nek to Hout Bay; it has thus spread very little in the last half century. Although there are other apparently suitable habitats in the Western Cape, the species has yet to venture beyond the Cape Peninsula. Possible reasons for the birds' failure to expand their range include predation by introduced Grey Squirrels *Sciurus carolinensis* (see Lever 1985) – it is believed that Squirrels eradicated Chaffinches from the Cape Town Public Gardens – and some climatic differences between the Cape Peninsula and the Western Cape (Frauenknecht 1998).

New Zealand

Between 1862 and 1877 Chaffinches from England (*F. c. gengleri*) were imported to New Zealand by acclimatisation societies (see Lever 1992) as follows: Nelson (23), Auckland (113), Canterbury (16), Otago (99), and Wellington (126), and many more were brought in by private individuals (Thomson 1922, 1926), making a total of well over 400 birds.

In Canterbury, Chaffinches soon became established, especially in exotic pine plantations, but seldom in native woodlands or above the treeline. In Otago, they became abundant around Dunedin, but later declined through eating poisoned grain intended for Rabbits *Oryctolagus cuniculus* (Thomson 1922). Even after trapping replaced poisoning, and other small passerines increased, the Chaffinch remained relatively rare. Elsewhere it spread only slowly, but by around 1920 was 'common throughout both the islands, and very abundant in some parts, especially from Taupo [central North Island] northwards', to the upper limit of the bush line at around 900m (Thomson 1922: 170).

In 1879, 70 Chaffinches were freed on Stewart Island, but all had disappeared by around 1914. They reappeared, probably as natural colonists from the mainland, before 1930, and spread to other offlying islands as follows: Mayor and Kapiti before 1930; the Snares before 1948; Three Kings, Mokohinau, Little Barrier, Codfish, the Aucklands and Campbell before 1955; and Macquarie and the Chathams before 1965 (Williams 1969, Kinsky 1970); they bred on Three Kings, the Chathams, the Antipodes, Campbell and the Aucklands before 1973 (Williams 1973).

Wodzicki (1965: 433) described Chaffinches as 'widely distributed and abundant, North, South, Stewart, and Chatham, Campbell, Snares, Auckland, and Macquarie Islands'. Williams (1969) referred to the Chaffinch as perhaps the most widespread and common bird in New Zealand, and Falla *et al.* (1979) considered it to be the country's most abundant finch; they found it wherever there are trees and shrubs up to 1,400m above sea level, and said that it had penetrated into bush and forests as no other finch had done, and that it also occurred in gardens, parks, orchards, farmland and both native and exotic woodland.

Heather & Robertson (1997) recorded breeding on the Chathams, Snares, Auckland and Campbell Islands, and said that vagrants had occurred on Lord Howe Island and the Kermadecs. Elsewhere Chaffinches are abundant on both main and many offshore islands. Although some northern European Chaffinch populations migrate, there is no evidence of migration in New Zealand.

Descendant populations of Chaffinches in New Zealand show very little genetic or morphological differentiation (in marked contrast to the also introduced House Sparrow *Passer domesticus*, Common Myna *Acridotheres tristis*, and Eurasian Starling *Sturnus vulgaris*). The pattern of variation in their populations is haphazard and does not correspond with environmental variation, nor is it predicted by the geographic proximity of subgroups. Thus random drift is likely to be the primary cause for chance patterns of geographic variation, which implies that genetic and morphological characteristics are now effectively neutral in regard to selection. In contrast, European populations are subdivided genetically or morphometrically by barriers to gene flow, such as the Pyrenees Mountains between Iberia and southern Europe (Baker *et al.* 1990, Baker 1991).

Impact: Until about 1920 a bounty was provided for the destruction of Chaffinches in such grain-growing areas as South Canterbury (Thomson 1922). Although Chaffinches sometimes cause limited damage to fruit crops (apricots, peaches, apples and nectarines) and to newly sown cereals and brassicas (Dawson & Bull 1969, Heather & Robertson 1997), their most significant impact may be to reduce the natural regeneration of some alien pines through their consumption of seeds. During the breeding season their main food is such injurious invertebrates as caterpillars, flies and aphids.

Norfolk Island

Barrett *et al.* (2003) list a record of the Chaffinch on Norfolk Island. Whether the species is established is uncertain.

Island Canary
Serinus canaria

Natural Range: Canary, Azores and Madeira Is.
Naturalised Range: Pacific Ocean: Hawaiian Is: Atlantic Ocean: Bermuda.

Hawaiian Islands

In 1909 Daniel Morrison purchased a pair of Island Canaries on Oahu, which he subsequently transported to Sand Island in the Midway group. In 1910, 10 young hatched in Morrison's aviary and were released later in the same year; Pratt *et al.* (1987) erroneously give the date of release as 1911. Breeding in the wild took place in December 1910, and in the first season some 60 young were reared successfully. The birds soon became established, within a few generations reverting to their wild-type colouring (Bryan 1912). Their successful establishment on Sand Island has been attributed to the absence of predators able to climb the trees in which the Canaries nest.

Various authors, e.g. Fisher & Baldwin (1945), the Hawaiian Audubon Society (1975), Zeillemaker & Scott (1976) and Pyle (1977), confirmed the birds' survival on Sand Island, where a flock of 73 was counted in 1978. Today, the species remains fairly common, albeit in small numbers, in the Midway Group (Pratt *et al.* 1987, Clement *et al.* 1993, Pratt 1994, AOU 1998).

Bermuda

The AOU (1998) states that *S. canaria* is established in Bermuda, where it died out between 1966 and 1970 (D. B. Wingate pers. comm. 1984).

Yellow-fronted Canary
Serinus mozambicus

Natural Range: Most of sub-Saharan Africa apart from SW South Africa.

Naturalised Range: North America: West Indies. Atlantic Ocean: ?Annobón I; ?São Tomé I. Indian Ocean: Agaléga Is; ?Mafia I; Mascarene Is; Seychelles Is. Pacific Ocean: Hawaiian Is.

West Indies

Raffaele *et al.* (1998: 444) say that the Yellow-fronted Canary was 'Introduced to Puerto Rico around 1960, this finch is very rare and local along the north coast. Small numbers were recorded from Vacia Talega, Punta Mamaayes and Ramey, but there are no recent records'.

Annobon Island; São Tomé Island

According to Peters (1968), *S. m. tando* (Gabon, Zaire, and Angola) has been introduced to these two islands in the Gulf of Guinea. In view of the subspecies present, however, natural colonisation from the mainland cannot be ignored. See also Christy & Clarke 1998.

Agaléga Islands

The introduction of this species to the Agalégas is recorded by Cheke & Lawley (1983). No other information is available.

Mafia Island

Hawkins & Safford (in prep.) say that Yellow-fronted Canaries have been introduced to Mafia Island off the coast of Tanzania; their present status there is unknown.

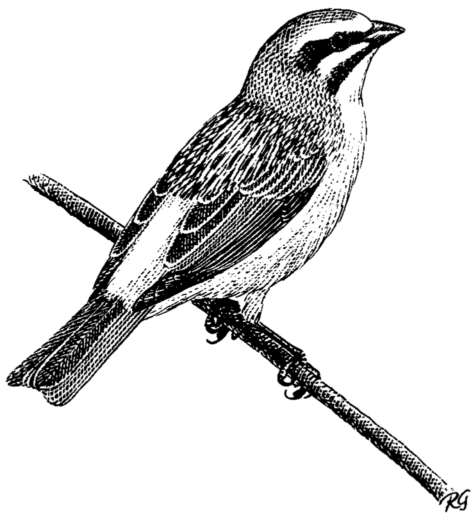
Mascarene Islands

Bernardin de St Pierre (1773) was the first to refer to the Yellow-fronted Canary on Mauritius, where Le Gentil de la Galaisière (1779–81) said that it had been imported to the Isle-de-France from South Africa during the Seven Years' War (1756–63). Cheke (1987) says that Le Gentil was on Mauritius in 1760–61 and 1770, and that it is likely that the birds were on the island in 1760.

On Réunion, it seems probable that *S. mozambicus* was introduced at or before the time it was imported to Mauritius (Pingré *c.* 1763, Maillard 1862).

The earliest reference to the Yellow-fronted Canary on Rodrigues that Cheke (1987) could find was by Vinson (1964), who according to Showler (2002) suggested a date of arrival around 1764.

Staub (1976) and Cheke (1987) recorded the species as very common on Mauritius and



Yellow-fronted Canary

Réunion, and the latter found it to be uncommon on Rodrigues. Hawkins & Safford (in prep.) say Yellow-fronted Canaries occur throughout Mauritius and Rodrigues, though they are only patchily distributed in the uplands of the former and are absent from neighbouring islets of both. On Rodrigues, Showler (2002) found that they prefer drier and more exposed localities, such as the coastal strip in areas planted with *Casuarina equisetifolia*, and inland on hillsides and open wooded ridges with *Casuarina* and other exotics such as *Eucalyptus tereticornis*, *Tabebuia pallida* and *Terminalia arjuna*. On Réunion, Hawkins & Safford (in prep.) reported *S. mozambicus* mainly in the coastal lowlands, and inland in open wooded localities up to 1,500m above sea level. The form established on Mauritius and Réunion is either *mozambicus* (east Africa and Zimbabwe to northern South Africa) or *granti* (southern Mozambique) – probably the latter (R. J. Safford pers. comm. 2004). See also Jones (1996) and Sinclair & Langrand (2003).

Impact: As early as the late eighteenth century, Le Gentil (1779–81; quoted by Cheke 1987) was referring to the Yellow-fronted Canary (and Yellow-crowned Canary) as 'a great destroyer', and in 1770 a bounty was offered for their destruction (Bernardin 1773, Le Gentil 1779–81, Ly-Tio-Fane 1968, Cheke 1987). Although Clark (1859) said that the bounty was withdrawn in the 1850s, when the cultivation of cereal crops declined, Meinertzhagen (1912) relates how on Mauritius farmers had to spend much of their time driving Canaries from their fields.

Seychelles Islands

In 1977 20–30 Yellow-fronted Canaries of the nominate subspecies (Kenya to Mozambique, Zimbabwe and South Africa) were illegally introduced to Assumption, where by 1986 the population was estimated to be between 25 and 35, at which it is believed to remain today. Between 1882 and 1892 the species also occurred on Desroches (and possibly elsewhere in the Amirantes) but subsequently died out (Skerrett *et al.* 2001).

Impact: *S. mozambicus* poses a potential threat to the endemic avifauna of nearby Aldabra Island which is so far free of alien birds (Skerrett *et al.* 2001).

Hawaiian Islands

Yellow-fronted Canaries were first reported on Oahu, at Koko Head, in 1964, where breeding was confirmed around 1977. Zeillemaker & Scott (1976) recorded the birds as local and rare in residential and community parklands on Oahu, where Berger (1981: 221) said the species was 'now a common resident in the Diamond Head–Kapiolani Park region of Waikiki; it has also been seen at Kawela Bay'.

Although *S. mozambicus* was probably released on the Puu Waawaa Ranch on Hawaii before 1960, it was not until 1977 that the first birds were recorded in the wild. At first they remained restricted to the eastern, southern and western slopes of Mauna Kea, from Puu Laau to Puu Kahinahina, between 2,100 and 3,800m. At about the same time some were also noted at Halepohaku (2,900m), and between Puu Kole and Puu Kaupakuhale and on Hualalai Mountain. By 1981 they had spread to the moist Ohia *Metrosideros collina* forest at 1,280m on Stainback Highway (Berger 1981). Scott *et al.* (1986) found them to be associated with dry woodland savannas with a light covering of native and exotic trees, and Paton (1981) suggested that the birds' range was expanding.

Pratt *et al.* (1987: 294) said the species was 'established on Oahu (Kapiolani Park area) and [western] Hawaii (most common near Puu Waa Waa)' but added that flocks could appear anywhere on the island. This distribution is confirmed by Pratt (1994) and the AOU (1998).

Yellow-crowned Canary (Cape Canary)
Serinus canicollis

Natural Range: Much of sub-Saharan Africa.
Naturalised Range: Indian Ocean: Mascarene Islands.

Mascarene Islands

It seems probable that *S. canicollis* was introduced to Réunion, where Staub (1976), Barré & Barau (1982) and Cheke (1987) reported it was common, at about the same time (before 1760) as *S. mozambicus* (Pingré *c.* 1763, Maillard 1862). The species occurs principally in scrubland and cultivated areas from around 600m to the lower limit of the *Philippia* heath at 1,800–2,000m.

R. J. Safford (pers. comm. 2004) assigned Yellow-crowned Canaries on Mauritius (where the species is now extinct) to the nominate subspecies (western South Africa) or *thompsonae* (eastern South Africa), so the likelihood is that those on Réunion are the same. See also Sinclair & Langrand (2003). (The subspecies *thompsonae* is not recognised by Dickinson (2003), who assigns all South African birds to the nominate subspecies).

Impact: See under *S. mozambicus*. On Réunion, *S. canicollis* is also reported to be a pest of fruit and vegetable crops.

Yellow Canary
Serinus flaviventris

Natural Range: From SW Angola and Botswana S through Namibia to Cape Province, South Africa.
Naturalised Range: Atlantic Ocean: Ascension I; St Helena I.

Ascension Island

In the nineteenth century Yellow Canaries were introduced to Ascension Island (Stonehouse 1960), where Stonehouse (1962) estimated the population at a minimum of 100–200 birds. (See also Brooke *et al.* 1995 and McCulloch 2004).

St Helena Island

From *St Helena Consultations* (1776) and Janisch (1908), Rowlands *et al.* (1998) concluded that canaries, subsequently identified as *S. flaviventris* by Cunningham (1910), Peters (1968) and Hartog (1984), were probably introduced to St Helena in 1776, and that this species is the only canary that ever became established on the island. Barnes (1817: 107, quoted by Rowlands *et al.* 1998) said that Yellow Canaries on St Helena were 'as numerous as sparrows in England'. In spite of the capture of many birds for sale to visiting ships until at least 1930 (Moreau 1931), *S. flaviventris* 'is now abundant throughout the island, including arid areas with prickly pear *Opuntia* spp. … Small flocks are often found along steep roadsides; larger flocks of over 100 occur in scrub and adjacent grassland, and where trees are interspersed through barren ground' (Rowlands *et al.* 1998: 201). See also McCulloch (2004). According to Hartog (1984), the Yellow Canary is a dominant species on St Helena, being virtually ubiquitous wherever there is vegetation.

For an hypothesis of morphological overdispersion of finches on St Helena see under Java Sparrow *Lonchura oryzivora* (Lockwood *et al.* 1996).

Impact: As long ago as 1870, J. C. Melliss was recording damage caused by *S. flaviventris* to ripe peaches on St Helena.

European Greenfinch
Carduelis chloris

Natural Range: Much of the W Palaearctic E to Tien Shan, but not the Arabian Peninsula.
Naturalised Range: South America: Argentina; Uruguay. Australasia: Australia; New Zealand. Atlantic Ocean: Azores Is. Pacific Ocean: Norfolk I.

Argentina

Greenfinches are believed to have been introduced to Argentina in about 1900. Armani (1983) reported them to be well established and abundant in 1961 between Mar de Ajo and Necochea, Mar del Plata, and by 1980 the population had considerably increased in Pinamar, Chapadmalal and Miramir. Greenfinches have nested in Punta Inoio, Mar de Ajo, Pinamar, Villa Gessell, Mar del Plata and Neocochea, south to Reta and Tres Arroyos. Other localities in which Greenfinches became established include Villalonga, Ramar Hejia, General Villegas, Pehuajo, Azul, Coronel Pringles and Bahía Blanca. According to Navas (1987), Greenfinches were established mainly in the region of Pinamar and Villa Gessell in the province of Buenos Aires, where they were relatively abundant and breeding. See also Narosky & Yzurieta (2000) and Mazar Barnett & Pearman (2001).

Uruguay

Greenfinches apparently first bred successfully in the wild at Montevideo in 1929 (Cuello & Gerzenstein 1962). By 1960, Armani (1983) found them to be abundant on the coast in the departments of Canelones (especially at La Paloma) and Maldonado (especially at Punta Ballena). Sick (1968) indicates that they had been established in a limited area near the south coast since about 1908. Armani (1983) reported the presence of Greenfinches as far north as Durazno, Sarandi Grande and Minas, and west to Colonia.

Although Navas (1987) says that the species was introduced to Uruguay, in the absence of corroborative evidence the possibility of natural colonisation from Argentina cannot be discounted. See also Narosky & Yzurieta (2000) and Azpiroz (2003).

Australia

It seems probable that Greenfinches (of the British race *harrisoni*) were included among the consignments of large numbers of songbirds imported to Australia from England in 1856–58. Of these, according to Ryan (1906), 110 Greenfinches were released near Melbourne between 1863 and 1872 and by the early 1900s they were established near the metropolis and around Port Phillip. In 1879–80 (perhaps earlier) seven pairs of Greenfinches were liberated near Adelaide in South Australia, and in the latter year others were released at Maneroo and Bodalla south of Sydney, New South Wales, where by 1896 they were said to be established (Ryan 1906).

By around 1910, Greenfinches in New South Wales had spread south and west to Albury, on the Victorian border, and to Bathurst. In the late 1940s, Tarr (1950) reported the species to be fairly common in Sydney and Melbourne, and said that elsewhere in Victoria it occurred also in Coleraine, Daylesford, Geelong, Caramut, Ballarat and Inglewood. By the following decade, Greenfinches had expanded their range west to Orange in New South Wales, and in South Australia were well established and common near Adelaide, in the Mount Lofty Ranges, and south to Victor Harbour (Condon 1962).

Greenfinches were first recorded in Tasmania, presumably as natural immigrants from Victoria, at Marrawah in the northwest in 1945. Before 1950 some had dispersed to Stanley and Robbins Islands, and in 1951 some were seen in the southwest at Port Davey. Before 1958 they had extended their range along the north coast as far east as Launceston (Sharland 1958).

European Goldfinch

In Bass Strait, Greenfinches were observed on Flinders Island in 1948, and McGarvie & Templeton (1974) reported that flocks of over 100 occurred annually on King Island.

Frith (1979: 192) described the Greenfinch in Australia as 'common around Adelaide and the adjoining hills, but not elsewhere in South Australia. It is well distributed throughout the southern half of Victoria but is only common locally. It is present in small numbers in a few places in New South Wales'. Pizzey (1980) found Greenfinches to occur in New South Wales in Sydney and discontinuously westwards to Orange and southwest to between the ACT and Albury. In Victoria, they were widely but patchily distributed, especially on the coast. In Tasmania they were present in the north, the east and in the centre, and on the west coast had been recorded south to between the Henty River and Strahan; as in Victoria, they were most abundant on the coast. They were common on King Island but less so on Flinders Island. In South Australia, Greenfinches occurred throughout much of the coastal southeast, and north to Adelaide and the Mount Lofty Ranges.

Clement *et al.* (1993) and Barrett *et al.* (2003) record *C. chloris* as resident and breeding from southeastern South Australia through Victoria to southeastern New South Wales, and in Tasmania, especially in the northwest.

In Australia, as in Eurasia, Greenfinches favour well-wooded farmland with an abundance of shrubs, and have colonised permanent leys and gardens and parks with exotic European trees and shrubs. They have also become established on the coast in native tea-tree thickets but have not successfully invaded native *Eucalyptus* forest.

Impact: Frith (1979) considered that *C. chloris* occupied a hitherto vacant niche in principally man-modified habitats, where it apparently does not come into conflict with any native species.

New Zealand

Between about 1862 and 1868 around 100 Greenfinches from England (*C. c. harrisoni*) were imported to New Zealand by the Nelson, Auckland, Otago and Canterbury Acclimatisation Societies (see Lever 1992). The birds soon became widely distributed in Canterbury (reaching the Mackenzie district by about 1870) and rather less so in Auckland (Drummond 1906, 1907). By about 1920, Thomson (1922) found Greenfinches to be well established and abundant in settled regions throughout both main islands.

Greenfinches were first recorded on the Chatham Islands by about 1920 (Thomson 1922), on Kapiti Island by Oliver (1930), and on Little Barrier, Stewart, Auckland and Campbell Islands by Oliver (1955), while Kinsky (1970) reported them as vagrants on the Kermadecs and Snares. On offshore islands they were first recorded as breeding on the Chatham and Campbell Islands by Williams (1973).

Falla *et al.* (1979) found Greenfinches to be widely but unevenly distributed on the main New Zealand islands, where in some localities they were locally abundant to around 600m, but were generally not long-term colonists of off-lying islands. Heather & Robertson (1997) recorded them as widespread and locally common on the mainland.

Greenfinches in New Zealand prefer open country, farmland, shelterbelts, the edges of exotic pine plantations, orchards and gardens. In autumn and winter flocks of over 1,000 individuals have been recorded (Heather & Robertson 1997).

Merilä *et al.* (1996) studied the genetics of Greenfinch populations in New Zealand. They found fewer alleles (1.45) per locus and fewer polymorphic loci (33%) in introduced populations than in native European populations (1.75; 55%), reflecting the narrow geographical origin of the introduced populations. There was no evidence for serious inbreeding or genetic drift, and introduced populations were genetically less weakly differentiated than European ones. Similar levels of genetic variation innative and introduced populations are consistent with expectations, given the relatively large size (*c.* 100) of the founder stock and the rapid increase in the population soon after introduction.

Reductions in levels of genetic variability in birds appear to be inversely proportionate to the size of the founder stock and the speed of population growth immediately after introduction.

Impact: Thomson (1922) recorded Greenfinches as a pest of grain crops and of apricots, cherries, peaches and plums. Dawson & Bull (1969) and Heather & Robertson (1997) say they also eat maize, oilseed rape and other brassicas, linseed, sunflowers, fodder radish, peas and hops. However, the latter authors claim they are only a minor pest and rarely cause serious damage.

Azores Islands

Marler & Boatman (1951) recorded the presence of Greenfinches on the island of Pico. Bannerman & Bannerman (1966), who say that the birds are believed to have been introduced from Portugal around 1890, found small numbers only on Terceira and São Miguel. According to Peters (1968), the race in the Azores is *C. c. aurantiiventris* from southern Europe.

Norfolk Island

Barrett *et al.* (2003) say that *C. chloris* has been recorded on Norfolk Island, which Heather & Robertson (1997) state has been colonised.

European Goldfinch
Carduelis carduelis

Natural Range: Much of the W Palaearctic, from the British Isles eastwards to between 75° and 80° E, north to between 60° and 65° N, and south to the Mediterranean, Israel, Iran, Afghanistan and Baluchistan. Winters south to N Africa and SW Asia.

Naturalised Range: North America: ?United States. South America: Uruguay. Australasia: Australia; New Zealand. Atlantic Ocean: Azores Is; Bermuda; ?Cape Verde Is. Pacific Ocean: Lord Howe I; Macquarie I.; Norfolk I.

United States

Although Clement *et al.* (1993) say that *C. carduelis* was established on Long Island, New York, the AOU (1998) and Sibley (2000) state that no naturalised populations presently occur in the United States.

Uruguay

Cuello & Gerzenstein (1962) and Sick (1968) record the establishment and breeding of Goldfinches in Montevideo and elsewhere in the department of Canelones in southern Uruguay. Armani (1984) reported that *C. carduelis* ranged from the departments of Maldonado and Lavalleja east of the capital westwards to the department of Soriano, and between 1960 and 1975 they regularly observed the species in the Lecoq Zoological Park, and also in the department of Colonia and near Lago del Sauce.

Lecoq, which covers a large area comprising tracts of open grassland interspersed with thickets and clumps of trees, is little maintained and seldom visited by man, and has always been the species' stronghold in Uruguay (Armani 1984, Narosky & Yzurieta 2000, Azpiroz 2003).

Heather & Robertson (1997) incorrectly say that Goldfinches have been introduced to Argentina – where a few vagrants from Uruguay have been reported – but omit the introduction to the latter.

Australia

Table 20 shows that between about 1827 and 1912 well over 250 Goldfinches were introduced to Australia. By the end of the nineteenth century they were well established in Victoria and common around Melbourne, Geelong and Port Phillip. By 1904 they had colonised the area between Winchester and Colac, had spread to Castlemaine by 1913, and to Carraragarmungee and Genoa near the New South Wales border by 1915. By the 1930s most suitable habitat in the state had been colonised (Middleton 1965).

In New South Wales, Goldfinches had become settled around Sydney by 1886, had reached Goulburn by 1913, were established and common in the ACT and at Boree before

1922, and arrived in Canberra before 1929. By the outbreak of the Second World War, Goldfinches were well established in settlements along the railway as far as Dubbo (Tarr 1950).

From northern New South Wales, Goldfinches spread over the border into southern Queensland. They were first recorded at Stanthorpe in 1917, at Brisbane in 1919 and around Hamilton by 1932 (Frith 1979).

Long (1981) traced the history of Goldfinches in Western Australia, where they were first released before 1912 and where a few became established in the Perth suburb of Graylands between 1927 and 1930. By 1948 small numbers occurred locally in some other suburbs of Perth. During the early- to mid-1960s the birds continued slowly to expand their range in and around Perth west of the Darling Scarp, and by the end of the decade they occurred from Wanneroo and Upper Swan south to beyond Armadale, Forrestdale and Bibra Lake. Outside the Perth metropolitan area, Goldfinches were established on the south coast at Albany from 1955 to at least 1969. Since the late 1960s, the species has declined in Western Australia, probably through a combination of disease, shortage of food due to land reclamation, predation, trapping for the cagebird trade and attacks from the native Singing Honeyeater *Lichenostomus virescens*. By the late 1970s Goldfinches probably survived only in Perth and Albany (Long 1981). The maps in Barrett *et al.* (2003) reveal a very small number of sightings (but no breeding) in the Perth area and none in Albany.

Goldfinches are believed to have been established on Tasmania since the early 1880s. By the turn of the twentieth century they were abundant around Hobart, Derwent Valley, New Norfolk, Glenora and Macquarie Plains, and on the north coast near Latrobe and Davenport (Frith 1979). They are still abundant today in the northwest (Barrett *et al.* 2003).

Tarr (1950) reported Goldfinches to be widely distributed throughout both New South Wales (especially around Sydney) and

TABLE 20 Introductions of the Goldfinch *Carduelis carduelis* to Australia, 1827–1912.

Date	*Number*	*Introduced to*	*Introduced by*	*Remarks*
?1827	'Several'	Hobart, Tasmania	?	—
1856	Part of a shipment of 800 songbirds from England	Melbourne, Victoria and Sydney, New South Wales	?	—
1857	?	Melbourne, Victoria	A dealer named Brown	—
1857	'Several pairs'	Melbourne, Victoria	—	—
1858	?	?	A Mr Rushall	—
1862	?	Adelaide, South Australia	South Australia Acclimatisation Society (A.S.)	—
1863	34	Melbourne, Victoria	Victoria A.S.	Released
1863	12	Kerang, Victoria and New South Wales	Victoria A.S.	Released
1864	20	Melbourne, Victoria	Victoria A.S.	Released
1879	>43	Adelaide, South Australia	South Australia A.S.	Released
1880	32	Various localities in New South Wales	From New Zealand	Released
c. 1880	?	Hobart & Launceston, Tasmania	?	—
1881	110	Adelaide, South Australia	South Australia A.S.	Released during 1880s
1889–1912	?	Perth, Western Australia	Western Australia A.S.	Released

Source: Ryan (1906).

Victoria. In South Australia they were established on the Adelaide Plains, from the Mount Lofty Ranges to Victor Harbour, on the south Yorke Peninsula and on Kangaroo Island, around Tantanoola, north to Clare, and eastwards to the border with Victoria. In Queensland, Goldfinches were confined to the Darling Downs and around Brisbane, and in Western Australia to Perth. They were common in much of Tasmania and occurred also on King and Flinders Islands in the Bass Strait.

According to Frith (1979: 192):

> The Goldfinch … has spread throughout Victoria and south-east South Australia; it … is now very common [in Tasmania]. In New South Wales it has occupied all the southeastern part …. It is established in south-east Queensland. In New South Wales and Queensland it is more common on the cooler tablelands than the coast, but is very numerous also in some irrigated inland districts. In Western Australia it has limited distribution in Perth … and near Albany.

Barrett *et al.* (2003) noted a national decrease in the population of *C. carduelis* since the early 1980s, although the distribution (other than in Western Australia) remained much the same.

In Australia, as in Eurasia, the Goldfinch favours open, rough and neglected fields, roadside verges and weedy wasteland, and has colonised open pastures and creek banks. It is also found in stands of poplars *Populus* spp, pines *Pinus* spp. and jacarandas *Jacaranda filicifolia* in urban areas. It has not successfully invaded native *Eucalyptus* forest. In autumn and winter the species is locally nomadic.

Impact: In the east of their Australian range, Goldfinches are a minor pest of apricot buds, but also kill the larvae of apple moths. In Australia, they appear to occupy a vacant niche of mainly man-made habitats. There seems no indication as to why the Goldfinch has been a much more successful Australian colonist than the Greenfinch.

New Zealand

According to Thomson (1922), between 1862 and 1883 well over 500 Goldfinches were released in New Zealand by the Nelson, Otago, Auckland, Canterbury and Wellington Acclimatication Societies (see Lever 1992). Thomson (1922: 173) recorded that 'The birds appear to have at once established themselves at all the centres [of release], and to have quickly spread. They are now extraordinarily abundant in all parts of New Zealand'.

By around the turn of the twentieth century, Goldfinches had straggled to the Antipodes, Snares, Auckland and Campbell Islands (Drummond 1907), and by 1910 had also been recorded on Chatham and the Kermadecs. Before around 1920 they were established on Chatham and the Aucklands (Thomson 1922), and by the end of the following decade had also been noted on Kapiti, Stewart, Three Kings, Mokohinau and Little Barrier Islands (Oliver 1955).

Wodzicki (1965: 433) found Goldfinches to be 'common, widely distributed, and abundant, [on] North, South, Stewart, and Chatham, Raoul [Kermadecs], Antipodes, Snares and Auckland Islands'. Kinsky (1970) confirmed Wodzicki's distribution, and Williams (1973) recorded breeding on Chatham, Campbell, the Antipodes and Snares, Goldfinches in New Zealand occur on much of both the main islands to above the tree line at around 1,000m, but are relatively uncommon in Westland. In winter, flocks of up to 2,000 frequent coastal saltings, especially in the north, where they feed on glassworts *Salicornia* spp. At other seasons they inhabit open country, farmlands, orchards and gardens. They are said to be more abundant in New Zealand than in Britain.

Impact: Oliver (1955) reported that Goldfinches can become a minor pest of grain crops and oilseed rape, and of strawberries, whose seeds they peck from ripening fruit. They help to spread the seeds of such weeds as Tree Lupins *Lupinus arboreus*, thistles, redroot, storksbill and meadowgrass. In compensation, they also kill such injurious invertebrates as aphids and caterpillars (Heather & Robertson 1997).

Azores Islands
Goldfinches were first recorded in the Azores in 1903, where they are believed to have been imported from Madeira around 1880 (Dickinson (2003) does not indicate the presence of the Goldfinch on Madeira). They were said to occur in small numbers on São Jorge, Faial, São Miquel, Terceira and Pico (Marler & Boatman 1951, Bannerman 1965, Bannerman & Bannerman 1966). The form in the Azores is believed to be *C. c. parva* (western Mediterranean and Canary Islands).

Bermuda
Although Goldfinches were widely introduced to Bermuda as cagebirds from the early nineteenth century, the principal source of the present population is believed to have been the release of large numbers of songbirds, including Goldfinches, from a disabled steamship off the port of St George's around 1884 (Reid 1884). Within a decade, small charms had become established throughout the island, and by the outbreak of the First World War the Goldfinch was said to be Bermuda's fourth most abundant bird, and it is today a common resident in the islands (e.g. Wingate 1973, AOU 1998, Raine 2003). The race in Bermuda was identified by Austin (1968) as *C. c. parva* (western Mediterranean, Azores, and Canary Islands).

Cape Verde Islands
Bannerman & Bannerman (1968) say that in 1964 Goldfinches (probably *parva*) that had been imported to Porto Praia on São Tiago were established and breeding there and in nearby Fazenda, where in the following year a small population had become established. None have been reported since 1968, so these birds have probably died out (Hazevoet 1995).

Lord Howe Island; Macquarie Island; Norfolk Island
Barrett *et al.* (2003) say that *C. carduelis* has been recorded on Lord Howe, Norfolk and Macquarie Islands; on Norfolk, Smithers & Disney (1969) recorded the presence of adults and young around the Melanesian Mission; on Macquarie, the species was first reported in 1956.

Diet: For information on the diet of *C. carduelis* in its native and naturalised ranges see Ruelle (1993).

Red Siskin
Carduelis cucullata

Natural Range: NE Colombia, N Venezuela, Guyana and Trinidad.
Naturalised Range: North America: West Indies.

West Indies
Although Raffaele (1983) said that the Red Siskin may have been originally introduced to Puerto Rico as early as the late nineteenth century, he believed that the 1930s is a more likely date. In about 1954, Juan Alberto Wirshing probably imported Red Siskins from Venezuela to his menagerie on Caja de Muertos Island off the coast of Ponce in south-central Puerto Rico, from which some may have escaped or been deliberately released and dispersed to the mainland (Moreno 1997).

Raffaele *et al.* (1998: 443) said that the species is '… rare and local … between Coamo, Ponce, and Guayama. Illegal collection threatens the population'. Raffaele (1983) described the bird's primary habitat as semi-arid scrubland in south-central Puerto Rico, where Moreno (1997) believed the population may be spreading.

Because of the species' decline in South America, where the AOU (1998: 667) says it has been 'recorded in the original range during the last 30 years only in Colombia, perhaps approaching extinction there' due to over-collecting for the pet trade (Raffaele 1983), the Puerto Rican population may be of considerable conservation significance. *C. cucullata* is classified by the World Conservation Union as Endangered.

Common Redpoll
Carduelis flammea

Natural Range: N Holarctic circumpolar region; winters S to W and S Europe, C and E Asia, and NE USA.

Naturalised Range: Australasia: New Zealand. Pacific Ocean: Macquarie I.

New Zealand

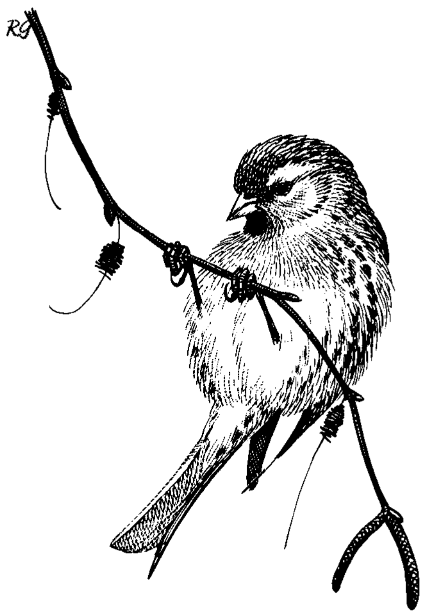
Between 1862 and 1875 a total of around 600 Redpolls from England were imported to New Zealand by the Nelson, Canterbury, Otago, Auckland and Wellington Acclimatisation Societies (see Lever 1992). The birds became established and rapidly increased in New Zealand, where Thomson (1922: 172) wrote that although the species was 'not commonly seen about the towns or in thickly settled districts, [it] is abundant in both islands, especially in open upland country at moderate elevations'. Four years later, Thomson (1926) reported *C. flammea* as common in high and open country from Foveaux Strait (between South and Stewart Islands) northwards to Auckland, being particularly common in Southland, Otago and Canterbury in South Island, and between Wellington and Taranaki on the west coast of North Island. Philpott (1918) reported Redpolls above the tree line at altitudes up to 900m.

On offlying islands, Redpolls reached Campbell and the Snares around 1907; Lord Howe (where they have since disappeared) in 1913 (Williams 1953); Kapiti and Stewart before 1930 (Oliver 1930); and Three Kings, the Chathams and the Aucklands prior to 1955 (Oliver 1955).

Williams (1953) and Wodzicki (1965) described Redpolls as widely distributed and locally abundant on both the main islands and on most of the above offlying islands, to which Kinsky (1970) added the Kermadecs. Williams (1973) reported breeding on the Antipodes, Aucklands, Snares, Chatham and Campbell Islands. Falla *et al.* (1979) found Redpolls to be abundant and well distributed in South Island up to 1,600m; in the north of North Island they were relatively scarce, but a few nested in Northland around Parengarenga Harbour, and along parts of the west coast of Auckland. Further south, the species was more plentiful on the Volcanic Plateau, and bred above the bush line in the ranges and in the south of North Island. Heather & Robertson (1997) reported the Redpoll as common, especially in higher and drier regions of South Island. It lives in farmland, orchards, tussockland, sand dunes, forest, subalpine scrub and herbfields, from sea level to 1,750m, and is commoner at higher elevations and less intensively settled districts. Some local movement and flock formation occurs in winter.

The race established in New Zealand is predominantly the British *cabaret*, with perhaps some nominate *flammea*, which is a winter visitor to Britain (Wodzicki 1965, Williams 1969).

Impact: Until the middle of the last century, *C. flammea* was considered to be, as in its native range, a harmless, even beneficial species, preying on turnip greenfly and other pests (Thomson 1922, Oliver 1955). In central Otago, however, Redpolls have latterly become a serious pest in orchards by

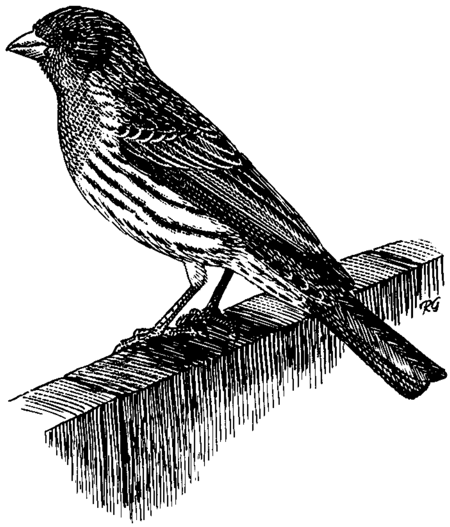


Common Redpoll

pecking at blossom and fruit, especially those of apricots (Long 1981), peaches and strawberries, and they also spread the seeds of such weeds as dock, redroot, sedges, grasses, clovers, fat hen, brassicas, thistles and evening primrose (Heather & Robertson 1997).

MACQUARIE ISLAND
Redpolls were first recorded on Macquarie Island in 1912 (Kinsky 1970), and probable breeding was reported by Williams (1973). Breeding was confirmed by Barrett *et al.* (2003).

House Finch
Carpodacus mexicanus



House Finch

Natural Range: W North America, from SW Canada S to S Mexico. (The House Finch appears to be spreading slowly eastwards, and has been extensively translocated by man to eastern North America. For details see Lever 1987: 398–400; also e.g. Cecil & Dinsmore 1995, James 1997 and Morneau *et al.* 1999).
Naturalised Range: Pacific Ocean: Hawaiian Is.

HAWAIIAN ISLANDS
House Finches of the form *C. m. frontalis* were introduced as cagebirds to the Hawaiian Islands, probably from California, before 1870 (possibly as early as 1859), where some soon escaped or were freed and became established in the wild (Caum 1933).

As early as the turn of the twentieth century, McGregor (1902) reported House Finches to be extremely common on Maui, and Munro (1944) found them to be well established on all of the main islands. Zeillemaker & Scott (1976) described them as abundant on Kauai and Hawaii, and common on Oahu, Molokai, Lanai and Maui. Pratt *et al.* (1987), Clement *et al.* (1993) and the AOU (1998) refer to *C. mexicanus* as abundant on all the main islands and as occurring as vagrants on Nihoa.

The House Finch in the Hawaiian Islands occupies a broad range of habitats and elevations, occurring in dry woodland, savanna, urban areas, agricultural land, high-altitude ranchland, forest ecotones and scrub. The species' main limiting factor seems to be the availability of water (Scott *et al.* 1986); according to Van Riper (1976), the success of the House Finch on Hawaii has been largely due to the expansion of ranching with its concomitant supply of water.

Impact: House Finches in the Hawaiian Islands help to spread the seeds of the alien Banana Poka *Passiflora mollisima* (Warshauer *et al.* 1983), and the native Fire Tree *Myrica faya* (Cuddihy & Stone 1990) and Naio *Myoporum sandvicensis* (Van Riper 1980), and various other native and exotic shrubs.

In Hawaii, the House Finch has become something of a pest to fruit and some vegetable crops – especially Papaya *Carica papaya* (Berger 1981).

In their study area at the Lyon Arboretum in Honolulu, Shehata *et al.* (2001) found no evidence of malarial infestation among House Finches.

ICTERIDAE (NEW WORLD BLACKBIRDS)

Troupial
Icterus icterus

Natural Range: N South America S to N Argentina; also Aruba and Curacao Is.
Naturalised Range: North America: West Indies. South America: ?Isla de Itamaracá.

West Indies
On Puerto Rico, Troupials were first reported to be breeding in the wild at Quebradillas by Gundlach (1878). Bowdish (1903), who found them to be popular cagebirds on the island, was told they had also become established in other localities. By the 1950s birds of the nominate subspecies (eastern Colombia and northwestern Venezuela) were also present on Jamaica, St Thomas and neighbouring Water Island. Allen (1962), who said that Troupials were long-standing but uncommon local residents on Puerto Rico, listed them as having also occurred on St John, Antigua, Dominica and Grenada. Allen (1962), Peters (1968) and de Schauensee (1970) state that the birds came from Curaçao, where the form is *ridgwayi.* Blake (1975) listed Troupials as occurring on St Thomas, Mona (off Puerto Rico), and also on Jamaica, where Lack (1976) said they had died out.

Bond (1979: 220) describes the Troupial as '… established in Puerto Rico and St Thomas, including Water Island; also reported from Jamaica, St John, Antigua, Dominica and Grenada … Recently introduced on Mona. … [inhabits] semi-arid woodland and mangrove swamps, chiefly in southwestern Puerto Rico (e.g. Guánica State forest) … and east and south coasts of St Thomas … numerous near Guánica'.

Raffaele *et al.* (1998: 441–442) say that *I. icterus* in Puerto Rico 'is common in the southwest but uncommon throughout the rest of the island. … also occurs in the Virgin Islands … on the south and east coast of St Thomas, on Water Island and on St John …. Birds observed on Antigua may be immigrants from the Virgin Islands or escaped pets, while those seen on Dominica and Grenada could be vagrants from Venezuela'. The AOU (1998) says that the Troupial is also established on Mona Island, but has only been 'reported' from St John.

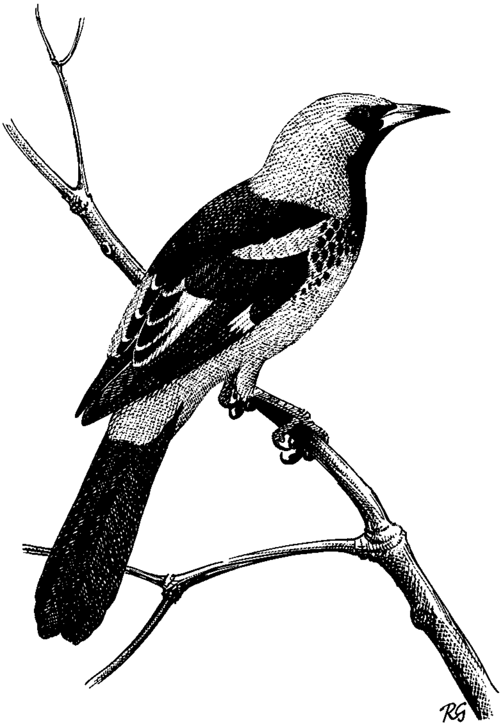
Isla de Itamaracá
According to Sick (1968), Troupials of the eastern Brazilian race *jamacaii* have been present on Isla de Itamaracá north of Recife since 1927. In view of the proximity of the Brazilian mainland a natural arrival cannot be discounted.

Spot-breasted Oriole
Icterus pectoralis

Natural Range: SW Mexico to NW Costa Rica.
Naturalised Range: North America: USA. Pacific Ocean: Isla del Coco.

United States
The Spot-breasted Oriole was one of the first exotic birds to breed in the wild in Miami, Florida, where Brookfield & Griswold (1956) found escaped cagebirds nesting along the Miami River in 1949. By 1956 it ranged north and south for more than 40km, and by 1961 had reached Hypoloxo Island in Broward County; the following year it had spread to West Palm Beach, 120km north of Miami (Stevenson 1961, 1962). King (1968) reported that *I. pectoralis* was established in Palm Beach, Broward and Dade Counties in south-eastern Florida, and by the following decade the species occurred in Brevard County up to 240km north of Miami and 65km south.

James (1997) believed that the birds were declining, and P. W. Smith (pers. comm. to James 1997) thought they might no longer occur north of Palm Beach County, and that the populations in West Palm Beach, Fort Lauderdale and Miami were decreasing. The AOU (1998) says that Spotted-breasted Orioles are established in Palm Beach, Broward and Dade Counties, and occasionally occur north to Brevard County.



Spot-breasted Oriole

According to Sibley (2000), *I. pectoralis* is found principally in mature trees in suburban localities, where it feeds largely on fruits and nectar. Peters (1968) identified the subspecies as the nominate *pectoralis* (eastern Oaxaca to central Chiapas, Mexico).

Isla del Coco

According to the AOU (1998), the Spot-breasted Oriole has 'apparently' been introduced to and is established on the Costa Rican Isla del Coco, 750km off the coast of Central America. No other information seems available.

Shiny Cowbird
Molothrus bonariensis

Natural Range: Originally from E Panama S to C South America. Since 1891, as a result of habitat modification, has spread naturally northwards through much of the Caribbean to the Bahamas, central Florida and southern Georgia (Raffaele *et al.* 1998, AOU 1998).

Naturalised Range: North America: West Indies: South America: Chile.

West Indies

Although most of the West Indies has been colonised naturally, the AOU (1998) suggests it was possibly introduced to Vieques (off Puerto Rico) before 1860 and probably to Barbados, where Raffaele *et al.* (1998) say it was first seen in 1916.

Chile

Shiny Cowbirds were first recorded in central Chile before 1877. Between 1906 and 1914 large numbers were imported as cagebirds and by 1910–12 sizeable flocks had become established near Machalí. By the late 1920s, they ranged from Coquimbo Province south to Malleco Province (Friedman 1929, Hellmayr 1932). By the mid-1960s, the species was numerous from Copiapó in Atacamá Province south to Aisén Province, i.e. between 27°S and about 47°S. Today *M. bonariensis* is established virtually continuously from Atacamá to Chiloë and at Chile Chico, Aysen, and is very common in the mediterranean habitats of central Chile (Vuilleumier 1991). It seems almost certain that the population is derived from escaped or released pets rather than from natural immigrants from Argentina, to whom the Andes would have proved an insuperable barrier (Hellmayr 1932). Shiny Cowbirds occur in a variety of habitats: open fields, farmland, pastures, forest edges, scrub, gardens and urban parks, from sea-level to 2,000m (Jaramillo *et al.* 2003). The subspecies established in Chile is the nominate *bonariensis* from central South America (Peters 1968).

Impact: Because the Shiny Cowbird is a brood parasite of other birds Vuilleumier (1991) considered that it plays an important ecological role in Chile, where Johnson (1965–67) recorded parasitised nests of the following native species, in descending order of frequency:

Common Diuca Finch *Diuca diuca*, Yellow-winged Blackbird *Chrysomus thilius*, Rufous-collared Sparrow *Zenotrichia capensis*, Long-tailed Meadowlark *Sturnella loyca*, Black-winged Ground Dove *Metriopelia melanoptera*, Fire-eyed Diucon *Xolmis pyrope*, Spectacled Tyrant *Hymenops perspicillatus* and the alien House Sparrow *Passer domesticus.*

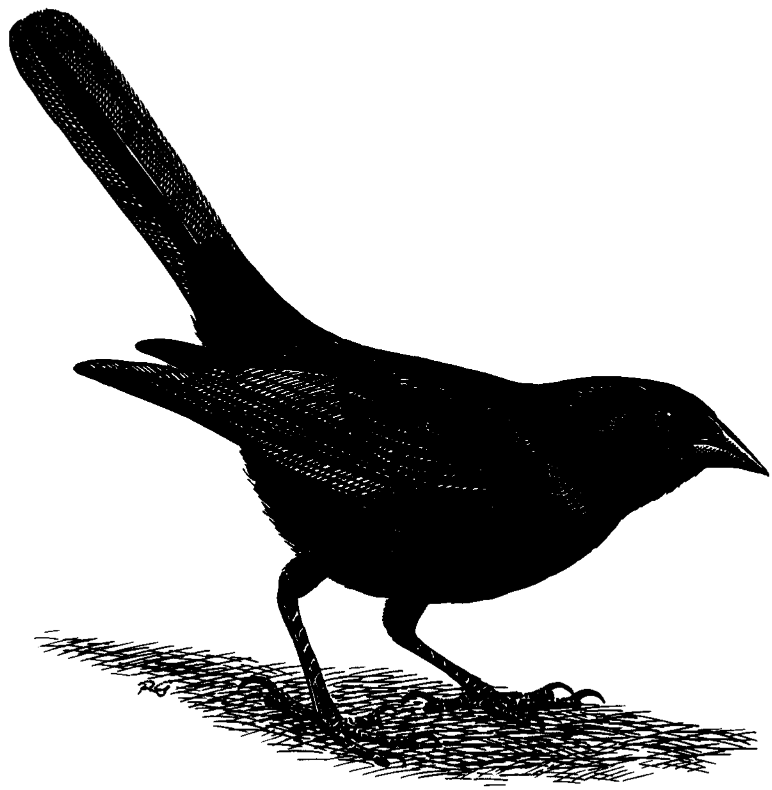
Western Meadowlark
Sturnella neglecta

Natural Range: SW Canada and W USA; winters S to NW Mexico.
Naturalised Range: Pacific Ocean: Hawaiian Is.

Hawaiian Islands

Western Meadowlarks were released on the island of Kauai in 1931 by Dora R. Isenberg, and also on Oahu (Caum 1933). Three years later others were liberated on Niihau and Maui, but they became established only on Kauai, where Zeillemaker & Scott (1976) described them as common in fields and cultivated land. Berger (1981: 206) said they were 'fairly common but highly localized, being found near Kekaha, Lihue, Kapaa, and Kilauea'. Pratt *et al.* (1987) said they were common in lowland fields throughout the island. Pratt (1994) and the AOU (1998) confirm the species' presence on Kauai.

Impact: The disappearance from Kauai of the also introduced Skylark *Alauda arvensis* has been attributed to competition from the subsequently introduced larger and ecologically similar Western Meadowlark.



Shiny Cowbird

Carib Grackle
Quiscalus lugubris

Natural Range: From N Venezuela, the Guianas, and NE Brazil N through the Lesser Antilles in the West Indies to Montserrat.
Naturalised Range: North America: West Indies.

West Indies
According to Peters (1968), the Barbados race *fortirostris* was introduced between 1912 and 1914 to Barbuda, Antigua and possibly St Kitts. Blake (1975) indicates an introduction also to St Martin. On Antigua, where Danforth (1934) recorded Carib Grackles as introduced and locally common, Holland & Williams (1978) found them to be abundant. Bond (1979: 216) described *Q. lugubris* as 'introduced on Barbuda, Antigua, St Kitts, and possibly St Martin', and as occurring only in settled localities. The AOU (1998) confirms the species' establishment on St Martin but says it has died out on St Kitts, whereas Raffaele *et al.* (1998), who say it is a common resident on most of the Lesser Antilles from Grenada to Anguilla, list it as surviving on St Kitts and as also occurring on St Barthélemy.

EMBERIZIDAE (BUNTINGS, AMERICAN SPARROWS AND ALLIES)

Yellowhammer
Emberiza citrinella

Natural Range: From the British Isles eastwards through Europe to E European Russia and Lake Baikal. Winters south to N Africa, SW and WC Asia, and Mongolia.
Naturalised Range: Australasia: New Zealand. Pacific Ocean: ?Lord Howe I; ?Macquarie I.

New Zealand
According to Thomson (1922), between 1862 and 1871 the Nelson, Auckland, Canterbury and Otago Acclimatisation Societies (see Lever 1992) released over 420 Yellowhammers in New Zealand. Williams adds that in 1872 and 1875 a further 148 were freed in Canterbury, and in 1879 32 more on Stewart Island where they apparently disappeared.

Thomson (1922: 176) records that Yellowhammers 'quickly spread all over New Zealand, and today are common from Foveaux Strait [between Stewart and South Islands] to the extreme north of the North Island', becoming established wherever grass and grain seeds were available.

On offlying islands, Yellowhammers were recorded on the Chathams in 1910, on Raoul in the Kermadecs (*c.* 1946), and Three Kings, Mokohinau, Little Barrier, Kapiti, Codfish, Campbell and the Aucklands before 1955 (Oliver 1955). Williams (1973) reported breeding only on Raoul and the Chatham Islands.

Wodzicki (1965) and Kinsky (1970) described *E. citrinella* as widespread and common on both main islands, and on Stewart, Raoul and the Chathams, and as a straggler to some other islands. Falla *et al.* (1979) found the species to occur widely on North and South Islands in a variety of habitats from beaches, saltings and marshes to alpine tussock grass at 1,600m; the birds bred regularly on the Chatham Islands and occasionally on Raoul, and had been recorded on even more remote subantarctic islands. Heather & Robertson (1997) said that they remained uncommon on the Chathams, and described the mainland population as widespread and locally common.

Impact: Thomson (1922: 176) said that Yellowhammers were 'destroyed wholesale as noxious pests in all grain-growing areas', and Oliver (1955) claimed that they were one of the most destructive introductions to New Zealand. Williams (1969) said that complaints of their depredations had become less common, and Heather & Robertson (1997) regarded them as a colourful addition to New Zealand's avifauna.

Lord Howe Island
Yellowhammers were first recorded on Lord Howe Island around 1949 (Oliver 1955); as

they are not mentioned by Barrett *et al.* (2003) they have presumably since died out.

MACQUARIE ISLAND

Barrett *et al.* (2003) record the presence of *E. citrinella* on Macquarie Island, where the species' status is being assessed.

Cirl Bunting
Emberiza cirlus

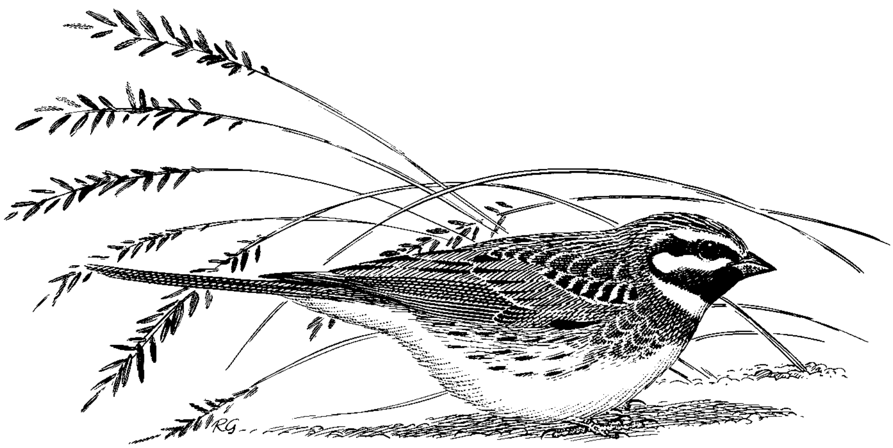
Natural Range: NW Africa, W and S Europe to W and N Asia Minor.
Naturalised Range: Australasia: New Zealand.

NEW ZEALAND

Although Thomson (1922, 1926) was able to trace only three documented introductions of Cirl Buntings to New Zealand – seven by the Otago Acclimatisation Society in 1871, 18 that were unsuccessfully released on Stewart Island in 1879, and four by the Wellington Society in 1880 or 1881 – it is likely that others were imported at around the same time.

The birds liberated in Otago on South Island and in Wellington on North Island quickly became established and spread. From the latter they had reached Taranaki by 1916, where flocks were apparently common along the coast at Hawera and elsewhere. Their appearance was, however, somewhat erratic; at one time they considerably increased in Otago and then, unaccountably, rapidly declined (Thomson 1922).

Williams (1953) and Oliver (1955) said that *E. cirlus* had a rather restricted distribution and was nowhere common; it occurred at Tauranga, Hawke's Bay, Manawatu, Wairarapa, Hutt Valley, Wellington, Canterbury and Otago, and on Southland's Resolution Island. Kinsky (1970) confirmed the species' presence in the above localities and in Nelson, Marlborough and North Westland, and perhaps in Taranaki. Falla *et al.* (1979) found Cirl Buntings to be widespread in open country but rather rare, except in the limestone country east of the Southern Alps in the north and east (e.g. near Oamaru in Otago) of South Island, and in the southern half of North Island. Heather & Robertson (1997) said that Cirl Buntings, which, with a total population of only 2,000–5,000, are the rarest of New Zealand's introduced birds, occur in open country from Northland to southern Otago, mainly in drier pastoral country interspersed with trees or hedgerows or in rough grassland with patches of gorse, briar, and matagouri, east of the Main Divide from Gisborne to Otago and near Nelson: they are locally common in Marlborough and central Otago. In winter, there is some local or nomadic movement into maritime grassland



Cirl Bunting

and saltmarshes and flock formation, especially in Tasman Bay in northern South Island.

cultivated and wooded island of Basse Terre, and why on Grande Terre and Martinique populations are localized and fairly small.

Grassland Yellow Finch
Sicalis luteola

Natural Range: From S Mexico to C and S C South America.
Naturalised Range: North America: West Indies.

West Indies

Pinchon (1963) says that Grassland Yellow Finches, according to Peters (1970) of the nominate subspecies (Colombia, Venezuela, Guyana and Brazil), were introduced to Barbados in about 1900, where Bond (1928) found them to be abundant on the windward side in 1926.

From Barbados, *S. luteola* colonised naturally the Grenadines, Mustique and southern St Lucia, and by 1945 had arrived in Martinique (Pinchon & Benito-Espinal 1980). Guth (1971) saw the species on both Grande Terre and Basse Terre, Guadeloupe, in 1969 and Bond (1972) was told it had arrived on St Vincent in that year. (Raffaele *et al.* (1998) give the dates of arrival in Martinique and Guadeloupe as 1951 and 1983 respectively). Between 1977 and 1982, Barré & Benito-Espinal (1985) saw Grassland Yellow Finches on Marie Galante off Guadeloupe, and Bond (1980) was informed of their arrival on Antigua in 1973. Raffaele *et al.* (1988: 429) described the species as 'An uncommon and local resident on Antigua, Guadeloupe, Martinique, St Lucia, Barbados, St Vincent and Grenada and a vagrant in the Grenadines (Mustique)'. See also AOU (1998).

Barré & Benito-Espinal (1985) found that on Guadeloupe, Martinique and Marie Galante, Grassland Yellow Finches inhabit open country, large meadows in dry areas and dense bushes, but enter tangled thickets only to roost. Their absence from small enclosures between sugar-cane fields may explain their failure to colonise fully the intensively

Saffron Finch
Sicalis flaveola

Natural Range: From N South America S to N Argentina.
Naturalised Range: North America: West Indies. South America: Panama. Pacific Ocean: Hawaiian Is.

West Indies

Saffron Finches are believed to have been introduced to Jamaica by the Revd J. M. Shakespeare in about 1823 (Allen 1962, de Schauensee 1970). Lack (1976) reported them to be widespread in lowland cultivated regions with short grass and scattered trees, particularly near human settlement, but said they were absent from native forest. The population is probably regularly reinforced by recruitment from escaped cagebirds. Raffaele *et al.* (1998) record the species as widely distributed and common in gardens, roadside verges and grassland on Jamaica.

Saffron Finches were introduced to Puerto Rico in about 1960 (Raffaele & Kepler 1992), where Raffaele *et al.* (1998) and the AOU (1998) say they are fairly common but local in gardens in and around San Juan, Río Piedras and Dorado.

Panama

In 1951 a pair of Saffron Finches – probably escaped pets from a ship passing through the canal – were observed at Gatún near the Caribbean coast (Scholes 1954). By the late 1970s the species was locally common in urban areas and parks along the Caribbean littoral of Panama from Gatún Dam to Gatún and Coco Solo (Long 1981, AOU 1998, pers. obs. 2004).

Hawaiian Islands

Saffron Finches, presumably escaped or released cagebirds, became established on

Oahu before 1965 and on Hawaii in 1966 (Berger 1981). They occurred on the former in Kapiolani Park, and on the latter in the area between Kona and Kamuela. Zeillemaker & Scott (1976) listed them as local and rare in residential and community parklands, on Oahu only. A. J. Berger (pers. comm. 1985) said there were 'several small populations in widely scattered locations on Oahu … also at several locations on Hawaii … 100 birds seen in one day at the Puuwaawa Ranch'. Pratt *et al.* (1987) recorded the species as common in Kona and Kohalo on Hawaii and noted that it possibly survived in Kapiolani Park on Oahu but might now be dying out. Pratt (1994) and the AOU (1998) listed Saffron Finches as occurring on both islands – in small numbers on Oahu and along the North Kona coast of Hawaii. Scott *et al.* (1996) found Saffron Finches on Hawaii in dry mesic lowlying localities interspersed with trees; the highest densities occurred in exotic tree habitats although most of the population was in Ohia *Metrosideras collina/polymorpha* woodland. The same authors predicted that *S. flaveola* was likely to spread north and south of Hualalai and onto the drier slopes of Mauna Kea and Mauna Loa on Hawaii, and possibly to windward Hawaii and to Maui.

Saffron Finch

Common Diuca Finch
Diuca diuca

Natural Range: Chile and Argentina.
Naturalised Range: Pacific Ocean: Easter I.

Easter Island
In 1928, Common Diuca Finches were introduced to Easter Island, where they still survive in spite of predation by also introduced Chimango Caracaras *Milvago chimango* (Johnson *et al.* 1970, Jaramillo *et al.* 2003). According to Holyoak & Thibault (1984), the race present is believed to be *crassirostris* (northern Chile and Argentina).

Yellow-faced Grassquit
Tiaris olivaceus

Natural Range: From E Mexico S to Colombia and Venezuela; also Cuba, Jamaica, Cayman Is. and Puerto Rico.
Naturalised Range: Pacific Ocean: Hawaiian Is.

Hawaiian Islands
Yellow-faced Grassquits, presumably escaped or released pets, were first seen at Pacific Palisades on Oahu in 1974, where they were described by Zeillemaker & Scott (1976) as local and uncommon on agricultural land and pastures. A. J. Berger (pers. comm. 1985), Pratt *et al.* (1987), Pratt (1994) and the AOU (1998) indicate that a small population continues to survive in the Koolau Mountains on Oahu.

Bahamas
The Yellow-faced Grassquit was introduced to New Providence in the Bahamas in 1963 with the Cuban Grassquit *T. canorus*, but has since died out.

Cuban Grassquit
Tiaris canorus

Natural Range: Endemic to Cuba.
Naturalised Range: North America: West Indies.

West Indies
This species, which is a popular cagebird, was 'Introduced to New Providence in the Bahamas in 1963 where it is fairly common throughout the island' (Raffaele *et al.* 1998: 425).

Red-crested Cardinal
Paroaria coronata

Natural Range: E Bolivia, Paraguay, Uruguay and Argentina.
Naturalised Range: Asia: Japan. North America: ?USA; ?West Indies. Pacific Ocean: Hawaiian Is.

Japan
The OSJ (2000) lists this species as a breeding resident in central Honshu (Saitama, Tokyo).

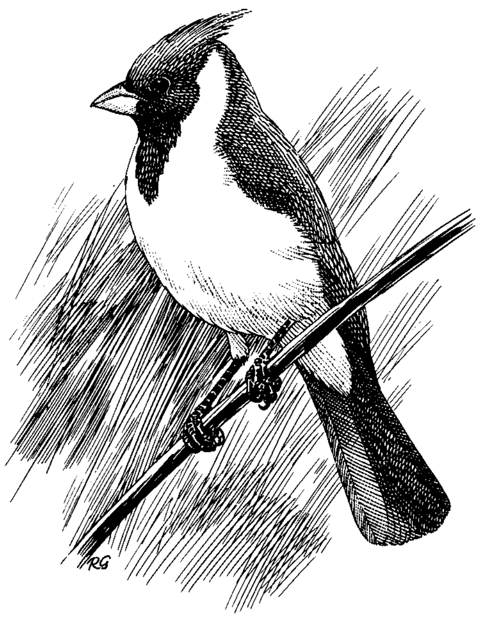
United States
Roberts & Wolfendon (1992), the AOU (1998), and Sibley (2000) say that although this species occurs in southern Florida, no permanent wild population has yet become established. James (1997) lists it as occurring in Broward, Dade and Orange Counties.

West Indies
Although the AOU (1998) states that the Red-crested Cardinal has been 'Introduced and established in … Puerto Rico (Dorado)', Raffaele *et al.* (1998) make no mention of this introduction.

Hawaiian Islands
Between 1928 and 1931, Red-crested Cardinals from Brazil were released on Oahu by William McInerny and on Kauai by Dora R. Isenberg (Caum 1933).

Thereafter, the species' history in the Hawaiian Islands is rather confused. Although Peterson (1961) said the birds were widely distributed on Oahu and local on Kauai and Maui, Richardson & Bowles (1964) found none on Kauai in 1960. Some were noted on Maui and Molokai in 1967 and in 1970 also on Kauai (Blake 1975). Red-crested Cardinals were described by Berger (1972) as common in parts of Hawaii and in drier regions of leeward Oahu. The Hawaiian Audubon Society (1975) said they occurred in low-lying dry bush country, thickets and settled areas on all the larger main islands, although they were uncommon on Oahu where, however, they were believed to be spreading. Zeillemaker & Scott (1976) described them as local and uncommon on Kauai and Molokai, common on Oahu, and local and rare on Maui, in introduced woodland and scrub and in residential and community parkland. A. J. Berger (pers. comm. 1985) said the species was then very common throughout lowland Oahu, and uncommon on Kauai and Maui.

More recently, Pratt *et al.* (1987: 290) recorded the Red-crested Cardinal as 'introduced … in 1929. Now common and widespread on Oahu, less common and



Red-crested Cardinal

localised on Kauai, Lanai, Molokai and Maui (Lahaina area). Reports from Hawaii have not been confirmed'. Pratt (1994) and the AOU (1998) confirm this distribution.

Yellow-billed Cardinal
Paroaria capitata

Natural Range: SE Bolivia, S Brazil, Paraguay and N Argentina.
Naturalised Range: Pacific Ocean: Hawaiian Is.

Hawaiian Islands
According to Pratt *et al.* (1987) and Pratt (1994), Yellow-billed Cardinals were introduced to the island of Hawaii around 1930 (the AOU (1998) says in 1933). Here they are established in dry scrub along the Kona coast between Kawaihae Bay and Honaunau, being most common at Honokohau. The AOU (1998) says that although the population is small it is currently spreading.

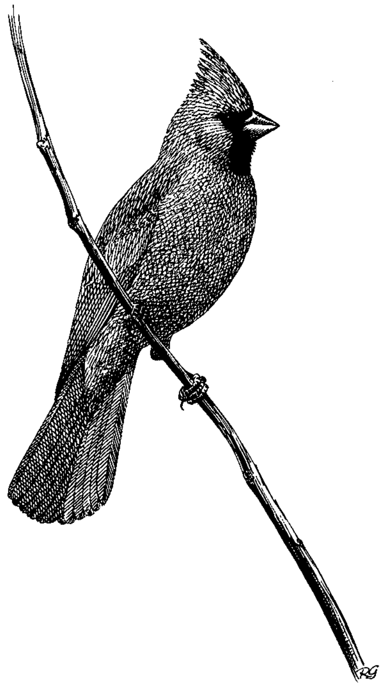
CARDINALIDAE (CARDINAL, GROSBEAKS, SALTATORS AND ALLIES)

Northern Cardinal
Cardinalis cardinalis

Natural Range: The E USA S to Georgia, Florida, SE Texas and Louisiana; Mexico, Guatemala, and Belize.
Naturalised Range: Atlantic Ocean: Bermuda. Pacific Ocean: Hawaiian Is.

Bermuda
According to Bartram (1879), Northern Cardinals of the nominate subspecies (eastern USA) were probably introduced to Bermuda from Virginia as pets by early settlers around 1700. 'Formerly abundant throughout the island', wrote Wingate (1973: 4–5), 'it was rapidly displaced from the built-up areas by the introduction of the House Sparrow [*Passer domesticus*]. It remained common, however, in rural areas up until the 1950s, when the loss of the cedar [*Juniperus bermudiana*] forest, the introduction of the Kiskadee [*Pitangus sulphuratus*] and establishment of the Starling [*Sturnus vulgaris*], and the increase of urbanization, all contributed to a drastic reduction of its numbers'. According to Raine (2003) it remains a common resident in woodland, ponds, gardens, swamps, mangroves, and marshes.

Hawaiian Islands
Northern Cardinals imported from California were released on Oahu by William McInerny in 1929 and 1931, on Kauai by Dora R. Isenberg in 1929, and at around the same time at Hilo on Hawaii (Caum 1933), By the late 1930s they had become well established on all three islands, and had spread from Kauai to Niihau, where prior to 1950 they were said to be abundant. They first appeared on Maui in 1949, on Molokai in 1951 and on Lanai in 1957 (Munro 1960).



Northern Cardinal

According to Peterson (1961), Northern Cardinals were then well established in lowland and residential localities on most of the larger islands, where Berger (1972) said they occurred in both hydric and xeric regions to an altitude of around 2,300m. Zeillemaker & Scott (1976) and Scott *et al.* (1986) described the species as common in both exotic and native woodland and scrub, and Pratt *et al.* (1987) said it was a common vagrant on Nihoa. The AOU (1998) confirms this distribution.

Impact: In Hawaii, *C. cardinalis* breeds throughout the year, enabling it to raise more broods than in its natural range. It multiplied rapidly after its introduction, and was soon reported to be damaging fruit crops.

Although in urban localities it lives sympatrically with the also introduced Red-crested Cardinal *Paroaria coronata*, there seems to be little interspecific competition (Fisher 1948).

THRAUPIDAE (TANAGERS)

Crimson-backed Tanager
Ramphocelus dimidiatus

Natural Range: Panama, N Colombia and Venezuela.
Naturalised Range: Pacific Ocean: Society Is.

Society Islands
Guild (1938) said that he had imported this species to Tahiti – in about 1930, according to Holyoak and Thibault (1984), who said that a decade earlier small numbers of Crimson-backed Tanagers were established in the Punaauia and Paéa areas. According to Pratt *et al.* (1987), the species was settled but uncommon on the west coast, where Thibault & Rives (1975) recorded it to be confined to gardens and plantations.

Red-legged Honeycreeper
Cyanerpes cyaneus

Natural Range: From Mexico S through W Colombia, C Bolivia, W Ecuador and Venezuela to the Guianas, Brazil, and NE Peru. Also Trinidad and Tobago Is.
Naturalised Range: North America: West Indies.

West Indies
Although de Schauensee (1964) suggests that this species' presence on Cuba is a result of human intervention, Bond (1979) indicated it to be a native of the island. Raffaele *et al.* (1998: 416) say it is 'A rather rare and local resident on Cuba, mainly found in the Sierra del Rosario, Sierra de la Güira, Pinar del Río and Sierra Maestra, but also occurs as scattered populations in Zapata Swamp and Havana. Formerly more widespread, may have been introduced to Cuba'. The AOU (1998), who claim it is only 'possibly established' on the island, say that reports are probably based on escaped pets. Cuba is not included in the natural range of the Red-legged Honeycreeper by Dickinson (2003). Garrido (2001), who believed the species was first introduced to Cuba from Mexico between 1915 and 1919, identified the subspecies as *C. c. carneipes* from eastern and southern Mexico.

APPENDIX A Naturalised birds that have had a negative impact on native birds included in the World Conservation Union *Red List of Threatened Animals*.

Alien Species	*Native Species*	*Country*	*Impact*	*IUCN Category*
Chukar Partridge *Alectoris chukar*	Hawaiian Goose *Branta sandvicensis*	Hawaiian Is.	Competition for browse	Vulnerable
Common Pheasant *Phasianus colchicus*	[New Zealand Quail *Coturnix novaezeelandiae*	New Zealand	Infections	Extinct *c.* 1875]
Muscovy Duck *Cairina moschata* and Mallard *Anas platyrhynchos*	Meller's Duck *Anas melleri*	Madagascar and Mauritius	Hybridisation	Lower Risk – near threatened
Mallard *Anas platyrhynchos*	Hawaiian Duck *Anas wyvilliana*	Hawaiian Is.	Hybridisation	Vulnerable
Ruddy Duck *Oxyura jamaicensis*	White-headed Duck *Oxyura leucocephala*	Spain	Hybridisation	Vulnerable
Cattle Egret *Bubulcus ibis*	Seychelles Magpie Robin *Copsychus sechellarum*	Seychelles Is.	Chick and egg predation	Critically Endangered
Weka *Gallirallus australis*	Magenta Petrel *Pterodroma magentae*	Chatham I.	Predation	Critically Endangered
Weka *Gallirallus australis*	[Red-fronted Parakeet *Cyanoramphus novaezelandiae erythrotis*	Macquarie I.	Predation	Extinct 1880–91]
Weka *Gallirallus australis*	[Buff-banded Rail *Gallirallus philippensis macquariensis*	Macquarie I.	Predation	Extinct 1894]
Crimson Rosella *Platycercus elegans*	Norfolk Island Parakeet *Cyanoramphus cookii*	Norfolk I.	Competition	Critically Endangered
Rose-ringed Parakeet *Psittacula krameri*	Mauritius Parakeet *Psittacula echo*	Mauritius	Competition	Critically Endangered
Barn Owl *Tyto alba*	Seychelles Scops Owl *Otus insularis*	Seychelles Is.	Competition	Critically Endangered
Barn Owl *Tyto alba*	Seychelles Kestrel *Falco araea*	Seychelles Is.	Competition	Vulnerable
House Crow *Corvus splendens*	Pink Pigeon *Nesoenas mayeri*	Mauritius	Predation	Critically Endangered
House Crow *Corvus splendens*	Mauritius Kestrel *Falco punctatus*	Mauritius	Predation	Endangered

APPENDIX A (*cont.*):

Alien Species	*Native Species*	*Country*	*Impact*	*IUCN Category*
Blackbird *Turdus merula*	[Island Thrush *Turdus p. poliocephalus*	Norfolk I.	Competition	Extinct (after 1969)]
Red-whiskered Bulbul *Pycnonotus jocosus*	Olivaceous Bulbul *Hypsipetes b. borbonicus/H. b. olivaceus*	Réunion & Mauritius	Competition for food	Vulnerable
Red-whiskered Bulbul *Pycnonotus jocosus*	Mauritius Cuckoo-shrike *Coracina typica*	Mauritius	Competition for food	Vulnerable
Red-whiskered Bulbul *Pycnonotus jocosus*	Mauritius Kestrel *Falco punctatus*	Mauritius	Competition	Endangered
Red-whiskered Bulbul *Pycnonotus jocosus*	Pink Pigeon *Nesoenas mayeri*	Mauritius	Competition	Critically Endangered
Red-vented Bulbul *Pycnonotus cafer*	Tahitian Monarch *Pomarea n. nigra*	Tahiti	Aggression	Critically Endangered
Common Myna *Acridotheres tristis*	St Helena Plover *Charadrius sanctaehelenae*	St Helena	Competition/ predation	Endangered
Common Myna *Acridotheres tristis*	Mauritius Parakeet *Psittacula echo*	Mauritius	Competition	Critically Endangered
Common Myna *Acridotheres tristis*	Mauritius Kestrel *Falco punctatus*	Mauritius	Competition for food and harassment	Endangered
Common Myna *Acridotheres tristis*	Seychelles Magpie Robin *Copsychus sechellarum*	Seychelles	Competition	Critically Endangered
Common Myna *Acridotheres tristis*	Long-billed Reed Warbler *Acrocephalus c. caffer*	Tahiti	Nest robbing	Vulnerable
Common Myna *Acridotheres tristis*	Tahitian Monarch *Pomarea nigra*	Tahiti	Nest robbing	Critically Endangered
Red Fody *Foudia madagascariensis*	Mauritius Fody *Foudia rubra*	Mauritius	Competition	Critically Endangered
Red Fody *Foudia madagascariensis*	Rodrigues Fody *Foudia flavicans*	Rodrigues	Competition	Vulnerable
Black Drongo *Dicrurus macrocercus*	Rota Bridled White-eye *Zosterops rotensis*	Rota I.	Predation	Critically Endangered

APPENDIX B Birds whose status as naturalised species is uncertain, or about which little is known.

Name	*Natural Range*	*Possible Naturalised Range*	*Date of Arrival*	*Source(s)*
Rufous-vented Chachalaca *Ortalis ruficauda*	N South America	West Indies (Bequia & Union, Grenadines)	? late 17th c. by Europeans or Carib Indians	Delacour & Amadon 1973
Crested Bobwhite *Colinus cristatus*	C & S America	West Indies (Mustique)	? before 1861	AOU 1998
Rock Partridge *Alectoris graeca*	Alps to Balkans; Italy & Sicily	Ukraine (former USSR)	1953	Yanusevich 1966
Red-necked Francolin *Francolinus afer*	E, S, SW Africa	Madagascar[1], Mascarenes[2], Philippines[1], Ascension I.	1. Before 1934 2. *c.* 1750	Meinertzhagen 1912; Peters 1934
Chinese Francolin *Francolinus pintadeanus*	NE India to SE China	Mascarenes (Réunion)[1]; Philippines (Luzon)[2]	1. *c.* 1740 by the French ?	1. Sonnerat 1782 2. Du Pont 1971
Daurian Partridge *Perdix dauurica* [sic]	E C Asia to C China	Philippines (Luzon)	Before 1971	Du Pont 1971
Green Jungle Fowl *Gallus varius*	Java to Sumba & Alor	Cocos (Keeling) Is	Before 2003	Barrett *et al.* 2003
Madagascar Partridge *Margaroperdix madagarensis* [sic]	Madagascar	Mascarenes (Réunion)	*c.* 1770 by the French	Sonnerat 1782
Blue-breasted (King) Quail *Coturnix chinensis*	India & Indonesia	Marianas (Guam) to E & C Australia	*C. c. lineata* from Philippines before 1946	Strophlet 1946
Jungle Bush Quail *Perdicula asiatica*	India & Sri Lanka	Mascarenes (Réunion)	*c.* 1850	Vinson 1868
Painted Bush Quail *Perdicula erythrorhyncha*	India	Mascarenes (Réunion)	Before 1834	Desjardins 1834
Greater White-fronted Goose *Anser albifrons*	Holarctic	UK; Germany; Netherlands	? before 1992	Lensink 1998; Blair *et al.* 2000
Black-bellied Whistling Duck *Dendrocygna autumnalis*	SE Texas to N Argentina	Balearic Is. (Mallorca)	Before 1998 when pair with 12 ducklings seen	Marti & del Moral 2003
Wood Duck *Aix sponsa*	W & E North America	England Germany Italy	1870s *c.* 1888–90 ?	Lever 1977, 1987, 1997 Gebhardt 1996 Biondi *et al.* 1995
Kerguelen Pintail *Anas eatoni*	Kerguelen & Crozet Is.	Amsterdam I.	1955 (by 1970 had spread to St Paul I.)	Segonzac 1972
Spot-billed Duck	India to China	Oman	? since 1996	Blair *et al.* 2000

APPENDIX B (*cont.*):

Name	*Natural Range*	*Possible Naturalised Range*	*Date of Arrival*	*Source(s)*
Anas poecilorhyncha				
Marbled Duck *Marmaronetta angustirostris*	Spain to C Asia	France; Oman	Since 1998 (Oman)	Blair *et al.* 2000
Common Pochard *Aythya ferina*	W Europe to C Asia	Andorra	Before 2000	Blair *et al.* 2000
Northern Bald Ibis *Geronticus eremita*	W Morocco; Syria; Turkey	SW Spain	2004	E F J Garcia pers. comm.
Common Moorhen *Gallinula chloropus meridionalis*	Sub-Saharan Africa	St Helena	*c.* 1930	Mackworth-Praed & Grant 1962
Gough Island Moorhen *Gallinula nesiotis comeri*	Gough I.	Tristan da Cunha	Early 1950s	Wace & Holdgate 1976
Little Crake *Porzana parva*	Europe to NW China	Kuwait	Before 2003	Gregory 2004
Spotted Crake *Porzana porzana*	W Europe to C Asia	Kuwait	Before 2003	Gregory 2004
Water Rail *Rallus aquaticus*	Much of Palaearctic	Kuwait	Before 2003	Gregory 2004
Madagascar Buttonquail *Turnix nigricollis*	Madagascar	Mascarenes (Réunion) Îles Glorieuses	Before 1963 Before 1974	Watson *et al.* 1963 Penny 1974
Speckled Pigeon *Columba guinea*	Sub-Saharan Africa	Canary Is.	Since 1998	Martí & del Moral 2003
Namaqua Dove *Oena capensis*	Sub-Saharan Africa	Kuwait	Before 2003	Gregory 2004
Red Turtle Dove *Streptopelia tranquebarica*	Tibet & India to Philippines	Singapore	1980	C J Hailes pers. comm. 1985
Brown Parrot *Poicephalus meyeri*	Sub-Saharan Africa	South Africa (Cape Province)	?	Forshaw 1980
Blue-naped Parrot	Philippines S to	Mantanani Besar & Si-Amil Is	Before 1962	Forshaw 1980

APPENDIX B (*cont.*):

Name	*Natural Range*	*Possible Naturalised Range*	*Date of Arrival*	*Source(s)*
Tanygnathus lucionensis	Sula Is.	(Malaysia)		
Great-billed Parrot *Tanygnathus megalorhynchos*	Molucca & Lesser Sunda Is.	Philippines (Balut)	Before 1934	Hachisuka 1934
Orange-chinned Parakeet *Brotogeris jugularis*	S Mexico to N South America	USA (Florida)	1970	Owre 1973
Rosy-faced Lovebird *Agapornis roseicollis*	Angola to South Africa	USA (Arizona)	Before 2000	Kaufman 2000
Dusky-headed Parakeet *Aratinga weddelli*	Colombia to Bolivia	USA (Florida)	Before 1986	Troops & Dilley 1986
Red-lored Parrot *Amazona autumnalis*	Mexico to Brazil	USA (Florida, California)	Before 2000	Sibley 2000
Blue-fronted Parrot *Amazona aestiva*	Bolivia to Uruguay	USA (Florida, California)	Before 2000	Sibley 2000
Mealy Parrot *Amazona farinosa*	Mexico to Brazil	USA (Florida, California)	Before 2000	Sibley 2000
White-fronted Parrot *Amazona albifrons*	Mexico to Costa Rica	USA (Florida, California) West Indies (Puerto Rico)	Before 2000 Before 1998	Sibley 2000 AOU 1998
Yellow-lored Parrot *Amazona xantholora*	Mexico to Belize	USA (Florida)	Before 2000	Sibley 2000
Thick-billed Parrot *Rhynchopsitta pachyrhyncha*	Mexico	USA (Arizona)	? 1990s	AOU 1998
Red-breasted Parakeet *Psittacula alexandri*	India to Hainan; many Indonesian islands	Borneo Penang Singapore Japan	Before 1960 Before 1975 Before 1997 Before 2000	Smythies 1960 King *et al.* 1975 Seng 1997 OSJ 2000
Plum-headed Parakeet *Psittacula cyanocephala*	India, Sri Lanka	South Africa	1970s	Lever 1987

Name	*Natural Range*	*Possible Naturalised Range*	*Date of Arrival*	*Source(s)*
Dunn's Lark *Eremalauda dunni*	Mauritania to Sudan; Syria to W Arabia	Kuwait	Before 2003	Gregory 2004
Varied Tit *Parus varius*	E Asia to Japan	Hawaiian Is	*c.* 1890	Phillips 1928
White-cheeked Bulbul *Pycnonotus leucogenys*	W Asia to India	UAE, Kuwait, Saudi Arabia, Bahrain, Oman	Before 1992	Richardson 1992; Jennings 2004
Savi's Warbler *Locustella luscinioides*	Europe to Kazakhstan; N Africa	Kuwait	Before 2003	Gregory 2004
Graceful Warbler *Prinia gracilis*	NE Africa & Arabia to Bangladesh	Kuwait	Before 2003	Gregory 2004
Moustached Warbler *Acrocephalus melanopogon*	S Europe to Afghanistan	Kuwait	Before 2003	Gregory 2004
Eurasian Reed Warbler *Acrocephalus scirpaceus*	Europe & NW Africa to Kazakhstan	Kuwait	Before 2003	Gregory 2004
Great Reed Warbler *Acrocephalus arundinaceus*	Europe to Xinjiang	Kuwait	Before 2003	Gregory 2004
Olivaceous Warbler *Iduna pallida*	S Europe to Xinjiang; NW Africa; Niger to Sudan	Kuwait	Before 2003	Gregory 2004
Greater Blue-eared Glossy Starling *Lamprotornis chalybaeus*	Sub-Saharan Africa	Canary Is Spain (Valencia)	Before 2001 Before 2000	J. Martin & T. Clarke pers. comm. 2004 Murgui 2000
Purple Glossy Starling *Lamprotornis purpureus*	Senegal & Mali to Nigeria; Cameroon to E Africa	Canary Is	Before 2001	J. Martin & T. Clarke pers. comm. 2004
Long-tailed Glossy Starling *Lamprotornis caudatus*	Senegal to Sudan	Spain (Valencia)	Before 2000	Murgui 2000
Brahminy Starling	Afghanistan to	UAE	Before 2000	Jennings 2004

APPENDIX B (*cont.*):

Name	*Natural Range*	*Possible Naturalised Range*	*Date of Arrival*	*Source(s)*
Sturnus pagodarum	Bangladesh			
Asian Pied Starling *Sturnus contra*	India to Yunnan	UAE	Before 2004	Jennings 2004
Oriental White-eye *Zosterops palpebrosus*	Afghanistan to China	USA (California)	Early 1970s	AOU 1983; Small 1994
Rufous Scrub Robin *Cercotrichas galactotes*	Europe, N Africa, Senegal to Somalia; Middle East	Kuwait	Before 2003	Gregory 2004
Green Avadavat *Amandava formosa*	India	Pakistan (Lahore)	*c.* 1960	Ripley 1961
Zebra Finch *Taeniopygia guttata*	Australia & Lesser Sunda Is	Nauru I., Papua New Guinea; Tuamotu Is.	Before 1962	Pearson 1962
		Portugal	Before 1988	Clement *et al.* 1993
Baya Weaver *Ploceus phillipinus*	Pakistan to Yunnan & Malay Peninsula	Saudi Arabia	Before 2004	Jennings 2004
Southern Red Bishop *Euplectes orix*	Sub-Saharan Africa	Spain (Extremadura; Sevilla; Almería) Canary Is. (Tenerife)	Before 2003	Martí & del Moral 2003
White-headed Munia *Lonchura maja*	Malaysia, Sumatra, Java, Bali, Thailand	Japan (Okinawa & Honshu)	Before 1981	OSJ 1981
African Silverbill *Lonchura cantans*	Senegal to Ethiopia, & Arabia	Portugal	Before 1997	Costa *et al.* 1997
Red-billed Quelea *Quelea quelea*	Sub-Saharan Africa	Spain (Ebro delta; Doñana)	Before 1982	Martí & del Moral 2003
Cut-throat *Amadina fasciata*	Sub-Saharan Africa	Portugal	Before 1997	Costa *et al.* 1997

APPENDIX C Continents and oceanic islands on which alien birds are naturalised (A), and faunal regions that are the origin of naturalised birds (B).

	(A)									*(B)*					
	EU	*AS*	*AF*	*NA*	*SA*	*AU*	*AO*	*IO*	*PO*	*PA*	*AF*	*OR*	*NE*	*NT*	*AU*
Chilean Tinamou *Nothoprocta perdicaria*									●					●	
Ostrich *Struthio camelus*						●				●	●				
Plain Chachalaca *Ortalis vetula*				●									●	●	
Helmeted Guineafowl *Numida meleagris*		●		●	●	●	●	●	●	●	●				
Mountain Quail *Oreortyx pictus*				●									●		
Californian Quail *Callipepla californica*	●			●	●	●			●				●		
Gambel's Quail *C. gambelii*									●				●		
Northern Bobwhite *Colinus virginianus*	●			●		●							●	●	
Wild Turkey *Meleagris gallopavo*	●	●		●		●			●				●	●	
Himalayan Snowcock *Tetraogallus himalayensis*				●								●			
Chukar Partridge *Alectoris chukar*	●	●	●	●		●	●		●	●		●			
Barbary Partridge *A. barbara*	●						●			●					
Red-legged Partridge *A. rufa*	●					●	●			●					
Black Francolin *Francolinus francolinus*	●								●	●		●			
Grey Francolin *F. pondicerianus*		●						●	●			●			

APPENDIX C (*cont.*):

	(A)									(B)					
	EU	*AS*	*AF*	*NA*	*SA*	*AU*	*AO*	*IO*	*PO*	*PA*	*AF*	*OR*	*NE*	*NT*	*AU*
Erckel's Francolin *F. erckelli*	●								●		●				
Grey Partridge *Perdix perdix*				●		●				●					
Common Quail *Coturnix coturnix*								●		●	●				
Blue-breasted Quail *C. chinensis*								●				●			●
Japanese Quail *C. japonica*	●								●	●					
Brown Quail *C. ypsilophora*						●			●						●
Jungle Bush Quail *Perdicula aviatica*								●				●			
Chinese Bamboo Partridge *Bambusicola thoracicus*	●	●										●			
Red Jungle Fowl *Gallus gallus*		●		●	●			●	●			●			
Kalij Pheasant *Lophura leucomelanos*					●				●			●			
Silver Pheasant *L. nycthemera*	●				●							●			
Reeves's Pheasant *Syrmaticus reevesii*	●									●					
Common Pheasant *Phasianus colchicus*	●	●		●	●	●	●	●	●	●		●			
Green Pheasant *P. versicolor*	●			●					●	●					
Golden Pheasant *Chrysolophus pictus*	●				●					●					
Lady Amherst's Pheasant *C. amherstiae*	●				●					●		●			

APPENDIX C (*cont.*):

	(A)									(B)					
	EU	*AS*	*AF*	*NA*	*SA*	*AU*	*AO*	*IO*	*PO*	*PA*	*AF*	*OR*	*NE*	*NT*	*AU*
Indian Peafowl *Pavo cristatus*				●		●			●			●			
Bar-headed Goose *Anser indicus*	●									●					
Snow Goose *A. caerulescens*	●									●			●		
Swan Goose *A. cygnoides*	●									●					
Barnacle Goose *A. leucopsis*	●									●					
Canada Goose *Branta canadensis*	●					●							●		
Black Swan *Cygnus atratus*	●					●									●
Mute Swan *C. olor*	●	●	●	●		●				●					
Egyptian Goose *Alopochen aegyptiaca*	●	●									●				
Ruddy Shelduck *Tadorna ferruginea*	●	●		●						●					
Muscovy Duck *Cairina moschata*	●		●	●	●		●	●						●	
Mandarin Duck *Aix galericulata*	●			●						●		●			
Mallard *Anas platyrhynchos*		●	●	●		●	●	●	●	●			●		
Meller's Duck *A. melleri*								●			●				
Northern Shoveler *A. clypeata*		●								●			●		
Red-crested Pochard *Netta rufina*	●									●					

APPENDIX C (*cont.*):

	(A)									(B)					
	EU	*AS*	*AF*	*NA*	*SA*	*AU*	*AO*	*IO*	*PO*	*PA*	*AF*	*OR*	*NE*	*NT*	*AU*
Ruddy Duck *Oxyura jamaicensis*	●	●	●										●		
Greater Flamingo *Phoenicopterus ruber*	●			●						●				●	
Chilean Flamingo *P. chilensis*	●			●										●	
Sacred Ibis *Threskiornis aethiopicus*	●	●					●				●				
Black-crowned Night Heron *Nycticorax nycticorax*	●									●		●	●	●	
Cattle Egret *Bubulcus ibis*								●	●	●	●	●	●		
Turkey Vulture *Cathartes aura*				●									●	●	
Chimango Caracara *Milvago chimango*									●					●	
Western Marsh Harrier *Circus aeruginosus*									●	●					
Weka *Gallirallus australis*									●						●
Purple Swamphen *Porphyrio porphyrio*				●		●				●	●	●			●
Chestnut-bellied Sandgrouse *Pterocles exustus*									●		●	●			
Rock Dove (Feral Pigeon) *Columba livia*	●	●	●	●	●	●	●	●	●	●	●	●			
Eurasian Collared Dove *Streptopelia decaocto*		●		●								●			
Barbary Dove (Ringed Turtle Dove) *S. risoria*	●			●		●	●				●				
Madagascar Turtle Dove *S. picturata*								●			●				

APPENDIX C (*cont.*):

	(A)									(B)					
	EU	*AS*	*AF*	*NA*	*SA*	*AU*	*AO*	*IO*	*PO*	*PA*	*AF*	*OR*	*NE*	*NT*	*AU*
Spotted-necked Dove (Spotted Dove) *S. chinensis*		●		●		●		●	●			●			
Laughing Dove *S. senegalensis*						●	●	●		●	●	●			
Island Collared Dove *S. bitorquata*		●							●			●			
Zebra Dove *Geopelia striata*		●					●	●	●			●			
Common Ground Dove *Columbina passerina*							●						●	●	
Emerald Dove *Chalcophaps indica*		●										●			●
Caribbean Dove *Leptotila jamaicensis*				●										●	
Mourning Dove *Zenaida macroura*									●				●	●	
Galah *Eolophus roseicapilla*						●									●
Little Corella *Cacatua sanguinea*		●													●
Tanimbar Corella *C. goffini*		●													●
Yellow-crested Cockatoo *C. sulphurea*		●													●
Sulphur-crested Cockatoo *C. galerita*		●		●		●			●						●
Kuhl's Lorikeet *Vini kuhlii*									●						●
Red Shining Parrot *Prosopeia tabuensis*									●						●
Crimson Rosella *Platycercus elegans*						●			●						●

APPENDIX C (*cont.*):

	(A)									(B)					
	EU	*AS*	*AF*	*NA*	*SA*	*AU*	*AO*	*IO*	*PO*	*PA*	*AF*	*OR*	*NE*	*NT*	*AU*
Eastern Rosella *P. eximius*						●									●
Budgerigar *Melopsittacus undulatus*		●		●		●									●
Eclectus Parrot *Eclectus roratus*		●							●						●
Rose-ringed Parakeet (Ring-necked Parakeet) *Psittacula krameri*	●	●	●	●			●	●	●		●	●			
Alexandrine Parakeet *P. eupatria*	●	●										●			
Grey-headed Lovebird *Agapornis canus*								●			●				
Fischer's Lovebird *A. fischeri*			●								●				
Yellow-collared Lovebird *A. personatus*			●								●				
Blue-and-Yellow Macaw *Ara araruana*				●										●	
Chestnut-fronted Macaw *A. severus*				●										●	
Blue-crowned Parakeet *Aratinga acuticaudata*	●			●										●	
Mitred Parakeet *A. mitrata*	●			●										●	
Green Parakeet *A. holochlora*				●									●	●	
Red-masked Parakeet *A. erythrogenys*	●			●										●	
Orange-fronted Parakeet *A. canicularis*				●									●	●	
Brown-throated Parakeet *A. pertinax*				●										●	

APPENDIX C (*cont.*):

	(A)									(B)					
	EU	*AS*	*AF*	*NA*	*SA*	*AU*	*AO*	*IO*	*PO*	*PA*	*AF*	*OR*	*NE*	*NT*	*AU*
Nanday Parakeet (Black-hooded Parakeet) *Nandayus nenday*		●		●			●							●	
Monk Parakeet *Myiopsitta monachus*	●			●	●		●							●	
Green-rumped Parrotlet *Forpus passerinus*				●										●	
Canary-winged Parakeet (White-winged Parakeet) *Brotogeris versicolurus*				●										●	
Yellow-chevroned Parakeet *B. chiriri*				●										●	
Hispaniolan Parrot *Amazona ventralis*				●										●	
Red-crowned Parrot (Green-cheeked Parrot) *A. viridigenalis*				●					●				●		
Lilac-crowned Parrot *A. finschi*				●									●		
Yellow-headed Parrot *A. oratrix*				●										●	
Yellow-crowned Parrot *Amazona ochrocephala*				●										●	
Orange-winged Parrot *A. amazonica*				●										●	
Smooth-billed Ani *Crotophaga ani*									●				●	●	
Barn Owl *Tyto alba*								●	●	●	●	●	●	●	●
Great Horned Owl *Bubo virginianus*									●				●	●	
Little Owl *Athene noctua*	●					●				●	●				

APPENDIX C (*cont.*):

	(A)									(B)					
	EU	*AS*	*AF*	*NA*	*SA*	*AU*	*AO*	*IO*	*PO*	*PA*	*AF*	*OR*	*NE*	*NT*	*AU*
Marianas Swiftlet *Aerodramus bartschi*									●						●
Laughing Kookaburra *Dacelo novaeguineae*						●									●
Great Kiskadee *Pitangus sulphuratus*							●						●	●	
Noisy Miner *Manorina melanocephala*									●						●
Australian Magpie *Gymnorhina tibicen*						●			●						●
Black Drongo *Dicrurus macrocercus*									●			●			
Tufted Jay *Cyanocorax dickeyi*				●										●	
House Crow *Corvus splendens*	●	●	●					●				●			
Rook *C. frugilegus*						●				●					
American Crow *C. brachyrhynchos*							●						●		
Eurasian Jackdaw *C. monedula*			●							●					
Common Magpie *Pica pica*		●								●		●			
Eurasian Skylark *Alauda arvensis*				●		●			●	●					
Red-whiskered Bulbul *Pyconotus jocosus*	●	●		●		●		●	●			●			
Red-vented Bulbul *P. cafer*	●	●				●			●			●			
Sooty-headed Bulbul *P. aurigaster*		●										●			

APPENDIX C (*cont.*):

	(A)									(B)					
	EU	*AS*	*AF*	*NA*	*SA*	*AU*	*AO*	*IO*	*PO*	*PA*	*AF*	*OR*	*NE*	*NT*	*AU*
Yellow-vented Bulbul *P. goiavier*		●										●			
Japanese Bush Warbler *Cettia diphone*									●	●					
Melodious Laughing Thrush *Garrulax canorus*		●							●	●		●			
Greater Necklaced Laughing Thrush *G. pectoralis*									●			●			
Grey-sided Laughing Thrush *G. caerulatus*									●			●			
Masked Laughing Thrush *G. perspicillatus*		●								●		●			
Red-billed Leiothrix *Leiothrix lutea*	●	●						●	●			●			
Japanese White-eye *Zosterops japonicus*									●	●					
Silver-eye *Z. lateralis*									●						●
Christmas Island White-eye *Z. natalis*								●				●			
Northern Mockingbird *Mimus polyglottos*				●			●		●				●	●	
Tropical Mockingbird *M. gilvus*					●									●	
Hill Myna *Gracula religiosa*				●				●	●			●			
Crested Myna *Acridotheres cristatellus*	●	●		●								●			
Jungle Myna *A. fuscus*		●		●				●	●			●			
White-vented Myna *A. javanicus*		●		●				●	●			●			

APPENDIX C (*cont.*):

	(A)									(B)					
	EU	*AS*	*AF*	*NA*	*SA*	*AU*	*AO*	*IO*	*PO*	*PA*	*AF*	*OR*	*NE*	*NT*	*AU*
Black-winged Myna *A. melanopterus*		●										●			
Pale-bellied Myna *A. cinereus*		●										●			
Bank Myna *A. gingianus*		●										●			
Common Myna *A. tristis*	●	●	●	●		●	●	●	●			●			
European Starling *Sturnus vulgaris*			●	●		●	●		●	●					
Asian Pied Starling *S. contra*		●										●			
Eurasian Blackbird *Turdus merula*						●			●	●		●			
Song Thrush *T. philomelos*						●			●	●					
Island Thrush *T. poliocephalus*								●				●			●
White-rumped Shama *Copsychus malabaricus*									●			●			
House Sparrow *Passer domesticus*		●	●	●	●	●	●	●	●	●					
Eurasian Tree Sparrow *P. montanus*	●	●		●		●	●	●	●	●		●			
Spanish Sparrow *P. hispaniolensis*		●					●			●					
Village Weaver *Ploceus cucullatus*	●			●	●		●	●			●				
Golden-backed Weaver *P. jacksoni*		●									●				
Lesser Masked Weaver *P. intermedius*		●									●				

APPENDIX C (*cont.*):

	(A)									(B)					
	EU	*AS*	*AF*	*NA*	*SA*	*AU*	*AO*	*IO*	*PO*	*PA*	*AF*	*OR*	*NE*	*NT*	*AU*
Streaked Weaver *P. manyar*		●										●			
Red Fody *Foudia madagascariensis*		●					●	●			●				
Northern Red Bishop *Euplectes franciscanus*	●			●							●				
Yellow-crowned Bishop *E. afer*	●	●		●							●				
Red-cheeked Cordon-bleu *Uraeginthus bengalus*							●		●		●				
Blue-breasted Cordon-bleu (Blue Waxbill) *U. angolensis*							●				●				
Orange-cheeked Waxbill *Estrilda melpoda*	●	●		●			●		●		●				
Red-tailed Lavender Waxbill *E. caerulescens*									●		●				
Common Waxbill *E. astrild*	●			●	●		●	●	●		●				
Black-rumped Waxbill *E. troglodytes*	●	●		●			●		●		●				
Red Avadavat *Amandava amandava*	●	●	●	●				●	●			●			
Red-browed Finch *Neochmia temporalis*									●						●
Bronze Mannikin *Lonchura cucullata*				●							●				
Indian Silverbill (White-throated Munia) *L. malabarica*	●	●		●					●		●	●			
Scaly-breasted Munia *L. punctulata*		●		●		●		●	●			●			
Javan Munia *L. leucogastroides*		●										●			

APPENDIX C (*cont.*):

	(A)									(B)					
	EU	*AS*	*AF*	*NA*	*SA*	*AU*	*AO*	*IO*	*PO*	*PA*	*AF*	*OR*	*NE*	*NT*	*AU*
Black-headed Munia *L. malacca*	●	●		●					●			●			
White-cowled Mannikin *L. hunsteini*									●						●
Chestnut-breasted Mannikin *L. castaneothorax*									●						●
Java Sparrow *L. oryzivora*		●	●	●			●	●	●			●			
White-rumped Munia *L. striata*		●										●			
Pin-tailed Whydah *Vidua macroura*				●				●			●				
Eastern Paradise Whydah *V. paradisaea*		●									●				
Dunnock *Prunella modularis*						●				●					
Chaffinch *Fringilla coelebs*			●			●			●	●					
Island Canary *Serinus canaria*									●	●					
Yellow-fronted Canary *S. mozambicus*				●			●	●	●		●				
Yellow-crowned Canary (Cape Canary) *S. canicollis*								●			●				
Yellow Canary *S. flaviventris*							●				●				
European Greenfinch *Carduelis chloris*					●	●	●		●	●					
European Goldfinch *C. carduelis*				●	●	●	●		●	●					
Red Siskin *C. cucullata*				●										●	

APPENDIX C (*cont.*):

	(A)									(B)					
	EU	*AS*	*AF*	*NA*	*SA*	*AU*	*AO*	*IO*	*PO*	*PA*	*AF*	*OR*	*NE*	*NT*	*AU*
Common Redpoll															
C. flammea						●			●	●			●		
House Finch															
Carpodacus mexicanus									●				●		
Troupial															
Icterus icterus				●	●									●	
Spot-breasted Oriole															
I. pectoralis				●					●					●	
Shiny Cowbird															
Molothrus bonariensis				●	●									●	
Western Meadowlark															
Sturnella neglecta									●				●		
Carib Grackle															
Quiscalus lugubris				●										●	
Yellowhammer															
Emberiza citrinella						●			●	●					
Cirl Bunting															
E. cirlus						●				●					
Grassland Yellow Finch															
Sicalis luteola				●										●	
Saffron Finch															
S. flaveola				●	●				●					●	
Common Diuca Finch															
Diuca diuca									●					●	
Yellow-faced Grassquit															
Tiaris olivaceous									●					●	
Cuban Grassquit															
T. canorus				●										●	
Red-crested Cardinal															
Paroaria coronata		●		●					●					●	
Yellow-billed Cardinal															
P. capitata									●					●	

APPENDIX C (*cont.*):

	(A)									(B)					
	EU	*AS*	*AF*	*NA*	*SA*	*AU*	*AO*	*IO*	*PO*	*PA*	*AF*	*OR*	*NE*	*NT*	*AU*
Northern Cardinal *Cardinalis cardinalis*							●		●				●		
Crimson-backed Tanager *Ramphocelus dimidiatus*									●					●	
Red-legged Honeycreeper *Cyanerpes cyaneus*				●										●	

Key.

Continents and Oceanic Islands

EU = Europe. AS = Asia. AF = Africa. NA = North America. SA = South America. AU = Australasia. AO = Atlantic Ocean. IO = Indian Ocean. PO = Pacific Ocean.

Faunal Regions

PA = Palearctic. AF = Afrotropical. OR = Oriental. NE = Nearctic. NT = Neotropical. AU = Australiasian.

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Index