Review

Not peer-reviewed version

Alien Birds in Sub-Saharan Africa: An Overview

Grzegorz Kopij *

Posted Date: 24 January 2025

doi: 10.20944/preprints202501.1827.v1

Keywords: introduction; invasive species; distribution; population densities; *Passer domesticus; Columba livia*

Review

Alien Birds in Sub-Saharan Africa: An Overview

Grzegorz Kopij

Department of Vertebrate Ecology, Wrocław University of Environmental & Life Sciences, ul. Kożuchowska 5b, 51-631 Wroclaw, Poland; grzegorz.kopij@upwr.edu.pl

Abstract: Introduced species may pose one of the biggest threat to the biodiversity conservation. Monitoring their status, distribution and abundance constitute today an important part of ecological and conservation studies throughout the world. In the Afrotropical Region (sub-Saharan Africa) avian introductions attract attention of many researchers, but there is a lack of comprehensive review of this subject on a continental scale. The presented paper constitutes an attempt to overview the status, distribution, threats and control measures of bird introduced in sub-Saharan Africa in the last 200 years. This review lists 150 bird species introduced in sub-Saharan Africa. Only 49 (32.7%) of them have developed viable populations and only 7 (4.7%) became invasive species, namely *Passer domesticus, Sturnus vulgaris, Acridotheres tristis, Corvus splendens, Columba livia var. domestica, Psittacula krameria* and *Pycnonotus jocosus*. Data on distribution of most introduced species are provided together with information on the place and year of their first introductions. For *Passer domesticus* and *Columba livia* var. *domesticus* data on population densities are also provided from several southern African towns. The most specious groups of introduced species were parrots (Psittaciformes) comprising 33.3% (including Pisittacidae: 14%, and Psittaculidae: 16%), Anatidae: 11.3%, Phasianidae: 11.3%, and Passeriformes: 29.3%. Most avian introductions in sub-Saharan Africa took place in Southern Africa (mainly Cape Town, Durban and Johannesburg areas) and in Madagascar and surrounding islands (mostly Mauritius, Reunion and Seychelles). Most introduced species which have developed viable populations originate from Afrotropical, Oriental and Palearctic regions (altogether 78%), with only 2% from the New World. The proportions among introduced species which have not established viable populations are quite different: 30% from the New World, and only 56% from the Afrotropical, Oriental and Palearctic regions (Figure 4). Main factors affecting successful avian introductions and introduction pathways have been identified. A review of control measurers undertaken in sub-Saharan Africa (mainly in small oceanic islands) is outlined for the following species: *Passer domesticus, Acridotere tristis, Corvus splendens, Pyconotus jocosus, Foudia madagascarensis, Psittacula krameiri* and *Agapornis roseicollis*.

Keywords: introduction; invasive species; distribution; population densities; *Passer domesticus; Columba livia*

1. Introduction

Dispersion, migration and colonization are ones of the fundamental features of living organisms. Therefore, changes in distribution and geographical ranges are natural, common and widespread, always and everywhere. Their intensity is related to environmental changes and to dispersal and reproductive abilities of living organisms. However, man can accelerated the changes on unprecedent scale, through high population growth and negative impact on natural environment.

According to the 'tens rule' (Williamson & Fitter, 1996) only about 10% of introduced species develop viable population. Out of these c. 90% achieve a status of naturalized, established populations, and only c. 10% of them assume the status of invasive species. Those species pose a serious ecological (e.g., disturbance of natural balance, dislocation of indigenous species), economic (e.g., agricultural pests) and social (e.g., human diseases) problems. In most countries in the world

 doi:10.20944/preprints202501.1827.v1

regions of the world, the negative impact of invasive species constituts the most important ecological problem, beside the habitat destruction.

Most avian introductions derive from the last three centuries, and most are associated with the British colonization. Today the major regions of avian introductions in the world include their major overseas settlements, i.e., Australia and New Zealand, Oceania (especially Hawaii), South Africa and USA. They deliberately tried to introduce exotic species mainly for hunting purpose, hence exotic birds are overrepresented today by game birds (Blackburn et al., 2009). The other motives for the introductions include pest control, aesthetic (bright colouration, pleasure songs), nostalgia and even conservation (e.g., Mandarin Duck *Aix galericulata* and Golden Pheasant *Chrysolophus pictus*) and religion (Buddhism and Taoism). Most of the recent introductions are however accidental and unintentional (Long, 1981; Downs & Hart, 2020).

Avian invasion has been well-studied, but subsequently summarized for only some parts of the world, such as USA (Johnston & Garrett, 1994; Cox, 1999; Avery & Tillman, 2005; Witmer et al., 2007; Garrett et al., 2018), Great Britain and Europe (Chiron et al., 2009; Kark et al., 2009; Hilton & Cuthbert, 2010), and Australia with New Zealand (Krull et al., 2014; Moulton & Cropper 2014; Vall-llosera & Cassey, 2017). For most tropical parts of the world, no comprehensive reviews are available on a continental (zoogeographical regions) scale. The presented paper attempts to summarize our knowledge on avian introduction in ones of such regions.

2. Materials and Methods

Most avian introductions in Africa began in the midlle of the 19th century with the European colonization (Blackburn et al., 2009). Appropiate literature since 1900 onwards (with a special emphasis on the last 50 years) was reviewed for information on avian introduction in Africa south of Sahara, including Madagascar and the following small islands and archipelagos: Cape Verde; São Tome e Principe, Bioko and Annobón of the Equatorial Guinea; Mascarenes, Seychelles, Comoros; Mafia, Zanzibar, Pemba off Tanzania; and Socotra.

Since definitions related to introductions differ between studies and authors, the following terms used in this article, require clarification. The definitions are based mainly on IUCN/WCU; IUCN 2015; Bern Convention; Genovesi & Shine (2004) and Hawkins et al. (2015). The following types of introduced species can be distinguished:

- Indigenous species (native, autochthonous): species living within its natural range.
- Alien species (introduced, non-native, non-indigenous, foreign, exotic): species introduced by man intentionally or accidentally.
- Invasive alien species (invader): introduced species which has been introduced, to areas not previously occupied, establishing viable breeding population, spreads and becomes a pest affecting ecosysstem, local biodiversity, economy and society (including human health).
- Non-invasive alien species: introduced species with developed viable population of low dispersal abilities and not affecting adversely ecosystems, economy and society in the conquered areas.
- Translocated species: accidental escapee from aviary or enclosure; may reproduce in wild, but has not develop viable population.
- Post-invasive alien species (established, naturalized): a species introduced long time ago (before 1900), well-established in the wild, but without expansion tendencies.
- Cryptogenic species: unknown origin (alien or indigenous), its expansion may be shaped by natural or anthropogenic factors.

The following types of introduction are recognized:

- Intentional introduction: purposeful relocation of a species beyond its natural range.
- Unintentional introduction: accidental relocation of a species beyond its natural range.
- Expansion: continuous natural enlargement of natural range by acquisition of the adjacent areas or natural occupation of new habitats within the original range

 doi:10.20944/preprints202501.1827.v1

- Invasion (colonization): natural spread into new areas accompanied by a rapid and often explosive exponential population growth and changes in natural environment and human economy.

To characterize population of the introduced species the following terms are used:

- Population stages: not established, developing, viable, established (naturalized.
- Population growth (dynamic): stable, increasing, declining, locally extinct.
- The types of invaded ecosystems can be grouped as follow:
- Natural ecosystem: natural formations not altered and not disturbed by man, usually in the climax stage.
- Semi-natural: natural formation modified/altered by human; in successive or/and climax stages.
- Artificial ecosystem: artificial formations created by man, not in a climax stage.

3. The Introduced Species

3.1. Invasive Alien Bird Species

Out of 150 alien species introduced in sub-Saharan Africa in the last 200 years, 49 (32.7%) have developed viable populations (this study), but only 7 (4.6%) became invasive (Liversidge 1985; Brooke et al. 1986; Dean 2000; Downs & Hart 2020; Shivambu et al. 2020), i.e., House Sparrow *Passer domesticus*, Common Starling *Sturnus vulgaris*, Common Myna *Acridotheres tristis*, Red-whiskered Bulbul *Pycnonotus jocosus*, House Crow *Corvus splendens*, Rock Pigeon *Columba livia* var. *domestica*, and Rose-ringed Parakeet *Psittacula krameri* (Table 1, 2; Figure 1A-F).

Table 1. Bird species introduced and established in sub-Saharan Africa.

Scientific species name	Common species name	Original range	Expanded range in Africa	Impact
Acridotheres tristis Sturnidae	Common Myna	SE Asia	South Africa (Durban: 1888, Gauteng, Mpumalanga, KZN, FS), Lesotho	high
Columba livia Columbidae	Rock Dove	S Palearctic	South Africa: 1850; all over sub-Saharan Africa	high
Passer domesticus Passeridae	House Sparrow	India	South Africa: Durban: 1893; till 1950's confined to KZN; S and E Africa; Sahel zone, Senegal; Ivory Coast, Ghana	high
Sturnus vulgaris Sturnidae	Common Starling	Europe	South Africa: Cape Town: 1897, W Cape: 1950's, E Cape: 1960's, KZN: 1970's	high
Corvus splendens Corvidae	House Crow	SE Asia	Zanzibar: 1890's; Kenya: 1947; Durban: 1972, Cape Town: 1979; Socotra: 1994; establ.: SA, Tanzania, Kenya, Socotra	high
Psittacula krameri Psittaculidae	Rose-ringed Parakeet	W Africa, SE Asia	SA: Cape Town: 1860, Durban: 1970's, Gauteng; Socotra; Maurit., Zanzibar, Kenya, Cape Verde; Seychelles: 1970's	high
Pycnonotus jocosus Pycnonotidae	Red-whisker. Bulbul	SE Asia	Established in Mauritius: 1892, Reunion: 1972; Seychelles: 1977; present in: Madagacar, South Africa, Zimbabwe	high
Alectoris chukar Phasianidae	Chukar Partridge	Eurasia	Robben Island: 1964	medium
Gallus gallus Phasianidae	Red Junglefowl	Orient	South Africa: KZN, Mpumalanga (Gravellote); Reunion; Mayotte	medium
Numida meleagris Numidae	Helmeted Guineafowl	Africa	Cape Verde, Comoros	medium

 doi:10.20944/preprints202501.1827.v1

Anas platyrhynchos Anatidae	Mallard	Holarctic	South Africa: 1940's; Gauteng: 1980's, W Cape; Madagascar, Reunion, Mauritius	medium
Bubulcus ibis Ardeidae	Cattle Egret	Africa, Asia	Seychelles and possibly Rodrigues Island	medium
Geopelia placida *Columbidae*	Peaceful Dove	Australia	Madagascar, Mauritius, Seychelles, Réunion, Glorioso Islands, Rodrigues	medium
Geophila striata Columbidae	Zebra Dove	Australia	Seychelles; 'hundreds of thousands of individuals'	medium
Agapornis canus Psittaculidae	Madagascar Lovebird	Madaga-scar	Rodrigues, Réunion, Comoros, Seychelles; unsuccessful (unsuc.) to Mauritius, Zanzibar, Mafia Islands, South Africa	medium
Agapornis fischeri Psittaculidae	Fischer's Lovebird	E. Africa	Tanga (Tanzania), S Kenya; Cape St. Francis: 2014	medium
Agapornis lillianae Psittaculidae	Nyasa Lovebird	E. Africa	Possibly introduced successfully to Zambia (Lundazi), Namibia and South Africa (Pretoria: 2013)	medium
Agapornis personatus Psittaculidae	Masked Lovebird	E. Africa	Dar es Salaam, Tanzania; Nairobi, Kenya	medium
Agapornis roseicollis Psittaculidae	Rosy-faced Lovebird	SW Africa	South Africa: Johannesburg: c. 1984, successful (suc.); Modimolle: 1993, Cape Town: 2008; Durban: 2008	medium
Tyto alba Tytonidae	Barn Owl	Global	Seychelles: 1949; introduced to controls rats; preys on the endagered Fairy Tern (EN) nests in small islands	medium
Foudia madagasca-riensis Ploceidae	Madagascar Fody	Madaga-scar	Suc.: Seychelles (Amirantes),Mauritius, Réunion, Rodrigues and possibly Comoros and Glorioso Islands	medium
Quelea quelea Ploceidae	Red-billed Quelea	Africa	Successfully introduced to Réunion	medium
Estrilda astrild Estrildidae	Common Waxbill	Africa	Suc.:Mauritius, Rodrigues, Amirantes, Seychelles, Réunion, Cape Verde, São Tomé; unsuc.: Madagascar	medium
Coturnix coturnix Phasianidae	Common Quail	Palearctic	Successful: Reunion; unsuccessful: Seychelle, Mauritius, Comores	low
Coturnix chinensis Phasianidae	Blue-breasted Quail	Orient, Australia	Mauritius, Kenya	low
Francolinus pinte-deanus Phasianidae	Chinese Francolin	China	Successfully introduced to Mauritius andpossibly to Madagascar and Seychelles; unsuccessful: Reunion	low
Pavo cristatus Phasianidae	Common Peacock	SE Asia	Robben Island: 1968; Cape Town, Bloemfontein	low
Aix galericulata Anatidae	Mandarin Duck	Palearctic	South Africa: Johannesburg: 1980, as breeding	low
Aix sponsa Anatidae	Wood Duck	Nearctic	South Africa: Durban: 1880, as feral	low

 doi:10.20944/preprints202501.1827.v1

Turnix nigricollis Turnicidae	Madagascar Buttonquail	Madaga-scar	Glorioso Islands and Réunion; unsuccessfully introduced to Mauritius	low
Nesoenas picturatus Columbidae	Malagasy Turtle-dove	Madaga-scar	Possibly successfully introduced: Mauritius and Réunion (perhaps native); *N. p. picturatus* succ. in Seychelles	low
Spilopelia chinensis Columbidae	Spotted Dove	Orient	Mauritius	low
Steptopelia decaocto Columbidae	Collared Dove	Pelearcti c	Successgul: Cape Verde; unsuccessful: South Africa: Cape Town area	low
Melopsittacus undu-latus Psittacidae	Budgerigar	Australi a	South Africa: KZN: 1958; Pretoria: 1987; Melville: 1995; Swakopmund: 2001; Johannesburg: 2013	low
Psittacus erithacus Psittaculidae	African Grey	C Africa	South Africa: Pietermaritzburg: 2013	low
Nymphicusholla ndic-us Cacatuidae	Cockatiel	Australi a	South Africa (WC, G)	low
Estrilda amandava Estrildidae	Red Avadavat	Orient	Successful: Reunion, Mayotte; unsuccessful: South Africa (Rosherville), Mauritius	low
Lonchura punctulata Estrildidae	Scaly-breasted Munia	Orient	Successful: Mauritius, Reunion; unsuccessful: Seychelles; Estrildidae	low
Lonchura oryzivora Estrildidae	Java Sparrow	Orient	South Africa: Port Alfred, Tanzania: Zanzibar; unsuccessful: Mauritius, Comoros, Seychelles,	low
Uraeginthus angolen-sis Estrildidae	Blue-breasted Cordon-bleu	Africa	Introduced possibly successfully to Zanzibar and São Tome e Principe	low
Passer hispaniolensis Passeridae	Spanish Sparrow	S Palearcti c	Cape Verde	low
Ploceus cucullatus Ploceidae	Village Weaver	Africa	Successful: Mauritius, probably to Réunion, possibly colonized or introduced to São Tomé; unsuc.: Cape Verde	low
Ploceus melanocepha-lus Ploceidae	Black-headed Weaver	Africa	Possibly introduced successfully to São Tomé	low
Carduelis carduelis Fringillidae	Goldfinch	Palearcti c	Successful: Cape Verde; unsuccessful: Cape Town: 1891	low
Crithagra mozambica Fringillidae	Yellow-front. Canary	Africa	Reunion, Mauritius, Rodrigues, São Tome e Principe	low
Fringilla coelebs Fringillidae	Common Chaffinch	Eurasia	Cape Town: 1890's, Cape Peninsula	

 doi:10.20944/preprints202501.1827.v1

Serinus canicollis Fringillidae	Cape Canary	Africa	Reunion; unsuc.: Mauritius	low

Table 2. Bird species introduced/translocated/escaped from captivity in sub-Saharan Africa, but did not established viable population, or established it but now regarded extinct (denoted with '+').

Species scientific name	Species common name	Origin	Range after introduction
Agapornis canus Psittaculidae	Grey-headed Parrot	Madagasc.	SA, KZN, 1890+; Mayotte, Kenya
Agapornis meyerii Psittaculidae	Meyer's Parrot	Afrotropic	SA: Cape Town +
Agapornis personatus Psittaculidae	Yellow-collared Lovebird	Afrotropic	SA, 2011-2023, Kenya
Agapornis pullarius Psittaculidae	Red-headed Lovebird	Afrotropic	Mayotte
Agapornis nigrigenis Psittaculidae	Black-cheeked Lovebird	Afrotropic	SA, Pretoria, 2005
Aix sponsa Anatidae	Wood Duck	Nearctic	SA: 4 sites, 1997, 1999, 2001, 2001, 2002
Alectoris melanocephala Phasianidae	Arabian Partridge	Arabia	Eritrea +
Amazona aestiva Psittacidae	Blue-fronted Amazon	Neotropic	SA: Pinetown, 1989
Amazona amazonica Psittacidae	Orange-winged Amazon	Neotropic	SA, 2011-2023
Amazona oratrix Psittacidae	Yellow-headed Amazon	Neotropic	SA, 2011-2023
Anas rubripes Anatidae	American Black Duck	Nearctic	SA: Durban, 1975
Anser anser Anatidae	Feral Graylag Goose	Palearctic	SA, 18th cen.
Ara ararauna Psittacidae	Blue-and-yellow Macaw	Neotropic	SA, 2011-2023
Aratinga jandaya Psittacidae	Jandaya Conure	Neotropic	SA: KZN, c.2005
Aratinga pertinax Psittacidae	Brown-throated Conure	Neotropic	SA: E. Cape, before 1983
Aratinga solstitialis Psittacidae	Sun Conure	Neotropic	SA, 2011-2023
Aratinga weddellii Psittacidae	Dusky-headed Conure	Neotropic	SA: KZN, c. 2005
Aythya ferrina Anatidae	Common Pochard	Pelearctic	SA: Cape Peninsula
Aythya fuilgua Anatidae	Tufted Duck	Pelearctic	SA: Pietermaritzburg
Aythya nyroca Anatidae	Ferrugineus Duck	Palearctic	SA: Gauteng, 1994
Cacatua sulphurea Cacatuidae	Yellow-crested Cockatoo	Oriental	SA: Pretoria, 1976-1983
Callipepla californica Odontophoridae	California Quail	Nearctic	SA +
Callonecta leucophrys Anatidae	Ringed Teal	Neotropic	SA: Vaalkop Dam, 1985
Ciarina moschata Anatidae	Muscovy Duck	Oriental	SA, Mayotte,
Colinus virginianus Phasianidae	Northern Bobwhite	Nearctic	Harare, Drakensberg
Columbina inca Columbidae	Inca Dove	Neotropic	SA: E Cape, 1992
Coracias cyanogaster Corvidae	Blue-bellied Roller	Afr., Sahel	SA: NW Province, 2003
Coracopsis vasa Psittrichasidae	Greater Vasa Parrot	Madag.	Unsuc. Reunion +
Corvus albus Corvidae	Pied Crow	Afrotropic	Mauritius; Mayotte

 doi:10.20944/preprints202501.1827.v1

Corvus frugilegus Corvidae	Rook	Pelearctic	SA, late 1890's +
Cyanoliseus patagonus Psittacidae	Burrowing Parrot	Neotropic	SA: Midrand, 1999
Cyanoramphus novaezelandiae Psittacidae	Red-crowned Parakeet	New Zealand	SA, 2011-2023
Cygnus atratus Anatidae	Black Swan	Australian	SA: Humansdorp, 1926
Cygnus olor Anatidae	Mute Swan	Palearctic	SA: E. Cape, 1918; W Cape, Nyanga (Zim.)
Dendrocitta vagabunda Psittacidae	Rufous Treepie	Orient	Cape Town, 1997
Dendrocygna autumnalis Anatidae	Black-bellied W. Duck	Neotropic	SA: Vaalkop Dam, 1997
Eclectus roratus Psittaculidae	Moluccan Eclectus	Moluccas	SA, 2011-2023
Eolophus roseicapilla Cacatuidae	Galah Cockatoo	Australian	SA, 2011-2023
Eudocimus ruber Threkiornithidae	Scarlet Ibis	Neotropic	SA: KZN, 2000-2001
Falco columbarius Falconidae	Merlin	Palearctic	SA: KZN, 1991
Forpus passerinus Psittacidae	Green-rumped Parrotlet	Neotropic	SA: Durban, 1870's +
Foudia sechellarum Ploceidae	Seychelles Fody	Seychelles	Sech.: Amirante Islands +
Fulica americana Rallidae	American Coot	Nearctic	SA: Durban, 1891 +
Gallinula commeri Rallidae	Gough Moorhen	Gough Is.	SA: Cape Town, 1893 +
Gallinula nesiotis Rallidae	Tristan Moorhen	TdC, G.Is.	SA: Cape Town 1893
Gallus sonneratii Phasianidae	Grey Junglefowl	Oriental	SA
Geopelia cuneata Columbidae	Diamond Dove	Australian	Mauritius (before 1768), Seychelles, Réunion, SA
Gracula religiosa Sturnidae	Common Hill Myna	Orient	Reunion
Lamprotornis iris Sturnidae	Emerald Starling	W Africa	SA: Midrand, 1993
Lamprotornis superbus Sturnidae	Superb Starling	E Africa	SA: Durban, 1993, 1998
Leiothrix argentauris Leiotrichidae	Silver-eared Mesia	Orient	SA: Gauteng, 2002
Leiothrix lutea Leiotrichidae	Red-billed Mesia	Orient	Reunion
Lonchura striata Estrildidae	White-rumped Munia	Orient	Reunion +
Lophura nycthemera Phasianidae	Silver Pheasant	Oriental	SA: Ceres (W Cape)
Luscinia megarhynchos Turdidae	Nightingale	Pelearctic	SA, late 1890's +
Margaroperdix magagascarensis Phasianidae	Madagascar Partridge	Madagasc.	Mauritius, Reunion +
Melanocorypha bimaculate Alaudidae	Bimaculated Lark	NE Africa	Nam.: Swakompund, 1930
Meleagris gallopavo Phasianidae	Wild Turkey	Nearctic	Unsuc. Mauritius +
Musophaga violacea Musophagidae	Violet Turaco	Afr., Sahel	Johannesburg, 1994-1995 +
Myiopsitta monachus Psittacidae	Monk Parakeet	Neotropic	SA?
Aratinga nenday Psittacidae	Black-hooded Conure	Neotropic	SA: E. Cape, before 1983; Johannesburg, 2001

 doi:10.20944/preprints202501.1827.v1

Neophema pulchella Psittaculidae	Turquoise Parrot	Australian	SA, 2011-2023
Neopsephotus bourkii Psittaculidae	Bourke's Parrot	Australian	SA, 2011-2023
Netta rufina Anatidae	Red-crested Pochard	Palearctic	Zim., 1986; SA: 1996, 2003
Nymphicus hollandicus Cacatuidae	Cockatiel	Australian	SA: Cape Town; Pretoria 1987
Ortygornis pondicerianus Phasianidae	Gray Francolin	Orient	Reunion
Oxyura jamaicensis Anatidae	Ruddy Duck	Nearctic	SA
Paroaria coronata Thraupidae	Red-crested Cardinal	Neotropic	SA: W. Cape, 1958
Paroaria dominicana Thraupidae	Red-cowled Cardinal	Neotropic	SA: Durban, 1960's
Passer montanus Passeridae	Eurasian Tree Sparrow	Palearctic	Reunion
Pastor roseus Sturnidae	Rosy Starling	Palearctic	Mauritius
Perdicula asiatica Phasianidae	Jungle bush-quail	Orient	Reunion
Phasianus colchicus Phasianidae	Common Pheasant	Palearctic	SA: W Cape (4 sites), Kimberley; 1900-1950 +
Platycercus elegans Psittaculidae	Crimson Rosella	Australian	SA, 2011-2023
Platycercus eximius Psittaculidae	Eastern Rosella	Australian	SA, 2011-2023
Ploceus capensis Ploceidae	Cape Weaver	Afrotropic	Mauritius
Ploceus intermedius Ploceidae	Lesser Masked Weaver	Afrotropic	Socotra
Ploceus nigerrimus Ploceidae	Vieillot's Black Weaver	W, E Afr.	SA: Durban, 2001-2002 +
Poicephalus cryptoxanthus Psittacidae	Brown-headed Parrot	Afrotropic	SA: Johannesburg, 1977
Poicephalus gulielmi Psittacidae	Red-fronted Parrot	Afrotropic	SA, 2011-2023
Poicephalus meyeri Psittacidae	Meyer's Parrot	Afrotropic	SA, Johannesburg, 1981
Poicephalus rueppellii Psittacidae	Ruppell's Parrot	Afrotropic	SA: Pretoria, 2007, 2013
Poicephalus rufiventris Psittacidae	Red-bellied Parrot	Afrotropic	SA, 2011-2023
Poicephalus senegalus Psittacidae	Senegal Parrot	Afrotropic	SA, 2011-2023, Liberia
Poicephalus suahelicus Psittacidae	Grey-headed Parrot	Afrotropic	SA: Johannesburg, 2009
Psittacula cyanocephala Psittaculidae	Plum-headed Parakeet	Oriental	SA: Pretoria, c.1979 +; Pietermaritzburg, 1899 +
Psittacula eupatria Psittaculidae	Alexandrine Parakeet	Orient	Socotra
Pyrrhura molinae Psittacidae	Green-cheeked Conure	Neotropic	SA, 2011-2023
Spermestes cucullata Estrildidae	Bronze Mannikin	Afrotropic	Mayotte
Streptopelia capicola Columbidae	Ring-necked dove	Afrotropic	Mayotte

 doi:10.20944/preprints202501.1827.v1

Streptopelia picturata Columbidae	Malagasy Turtle-dove	Madagasc.	Mayotte
Synoicus sinensis Phasianidae	Asian Blue Quail	Australian	Mauritius, Réunion +
Tadorna tadorna Anatidae	Common Shelduck	Pelearctic	SA: 5 records: 1974, 1985, 1989, 1990, 1995
Taenipygia guttata Estrildidae	Zebra Finch	Australian	SA: Gauteng,1984; E Cape
Turdus merula Turdidae	Blackbird	Pelearctic	SA, late 1890's, 1923 +
Turdus philomelos Turdidae	Song Thrush	Pelearctic	SA, late 1890's, 1947 +
Turtur tympanistra Columbidae	Tambourine Dove	Afrotropic	Mayotte
Uraeginthus bengalus Estrildidae	Red-cheeked Cordon-blue	Sahel zone	Unsuc. Cape Verde +
Vidua macoura Viduidae	Pin-tailed Whydah	Afrotropic	Unsuc. Mayotte +
Vidua paradisea Viduidae	Eastern Paradise Whydah	Afrotropic	São Tome e Principe

3.1.1. House Sparrow

Original range include the Middle East. In Africa, *Passer domesticus indicus* were introduced intentionally from India to Durban in the 1890's, and *Passer domesticus domesticus* from Great Britain to East London, at the beginning of 20th century (Summers-Smith, 1963; Lever, 1987). It established stable population in Gauteng only by the year 1950 (Dean, 2005c). By the 1980s it invaded most of southern Africa, to southern DRC in the west and to southern Tanzania in the east (Vierke, 1970; Summers-Smith, 1988; Dean, 2005). It is, however, still absent in the southern interior, for example in 2013-2016, it was still absent in E Namibia and N Botswana (Table 3).

It has also invaded northern and eastern Madagascar and the surrounding islands. In Madagascar, it was first recorded in mid-1980s in Toamasina (Langrand & Sinclair, 1994; Goodman et al., 2017).

Table 3. Population densities (pairs / 10 ha) and dominance of the House Sparrow and Rock Pigeon in selected southern African towns.Explanations: D – density (pairs per 10 ha), %D – dominance. In sample size 'p.' donets number of breeding pairs of all species.

Town	Sample size	Year	H. Sparrow		Rock Pigeon		Source
			D	%D	D	%D	
Bloemfontein, whole, SA	5100ha	1997	2.3	4.4	0.8	1.5	Kopij 2015
Bloemfontein, city centre, SA	123 ha	1994	25.0	13.7	15.0	8.2	Kopij 1996
Bloemfontein, resid. area, SA	55 ha	1993	3.4	3.2	2.1	1.9	Kopij 1994
Bethlehem, city centre, SA	55 ha	1996	10.9	16.9	7.3	11.3	Kopij 1997
Bethlehem, residen. area, SA	326 p.	1996	-	0.9	-	0.6	Kopij 1997
Bethlehem, industr. area, SA	89 p.	1996	-	41.6	-	0.0	Kopij 1997
Maseru, Lesotho	1631 p.	1996-99	-	3.3	-	1.3	Kopij 2000a
Roma, Lesotho	82 ha	1998-01	0.4	0.7	0.0	0.0	Kopij 2019
Semonkong, Lesotho	460 p.	1996-02	-	8.5	-	0.0	Kopij 2011
Thaba Tseka, Lesotho	657 p.	1996-02	-	5.5	-	0.0	Kopij 2011
Mokhotlong, Lesotho	339 p.	1996-02	-	13.6	-	0.0	Kopij 2011
Morija, Lesotho	295 p.	1996-02	-	0.0	-	0.0	Kopij 2011
Lesotho, 14 large villages	533 p.	1996-02	-	5.2	-	0.0	Kopij 2011
Windhoek, C Namibia	5139 p.	2011-14	-	5.3	-	4.1	Kopij 2023a

 doi:10.20944/preprints202501.1827.v1

Hentjes Bay, W Namibia	345 ha	2016/17	4.1	16.6	0.0	0.0	Kopij 2022a
Swakopmund, W Namibia	415 ha	2016/17	1.7	7.1	3.2	13.8	Kopij 2018
Walvis Bay, W Namibia	260 ha	2016/17	4.4	9.4	8.6	18.7	Kopij 2023b
Opuwo, NW Namibia	85 p.	2020	-	57.6	-	9.0	Kopij 2022b
Namibia, 3 towns, semidesert	59 p.	2018-20	-	13.6	-	13.6	Kopij 2022b
Outapi, N Namibia	130 ha	2017	19.2	48.4	1.5	3.9	Kopij 2019
Ongwediva, N Namibia	100 ha	2018	36.4	48.8	0.0	0.0	Kopij 2021b
Tsumeb, NE Namibia	190 p.	2017	-	4.7	-	0.0	Kopij 2021c
Grootfontein, NE Namibia	276 p.	2014	-	1.8	-	2.5	Kopij 2021a
Rundu, NE Namibia	90 p.	2015	-	0.0	-	8.9	Kopij 2021a
Katima Mulilo, NE Namibia	214 ha	2014/15	0.0	0.0	3.6	10.1	Kopij 2019
Katima Mulilo, NE Namibia	177 ha	2013	0.0	0.0	2.3	0.4	Kopij 2020
Katima Mulilo, NE Namibia	85 ha	2015	0.0	0.0	7.4	15.8	Kopij 2020
Kasane, NE Botswana	160 ha	2014/16	0.0	0.0	0.0	0.0	Kopij 2018b

In the 1890's, the House sparrow was introduced in Zanzibar, from where it spread to central Tanzania (Dean, 2005c). In the 1950s, it was introduced from South Africa (probably by ship) to Mombasa (Anderson, 2006), from where it spread (facilitated by trucks or trains) across Kenya along the Mombasa highway to Uganda (Schrey et al., 2014). In the 1970s, it was introduced from South Africa to Senegal, probably incidentally (Lever, 1987; Summers-Smith, 1988; 1992; Anderson, 2006) and spread in Senegal and coastal Mauretania (Dean 2005c).

There is a widespread and sharp decline of the House Sparrow in most European countries (Summers-Smith 2003), but in Africa the situation is revered. In most towns and cities in southern Africa, it belongs to the most common bird species today, even in those colonized quite recently in northern Namibia, i.e., in Opowo, Outapi, and Onguadiva, where it breeds in a density of 19-36 pairs per 10 ha (Table 3). It has been found especially abundant (comprising approximately a half of all breeding bird community) in impoverished rural parts (so called townships, locations) of towns and cities, e.g., Bloemfontein (Kopij, 1994, 2001a, 2015), Maseru (2000), coastal towns in Namibia (Kopij, 2018, 2022a, 2023b) and towns in most northern parts of the country (Kopij, 2018, 2019, 2021). While the House Sparrow is most abundant in the city centres (e.g., in Bloemfontein 25 pairs per 10 ha; Kopij, 1994), it tends to be much less common in residential areas (e.g., in Bloemfontein 2-3 pairs/10 ha; Kopij 2015), especially well-timbered ones, where the indigenous sparrow species (i.e., Cape Sparrow *Passer melanurus*) are often more common predominates (Table 3).

Today, the House Sparrow occurs in all other continents, except for Antarctica. Also introduced to islands, e.g., to Lesser and Greater Antilles, Macaronesia, Madagascar, New Guinea and New Zealand.

3.1.2. Common Starling

Native to the Palearctic Region. In the late 1890's, Cecil Rhodes introduced 18 Common Starlings in Cape Town (Dean 2000). Soon they colonizing the Cape Peninsula, and spread northwards, crossing the Berg River in the year 1928, from where they expanding eastwards, reaching East London by the year 1966, Kei river by the year 1971 and Umtata in 1981 (Gebhardt, 1954, 1959; Winterbottom & Liversidge, 1954; Liversidge, 1962; Skead, 1995; Quickelberge, 1989). Today they are widestread and common all over Western Cape and East Cape provinces (Hockey et al., 1989).

The Common Starling was recorded for the first time in Durban 1973 (Cyrus & Robson, 1980). By 1993, it was established along southern coast of the KwaZulu-Natal province (Harrison et al., 1997). At the beginning of the 21st century it was estabished in Gauteng province. Occupation of the dry interior was limited, but by the year 1970 it has reached the Orange River (Brown, 1985). In the Free State Province, recorded for the first time on the southern border in 1986 (Earlé & Grobler, 1987). The first breeding was recorded in 1997/98 (Kopij, 2001b).

 doi:10.20944/preprints202501.1827.v1

In Lesotho, the Common Starling was recorded for the first time in Maseru in 1988. In 1996-1998, 1-2 probably breeding pairs were recorded there (Kopij 2000). In Roma, first breeding was recorded in 1991; ten years later there were at least 15-20 breeding pairs in this area, including 10 pairs per 82 ha on the NUL campus (Kopij, 2001a). While in 1987-1997 only 1-2 pairs in two sites (Maseru, Roma) were known in Lesotho, 21-27 pairs in 4 sites (Maseru, Roma, St. Joseph and Masite) were recorded in 1998-2002 (Kopij 2014).

In Namibia, the common Starling was first recorded in Oranjemund in 1970 (Brown, 1985). At the beginning of 21st century, the Common Staring was recorded in southern Namibia (70 km south of Grünau, in Hohenfels, and in Lüderitz on the coast), indicating furhter northward expansion (Cunningham, 2016).

As the result of introduction, the Common Starling occurs today in all continents of the world, except Antarctica. It is today especially common in USA, although in 1966-2004, slight declined in numbers was recorded there (Avery & Tillman, 2005). Common and widespread also in SE Australia (Phair, 2015).

3.1.3. Indian Myna

The Common Myna original range includes SE Asia.

In sub-Saharan Africa, Common Myna *Acridotheres tristis tristoides* from Myanmar and Nepal has been introduced to Durban in c. 1900. From there it spread all over KwaZul-Natal and NE Free State, where for example, 3.5 pairs per 10 ha (with a dominance: 16.9%) were recorded in 1996 in Bethlehem town centre (55 ha) in this province, being also a dominant species in the residential and industry areas in the town (Kopij, 1997). Spreading northwards along the coast, it reached Ponta Malongane in Mozambique in 1997 (Craig, 2005). Whereas spreading southwards along the coast it has reached Porth Elizabeth and Cape Town at the beginning of the 21st century (Craig, 2005; Peacock, 2007).

The Common Myna *Acridotheres tristis tristis* from India and Sri Lanka has been introduced to Johannesburg in c. 1938, and Pretoria in 1955. It the later city it has developed viable population only in the 1980's. Although it was recorded as breeding in Kimberley, North-West Province in the 1960's, it failed to develop viable population in the town (Craig, 2005).

In Lesotho, the Common Myna was first recorded in the mid-1990's in Maseru; in 1996-1998, 2-5 breeding pairs were recorded in the city (Kopij, 2000a), and 5-10 pairs in 1998-2002 (Kopij, 2014). The first record at Roma was made in 1999 (Kopij, 2001b). In 1998-2002, it was also recorded in Morija and Leribe (2 pairs in each town) (Kopij, 2014).

In Botswana, the Common Myna was recorded for the first time in Nata near Jwaneng in 2012 (Engell & Willard, 2017), and in Kasane on the Chobe River in 2014 (Tyler, 2015). In 2014, it was recorded also for the first time in Victoria Falls on Zimbabwe/Zambian border (Douthwaite, 2015), about 100 km E of Kasane.

It invades Namibia from the south and from the extreme north-east. In the south, it was recorded for the first time in Oranjamund in 2014 and in Rosh Pinah in 2017 (Thompson, 2017). In the north-east, it was first recorded in Katima Mulilo in 2016 (with first breeding in the town in 2017) and in Ngoma in 2016 (Engel & Willard, 2017), about 60 km W of Kasane. Therefore, the Common Myna has already crossed the Zambezi River and most probably now it spreads further north.

The Common Myna has been also introduced to Madagascar, Comoros, Mauritius, Mayotte, Seychelles, Reunion, Zambia and Zimbabwe. Beyond Africa, the Common Mynas has been introduced in North America, Middle East, Australia and New Zealand and numerous islands around the world.

3.1.4. House Crow

Naturally, the House Crow's occurs in Iran, Afghanistan, Pakistan, India, Bangladesh, Burma, Nepal, Sri Lanka, Thailand and extreme south-western China (Meininger et al., 1980; Ali, 2002; Nyári et al., 2006; Ryall, 2010).

 doi:10.20944/preprints202501.1827.v1

For the first time, it was introduced in sub-Saharan Africa, in Zanzibar in the 1890s. From there it spread along the coast (by ship) to Mombasa (1947), and from there along the railway to Kenyan interior (Ryall and Reid, 1987; Ryall, 1992). House Crows have become well-established in Mauritius.

In South Africa, the House Crow appeared on the Indian Ocean coast in the early 1970's. It was first recorded in Durban, where it has developed a sizable population. In the early 1990's it has also established a small population (several hundred individuals in the early 2000's) in Cape Town (Dean, 2000, 2005b).

A control programme in Durban has significantly reduced numbers and range of the species. In 2019-2023 it occurred mainly in Durban coastal area from the Blue Lagoon in Durban North to Isipingo to the south (Mashao et al., 2023). Subsequently, the main centre of population became Richard's Bay, 200 km north of Durban. In Cape Town, where population were markedly reduced, it now occurs mainly in Khayelitsha area (sabap2.adu.org.za). Isolated individuals was recorded in East London on 15 June 2010 (Demey, 2010; Ryall, 2016).

The House Crowvwas introduced unintentionally to various countries, often on ships as a 'hitchhiker' to Tanzania (Shimba and Jonah, 2016), and Socotra Island (Yemen). It was intentionally introduced to some countries to clean garbage, and to control caterpillars, and ticks on livestock (Brook et al., 2003; Fraser et al., 2015). In Zanzibar, they were reported to be introduced in the 1890s from where they spread to Kenya in 1947, especially along the coastal areas between Mombasa and Malindi, as well as hitchhiking on ships travelling from Asia to East Africa (Ryall & Reid, 1987; Ryall, 1992).

The House Sparrow is introduced also to the following countries: Benin (Cotonou, 2010), Djibouti, Egypt, Eritrea, Madagascar (Toamasina, 2014), Mauritius, Morocco, Mozambique (Maputo 1976, Pemba, Nacala, Quelimane, Beira, and Matola), Namibia (Walvis Bay, 2011), Seychelles, Socotra Isl. (Hadibu, 1994: 1 ind., 1996: 3 ind., 2003: 26 ind.), Somalia, South Africa, Sudan and Tanzania. A survey by Shimba (2011) in Dar es Salaam city, Tanzania, estimated that there were 800,000 House Crows in empoverished parts of the city.

As a result of introduction, the House Crow occurs today: southern Asia from Turkey to Vietnam, Japan and Australia; southern parts of U.S.A.; in Central America; South America (Chile); in many countries in Europe (Ryall, 2002; Brook et al., 2003; Ottens & Ryall, 2003; Ottens, 2003; Suliman et al., 2011; Kamel, 2014; Shimba & Jonah, 2016; Nxele & Shivambu, 2018)

3.1.5. Rock Pigeon

The Rock Pigeon occurs natually in the Mediterranean Europe, northern Africa, Middle East, and it extends to south-east Asia (Johnston, 1992; Stern and Dickinson, 2010). As a result of introduction, it occurs today in all continents, except for Antarcica (Stern and Dickinson, 2010). Outside its native range, it occurs in at least in 64 countries (Johnston 1992, Sacchi et al., 2002; Rose et al., 2006; Przybylska et al., 2012; BirdLife International, 2016) and it is still expanding.

It was introduced to South Africa during the Angolo-Boer War (1899-1902), to enable effcient communication (Lincoln, 1927), and then became invasive. At present, it occurs all over southern Africa, reaching northern Angola in the west and northern Kenya in the east. It is, however, still absent in DRC and in the East African Rift Valley (Dean 2005a, Johnston 1992). In Namibia, it reached high densities in towns such as Walvis Bay, Swakopmund or Katima Mulilo, but is virtually absent in Hentjs Bay, Ondguadiva or Tsumeb (Table 3). No geographical of ecological trend is apparent in this country.

In southern African cities/towns, population densities of the Rock Pigeon varied from 0 to 15 pairs/10 ha (Table 3). It may greatly vary even within the same city. For instance in the city centre of Bloemfontein, the population density was 15.0 pars/10 ha, but in the neighbouring residential suburbs, it was only 2.1 pairs per 10 ha. Similarly in Bethlehem town centre it was 7.3 pairs/10 ha but none was recorded in industry area (Table 3). In Lesotho, the Rock Pigeon was virtually absent in rural and urban areas, except for the capital Maseru, where it is common in the city centre (Kopij 2000).

 doi:10.20944/preprints202501.1827.v1

3.1.6. Rose-ringed Parakeet

The Ring-ringed Parakeet occurs naturally in the Sahel zone of Africa and SE Asia (Pakistan, India, Bangladesh Sri Lanka, Nepal and Myanmar). In Soth Africa, itt has a recorded expansion/ invasion into five regions, i.e., Cape Town, Steytlerville (NW of Porth Elizabeth), Shelley Beach (S of Port Shepstone), Bethal and Hazyview. It occurs no longer in five regions, where it was recorded in 1987-1991, viz. East London, Ladysmith (KwaZulu-Natal), St Lucia (KZN), Mkuze (KZN) and Leeudoringstad (North West province) (Symes, 2014). The species develop viable population only in Gauteng (mainly Johannesburg and Pretoria areas), Durban and Pietermaritzburg area.

First recorded as breeding in South Africa in the 1850's in Cape Town, but failed to develop viable population (Symes, 2014). Again seen there in the 1980's, the 1990's and in 2010, but still has not develop a viable population there.

The Rosy-ringed Parakeet was found to breed at Sodwana Bay in the late 1960s (Vincent, 1972), Mkuze Game Reserve in the early 1970s, in Mandini, Zululand, in July 1979, and St Lucia in July 1982, but everywhere it failed to establish a viable population. In Durban, it was introduced in the 1970's and soon began to expand (Pereen & Cowgill 2005; Shivambu et al. 2021). In 2000, 700-1000 individuals were counted, in 2018-2019: 1783 +_505 ind./750 km^2 (Shivambu et al., 2021) and it is still expanding.

In Gauteng, the first record of 5-8 ind. was made in 1985 in central Johannesburg. By mid-1990 the population increased to c. 200 ind. (Perrin & Cowgill, 2005; Simes, 2014); in 2013: at least 300-500 ind. in Johannesburg and at least 400 ind. in Pretoria were counted.

In recent years, it is expanding in South Africa and Mauritius (Jones, 1980; Hart & Downs, 2014; Symes, 2014). In November 2018, the Rosy-ringed Parakeet was recorded in the Nhangaan Forest near Nhangau, Sofala Province, and in Maputo City in July 2021 and October 2021 (Trezza et al., 2023).

It has established viable breeding populations in many part of the world. In Europe, it developed viable populations in the UK, France, Germany Belgium, the Netherlands, Spain, Portugal, Italy, Greece, Turkey and. All European populations numbered more than 85 000 individuals in 2016 (Pârâu et al., 2016). It has invaded also the northern Africa, Middle East, Thailand, Indonesia and Japan. Recently introduced to the New World, i.e., Florida, California, Venezuela and Hawaii (Iqbal, 2017; Nebot, 1999).

3.1.7. Red-whiskered Bulbul

Its original range extends from Pakistan throughout SW China and India to Indochina. In Africa, itt is well-established in Mauritius, where it was introduced intentionally in 1892. From there, it was introduced unintentionally to Reunion (1978) and Assumption Island in Seychelles (1977) (Carié, 1910). In 1987, there were c. 200 breeding pairs in the Assumption Island (Roberts, 1988); and several thousand individuals in 2014. (Uranie, 2015). In Mayotte, it was introduced in 1985, but unsuccessfully (Cheke, 2010). Recorded also in Madagascar, South Africa and Zimbabwe, although it has not develop viable populations in these countries.

As a result of introduction, the Red-whiskered Bulbul occurs in Japan, Indonesia, southern Malaysia, Singapore, Taiwan, Australia, Borneo, Hong Kong (China), the United Arab Emirates, Oman, Saudi Arabia, USA, Hawaii, Juan de Nova Island, Spain, Canary Islands, Nicobar Islands (Leven & Corlett, 2004; Walther, 2011; Clements et al., 2018).

 doi:10.20944/preprints202501.1827.v1

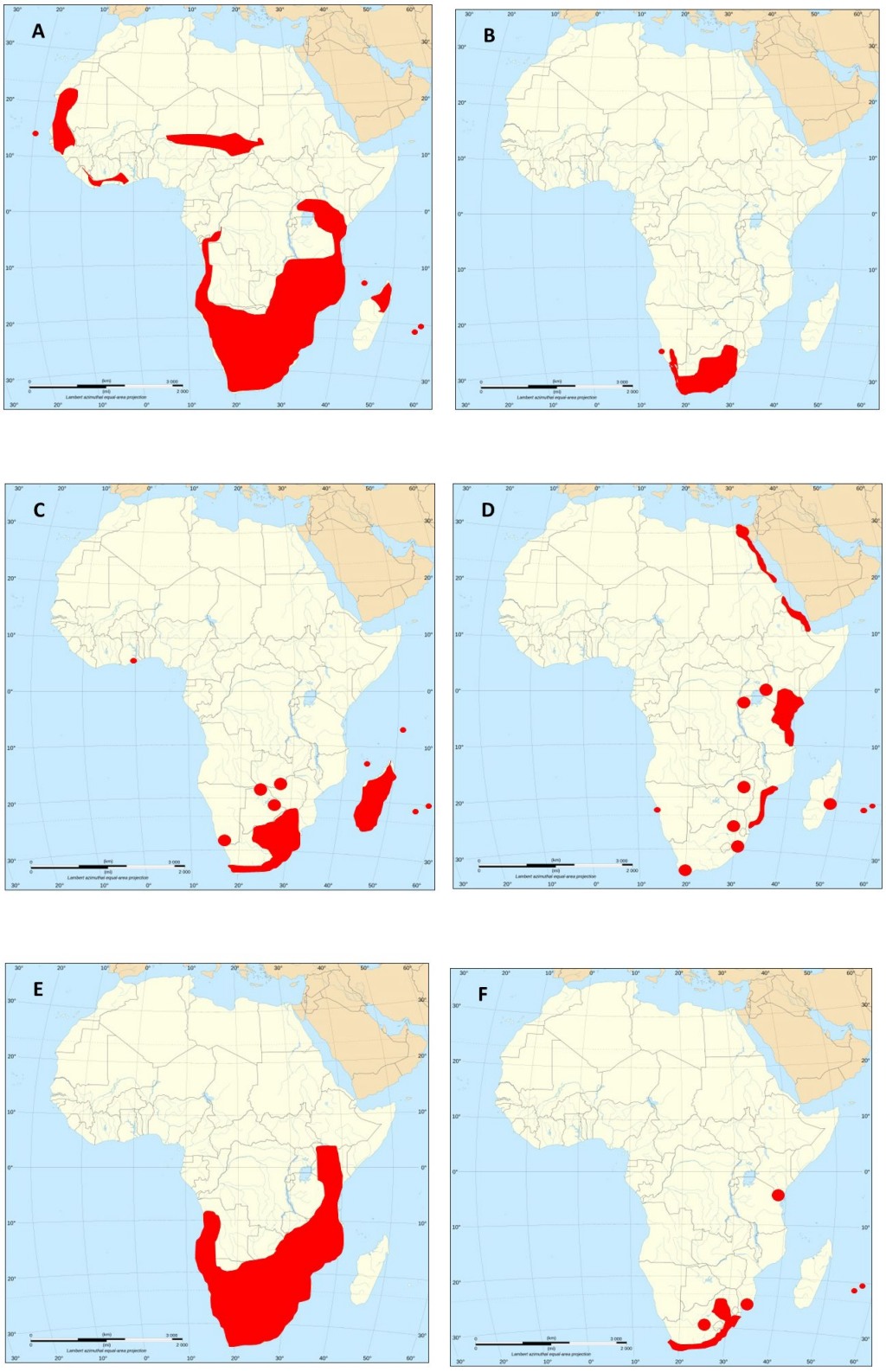

Figure 1. Distribution of the invasive bird species in sub-Saharan Africa: A – House Sparrow, B – Common Starling, C – Common Myna, D – House Crow, E – Rock Pigeon, F – Rose-ringed Parakeet.

3.2. Non-Invasive But Established Alien Bird Species

Most bird species which were introduced to sub-Saharan Africa and developed viable populations (n = 49 species) did not became invasive (Liversidge, 1985; Brooke et al., 1986; Dean, 2000; Faulkner et al., 2007; Dyer et al., 2017; Downs & Hart, 2020; Shivambu et al., 2020). In most cases the

 doi:10.20944/preprints202501.1827.v1

established populations are small with very restricted ranges. Most species have developed viable populations in small islands, mainly around Madagascar on the Indian Ocean (Table 1). On these small oceanic islands, some of them may even pose a threat to the indigenous fauna, becoming locally harmful, therefore invasive.

The Chaffinch is an exception in this regard. At the end of 19th century, a flock was released in Cape Town, which developed a small population of 1500-2000 individuals at the beginning of 21st century in and around this city in pine plantations between Tokai and Rondebosch, and around Fish Hoek and Noordhoek (Dean, 2005c). A similar situation may persist in the Masked Lovebird introduced in Dar es Salaam and Nairobi, and in the Nyasa Lovebird introduced in Lundazi, Zambia.

The Budgerigar is a species also of special interest in this group. From 1947, c. 50 individuals were recorded throughout the years in Umbogintwini, KwaZulu-Natal, but today its status is unknown there. Apparently, it was established in the city of Swakopmund, on Atlantic Ocean in Namibia in 2001 (Hockey et al., 2005), but not recorded there in 2017-2020 (Kopij, 2018a), neither in the neighbouring towns, Walvis Bay (Kopij, 2023b) and Hentje's Bay (Kopij, 2022a).

The Mallard is regarded as invasive species in most areas, where it was introduced. In Africa, although introduced long time ago, it has not established viable populations to date. It exists in urban parks and gardens, as a semi-domestic/feral poultry and does not affect adversely the biodiversity nor the human economy (Stephens, 2019). The Graylag Goose, Muscovy Duck, and American Black Duck are in a similar situation.

3.3. Not Established Alien Bird Species

Most species introduced to sub-Saharan Africa has failed to develop viable populations. The group includes 101 species. It is, however, important to point out that the real number might be much higher, as some introductions could passed unrecorded, especially in countries beyond southern Africa. Excluded are here all species which could have been vagrants from its main range in other parts of Africa or short-lived aviary escapee, evidently not established even for one breeding season. For example, more than 30 parrot species have been observed in South Africa alone, most of them as escappe from cages (Symes, 2014).

Most of the introduced species were present for some time in the wild, but were probably not breeding there and subsequently disappeared altogether. Some others did develop a viable population, but subsequently the population declined and become extinct in the introduced areas (e.g., Mute Swan). Some individuals may persist as feral individuals on farmyards.

Among interesting introduction is that of the Rook. In the late 1890's, as many as 200 ind. were released near Cape Town, but they failed to establish breeding population (Hockey et al., 2005). The Blackbird was also released in Cape Twon in the same time, it even bred there for several years, but finally became extinct by the year 1923 (Hockey et al., 2005). Similarly, the Song Thrush, released in the same place and time, developed a viable breeding population, but subsequently declined and became extinct by the year 1947 (Hockey et al., 2005).

4. General Characteristics of the Avian Introductions in Sub-Saharan Africa

4.1. Species Representativness

At present, 212 species are successfully introduced in the world. Out of this total, only c.10% affect biodiversity adversely through predation (1%), competition with native species (3%), and other effects (5%) (Martin-Albarracin et al., 2015). Worldwide 64% of established introduced mammal species become invasive, while this proportion was only 34% for birds (Jeschke, 2008). In USA, 97 alien species developed 'self-sustaining populations' (Avery & Tillman, 2005), in Australia, out of 242 avian species introduced, 77 (32%) developed viable populations (Vall-Ilosera & Cassey, 2017).

In sub-Saharan Africa, at least 150 bird species were introduced, but only 49 of them (32.7%) have developed viable populations, and only 7 (4.6%) became invasive (Table 1 and 3). Accoriding to Faulkner et al. (2017), 87 bird species were introduced to Africa, (including 67 species from

 doi:10.20944/preprints202501.1827.v1

Mauritius); the number is certainly underestimated. Dyer et al. (2017), on the other hand, listed 218 species. There is, however, a number of doubtful and inaccurate records in this list. For many species no information of the place and year of the introduction is given, some records include de facto introductions or reintroductions of indigenous species to their native ranges, some other may represent records of vagrant from other parts of Africa, or ephemeral escapee from aviaries. In a similar way overestimated seems to be the number of introduced species (n=192) compiled by Downs & Hart (2020).

Most avian introductions in sub-Saharan Africa took place in Southern Africa (mainly Cape Town, Durban and Johannesburg areas), in Madagascar and surrounding islands (mostly Mauritius, Reunion and Seychelles) and in the coast of Tanzanya and Kenya (icluding islands: Pemba, Zanzibar and Mafia).

Over the last 200 years, two introduction peaks took place in sub-Saharan Africa: the first one at the end of 19th century, and the second one at the end of 20th and at the beginning of 21st century (Figure 1). The former resulted from the activity of the former British Acclimatization Society, which promoted introductions of alien species in the end of 19th century in South Africa and other British colonies in Africa and beyond, for both utilitarian (hunting) and 'aesthetic' reasons ('enrichment' of local flora and fauna).

In the latter period, the peak is a result of increased commerce, inernational contacts and increased interest of bird-lovers in keeping ornamental birds in aviaries and cages.

Worldwide, Psittacidae (131 species) and Anatidae (92 species) are the most speciose groups of invasive bird species (Dyer et al., 2017). Other families with high number of invasive species include Phasianidae, Passeridae, Fringillidae, and Columbidae (Blackburn & Duncan 2001, Vall-Ilosera & Cassey, 2017). In sub-Saharan Africa, the most specious groups were parrots (Psittaciformes) comprising 33.1% (including Pisittacidae: 13.9%, and Psittaculidae: 15.9%), Anatidae: 11.3%, Phasianidae: 11.3%, and Passeriformes: 29.1% (including Estrildidae: 6.0% and Ploceidae: 5.3%, as the most speciose passerine families) (Table 4).

Most introduced species which have developed viable populations originate from Afrotropical, Oriental and Palearctic regions (altogether 78%), with only 2% from the New World. The proportion among introduced species which have note not developed viable populations are quite different: 30% are from the New World, and 56% from the Afrotropical, Oriental and Palearctic regions (Figure 3).

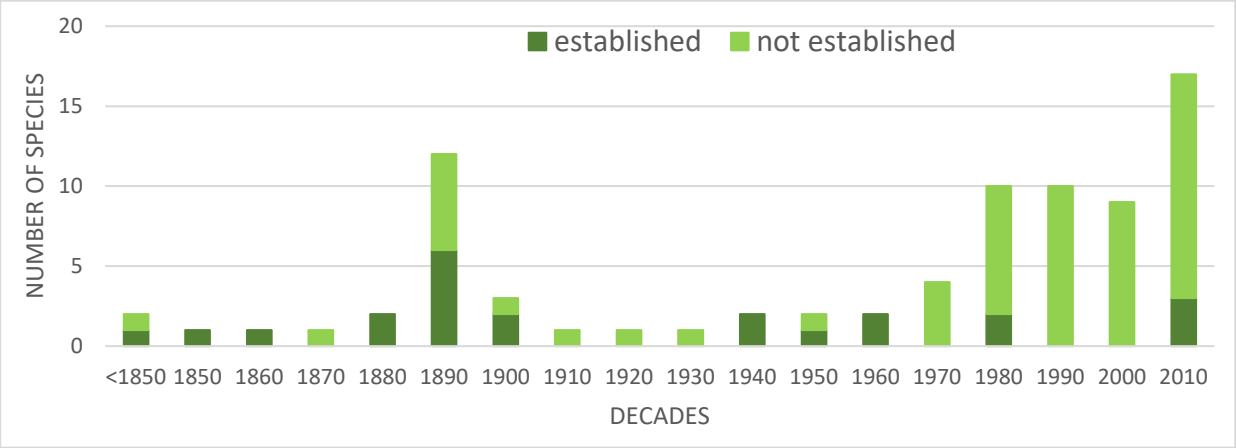

Figure 2. Known years of successful (n=25) and unsuccessful introduction (n=58) of birds in sub-Saharan Africa.

 doi:10.20944/preprints202501.1827.v1

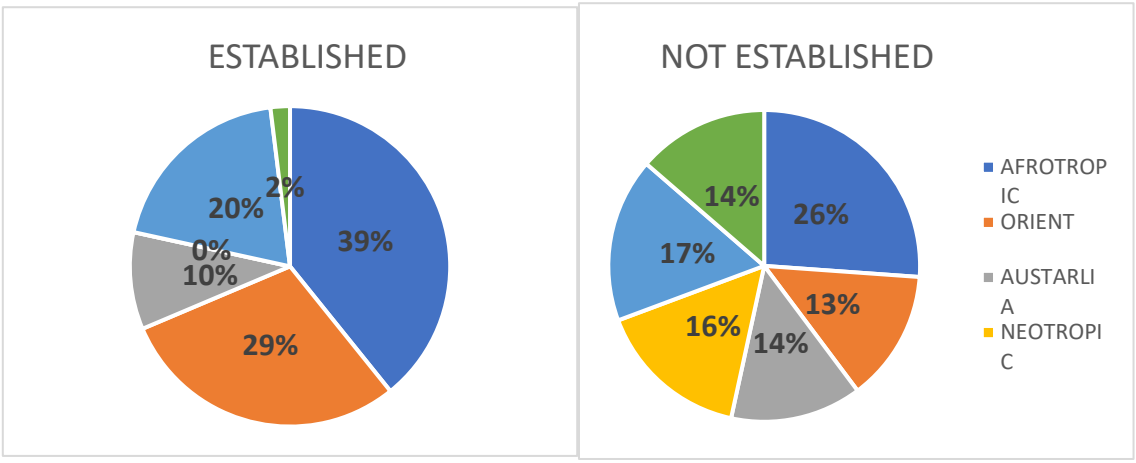

Figure 3. Original zoogeographical regions of bird species introduced in sub-Saharan Africa.

Table 4. Systematic positions of bird species introduced to sub-Saharan Africa.

	Established		Not stablished		Total	
Taxonomic rank	**N**	**%**	**N**	**%**	**N**	**%**
Galliformes	8	16.3	11	10.9	19	12.7
Phasianidae	7	14.3	10	9.9	17	11.3
Odontophoridae	0	0.0	1	1.0	1	0.7
Numidae	1	2.0	0	0.0	1	0.7
Anseriformes	4	8.2	13	12.9	17	11.3
Anatidae	4	8.2	13	12.9	17	11.3
Ciconiiformes	1	2.0	1	1.0	2	1.3
Threskiornitidae	0	0.0	1	1.0	1	0.7
Ardeidae	1	2.0	0	0.0	1	0.7
Falconiformes	0	0.0	1	1.0	1	0.7
Falconidae	0	0.0	1	1.0	1	0.7
Gruiformes	1	2.0	3	3.0	4	2.7
Rallidae	0	0.0	3	3.0	3	2.0
Turnicidae	1	2.0	0	0.0	1	0.7
Columbiformes	6	12.2	5	5.0	11	7.3
Columbidae	6	12.2	5	5.0	11	7.3
Musophagiformes	0	0.0	10	1.0	1	0.7
Musophagidae	0	0.0	1	1.0	1	0.7
Coraciformes	0	0.0	1	1.0	1	0.7
Coracidae	0	0.0	1	1.0	1	0.7
Psittaciformes	9	18.4	41	40.6	50	33.3
Psittacidae	1	2.0	20	19.8	21	14.0
Psittaculidae	7	14.3	17	16.8	24	16.0
Cacatuidae	1	2.0	3	3.0	4	2.7
Psittrichasidae	0	0.0	1	1.0	1	0.7
Strigiformes	1	2.0	0	0.0	1	0.7
Tytonidae	1	2.0	0	0.0	1	0.7
Passeriformes	20	40.8	24	23.8	44	29.3
Alaudidae	0	0.0	1	1.0	1	0.7
Corvidae	1	2.0	2	2.0	3	2.0
Pycnonotidae	1	2.0	0	0.0	1	0.7
Turdidae	0	0.0	3	3.0	3	2.0
Sturnidae	2	4.1	3	3.0	5	3.3
Passeridae	2	4.1	1	1.0	3	2.0

 doi:10.20944/preprints202501.1827.v1

Ploceidae	4	8.2	4	4.0	8	5.3
Viduidae	0	0.0	2	2.0	2	1.3
Estrildidae	5	10.2	4	4.0	9	6.0
Fringillidae	4	8.2	0	0.0	4	2.7
Leiothrichidae	0	0.0	2	2.0	2	1.3
Thraupidae	0	0.0	2	2.0	2	1.3
Total	49	100.0	101	100.0	150	100.0

4.2. Factors Affecting Successful Introduction

There are several factors that determine the effective establishment of introduced species, viz. environmental and landscape-level changes, food resources, climate (House Sparrow, Rock Pigeon; could be Common Starling and Common Myna), ecological and physiological characteristics (e.g., behaviour, breeding ecology, diet composition, juvenile development, migratory status, body size and genetic variability), and introduction circumstances (e.g., time of release, the number of individuals released and the number of release events) (Dean, 2000; Sol & Lefebvre, 2000; Kolar & Lodge, 2001; Butler, 2003; Hayes & Barry, 2008; Shwartz et al., 2009).

Urbanization results in homogenization, with most introduced species present in urban areas (van Rensburg et al., 2009). This is because in urban areas introduced species expoloit rosources (food and nesting sites) better than native species (Sol et al., 2012). In sub-Saharan Africa all invasive species are strictly associated with urban environment, with some affinities to rural habitats.

4.3. Ecological Characteristic of Successful Species

There are several factors which determine success of introduced species:

-the pioneer group is large enough to prevent stochastic extinction within the first few years;

- a commensal with man; strongly associated with man-made structures (including impoundments), cultivations, lawns and gardens (Rock Pigeon, House Crow, House Sparrow);

- eurobiont (wide range in habitat tolerance);

- an generalist feeder of invertebrates (e.g., pest species on monocultures), seeds and scraps of human-processed foods (Common Myna, House Sparrow, House Crow, Rock Pigeon);

- communal roosting although single breeder (House Sparrow, Common Starling, Common Myna, Rock Pigeon, Rosy-ringed Parrot);

- group foraging (same species as above);

- climate tolerance;

- 'r'-reproductive strategy (high clutch size and breeding success, few clutches per year) (Common Starling, House Sparrow);

-flexible in nest site selection, including man-made structures and alien trees and shrubs (Common Staling, Rock Pigeon);

-aggressive in the competition for food and nesting site (Common Starling, Common Myna).

4.4. Factors Affecting Unsuccessful Introductions

In comparison to other parts of the world, most avian introduction if Africa were unsuccessful. The following factors affect this:

- too low number of introduced individuals;

- species does not benefit from urbanization or agriculture, not strongly dependent on human activity;

- the diet is mainly seeds/grain or insects;

- competition from indigenous species;

- preference for disturbed mesic habitats, but avoidance of arid areas and natural vegetation, especially dense forests;

- low breeding success due to egg and chick predation;

- predation on adults by a wide array of vertebrate predators;

 doi:10.20944/preprints202501.1827.v1

4.5. Introduction Pathways

Globalization facilitates and accelerate the rate of species invasions (Meyerson & Mooney, 2007). In sub-Saharan Africa, birds have been intentionally introduced into new areas for the following reasons: 1) acclimatization (acclimatization societies, which were popular in the 19th century in European colonies; introduced plants and animals into regions in which the fauna was considered deficient, e.g., many bird species in and around Cape Town); 2) biological control (control of insect populations, rodents, carcasses etc.; e.g., Common Myna, House Crow, Red-whiskered Bulbul); 3) ornamental/aesthetic purposes (e.g., Chaffinch, Common Starling); 4) game birds, for hunting purposes (most waterfowl and gallinaceous birds); 5) intentional release of captive pet or ornamental birds (most parrots and finches). However, many bird species were introduced unintentionally, being often s escapee from aviary (most ornamental birds) (Brochier et al., 2017).

5. Management and Nature Conservation Implications

5.1. Impact Categories

Many introduced species cause apparently minimal or no damage, others assume status of persistent and destructive pests.

Introduction and naturalization of non-native species is one of the most important threats to global biodiversity. Seven types of impact on native ecosystems were evaluated: competition (Strubbe & Matthysen, 2009; Hernández-Brito et al., 2014; Grandi et al., 2018); predation (Mooney & Cleland, 2001); hybridization (Gaertner et al., 2016); spread of disease and parasites (Weber, 1979; Crowl et al., 2008); chemical, physical, and structural impact on ecosystem through grazing/ herbivory/ browsing. Most of these impacts are theoretical/potential/not evidenced (Craig & Edwards, 2024).

5.1.1. Hybridization

The Mallard may hybridize with other ducks. The following species in Africa may be affected: Yellow-billed Duck *Anas undulata* in South Africa, African Black Duck *Anas sparsa* in South Africa and Meller's Duck *Anas melleri* in Madagascar. Mallards may pose threat specially in small oceanic slands.

5.1.2. Competition

The Common Staling competes for holes with other hole-nesting birds (e.g., Red-winged Staring *Onychognathus morio*. Little Swift *Apus affinis*, Olive Woodpecker *Dendropicos griseocephalus*). Usurping nests by contamination (as well as physical competition) is also a problem (e.g., native parrots use little, if any, bedding, whereas starlings will rapidly fill and contaminate tree hollows) (Joubert, 1945; van der Merwe, 1984; Kopij, 2009). The Rose-ringed Parakeet and the Common Starling, which breed prior to most other secondary cavity-nester species, may reduce nesting sites availability for bats and parrots.

5.1.3. Predation

The Common Myna competes Seychelles Magpie Robin *Copsychus sechellarum* by occupying nest boxes, and destroying eggs and chicks (Komdeur, 1996; Canning, 2011). The Seychelles Magpie Robin is an endangered species. Similar situation was recorded in the critically endangered Seychelles Flycatcher *Terpsiphone corvina* (Feare, 2010), vulnerable Seychelles White-eye *Zosterops modestus* (Payet, 2007) and sea birds (Feare et al. 2015). The House Crow destroys clutches or broods of other bird species, e.g., African Sacred Ibises *Threskiornis aethiopicus,* African Spoonbills *Platalea alba* and Black-headed Herons *Ardea melanocephala* (Dean, 2005b). The Red-whiskered Bulbul preys upon the endangered native golden orb weaving spiders (*Nephila spp.*) in Mauritus (Islam & Williams, 2000; Linnebjerg et al., 2010).

 doi:10.20944/preprints202501.1827.v1

5.1.4. Disease Transmission

The House Sparrow is a vector of arthropod-borne viruses, such as western equine encephalitis virus, eastern equine encephalitis virus, Buggy Creek virus, St Louis encephalitis virus, and West Nile virus and. The Common Starling is a vector of psittacosis *Chlamydophila psittaci*, bacteria (*Escherichia coli, Salmonella spp*., *Campylobacter, Mycobacterium*) and avian malaria *Plasmodium relictum.* Also the Common Mynas is known as a vector of avian malaria, dermatitis,psittacosis, salmonellosis and arbovirusal infections (Clark et al., 2015). The Rock Pigeon can be a vector of more than 60 different pathogens including those recorded in the Common Starling. The Rosy-ringed Parakeet is a carrier of some zoonotic diseases such parrot fever *Chlamydia psittaci* (Pisanu et al., 2018) and H9N2 Influenza A viruses (Mase et al., 2001). The House Crow transmits the New Castle disease.

5.1.5. Parasitism

Virtually all birds have parasites which they transmit among themselves and some may transmit to human. The Rock Pigeon has especially large burden of the following ectoparasites: bugs (e.g., *Cimex lectularius*), fleas (e.g., *Ceratophyllus gallinae*), flies (e.g., *Fannia canicularis*), mites (e.g., *Dermanyssus gallinae*) and ticks (e.g., *Argas reflexus*) that are known to infest humans (Haag-Wackernagel, 2005).

5.1.6. Human-Wildlife Conflict

The Rock Pigeon, House Crow, House Sparrow, Common Staling and Common Myna cause damages to infrastructure, roof linings, buildings, and monuments. The Common Starling forms large flocks in non-breeding season and is renown from collisions with aircrafts. The House Crow attacking people to obtaain food (Ryall, 1992; Suliman et al., 2011; Shimba and Jonah, 2016), and kills chickens on poultry farms (Dodoma, Tanzania; Ngongoda, Mirimi 2024). The Rosy-ringed Parakeet can cause severe noise disturbance, as it roosts in the thousands at night and have very loud vocalizations (Parau et al. 2016).

5.1.7. Agricultural Pests

The Common Starling is notorious pest of fruits. It damages especially often cherries and grapes, but also figs, peaches, straw berries, blueberries. Also the Common Myna may consume grapes, pears, strawberries, apricots, apples, and other fruits.

5.1.8. Seed Dispersal

The Red-whiskered Bulbul disperses seeds invasive plants altering plant communities (Simberloff & Von Holle, 1999; Linnebjerg et al., 2009; Mo 2015). The Common Staling is known to disperse the invasive Western Coastal Wattle *Acacia cyclops* (Glyphis et al., 1981). The Rosy-ringed Parakeet is known to cause damage to vine grape, almonds *Prunus dulcis*, *Citrus* spp., guavas *Psidium guajava*, mangos *Mangifera indica*, and common sunflower *Helianthus annuus* heads (Ahmad et al., 2012; Mentil et al., 2018). The Rock Pigeon causes damage to maize, seeds, legumes (soybeans and chickpeas) and sunflower crops, while the House Crow damages fruits and crops such as cereal, maize or groundnuts (Suliman et al., 2011; Akram et al., 2013; Kamel, 2014; Khan et al., 2015).

5.2. Control Measures

Control measures to reduce detrimental alien bird populations include: prevention, early detection and rapid response, eradication and restoration. Some of eradication methods include shooting, limiting food resources, clutch/brood destruction,trapping, using toxic substances, bioacoustic, and sterilization (Brook et al., 2003; Yap & Sodhi, 2004; Iriarte, 2005; Feare, 2010; Geartner et al., 2016). A need for invasive species control, eradication methods used etc. varies among species (Veitch & Clout, 2001; Bremner & Park, 2007; Coates, 2007).

 doi:10.20944/preprints202501.1827.v1

Feral and domestic cats are main predators of the House Crow and Common Myna. The Peregrine Falcon *Falco peregrinus* is an efficient predator of Rock Pigeons, while *Accipiter*-raptors may efficiently control communally roosting birds, such as House Sparrow, Common Starlings, Common Myna or parrots. Some species, like Common Starling can be controlled using sonic devices.

Physical and chemical methods have been used to control Rock Pigeons, including shooting, poisoning, contraceptives, nest destruction, and reduction of food availability. Eradication from small islands is feasible and achievable by trapping, nest destruction and shooting, poisoning, and mist-netting (Canning, 2011).

Examples of successful eradications:

- Common Myna in North Island, Seychelles, (>200 ha, estimated populations of myna: c. 750–1000 ind.), 4641 ind. were killed (Feare, 2021; Canning, 2011; Feare et al., 2016, 2021); Assumption Is (11.1 km^2), Seychelles, 2004, 5270 ind. were killed (Millet et al., 2004; Cruz & Reynolds, 2019); Fregate Island (219 ha), Seychelles, 2010-2011, 745 ind. were killed (Canning, 2011); Socotra (Yemen et al., 2010).

- House Sparrow in Round Island (219 ha), Mauritius, 320 ind. were killed in 2008-2009; but not eradicated totally (Bednarczuk et al., 2011)

- Madagascar Fody in Assumption Island, Seychelles, over 3200 ind. were eliminated, with the last bird shot in January 2015 (Bunbury et al., 2019).

- House Crow in Socotra Island. Between 2002 and 2008, the numbers of adults were successfully controlled by clutch/brood destruction. In April 2009 two professional snipers shot all adults. A total of 242 young House Crows were collected and killed (Suleiman & Taleb, 2010; Suleiman et al., 2010); House Crow in Mauritius were poisoned with the starlicide (Puttoo & Archer, 2004), and α-chloralose Crows (Feare & Mungroo, 1990).

- Red-whiskered Bulbul in Mayotte, eradicated in the 1990s (Sinclair, 2013). In the Assumption Island (Seychelles), 5279 birds were eliminted in 2012-2014 (Bunbury et al., 2013; Uranie, 2015); Mascarene Islands, pesticides and bird lime were used to kill the mynas (these untargeted chemicals destroy also indigenous birds) (Clergeau & Mandon-Dalger, 2001); in Réunion Island, in addition to trapping, management practices were also used to mitigate the human-wildife conflict to protect agricultural crops (Clergeau et al., 2006; Amiot et al., 2007).

-Rosy-faced Parakeet in Mahé (155 km^2), Seychelles, shooting by a team of professional hunters, 548 birds were shot from 2013 to 2017 (Bunbury et al., 2019).

-Ring-necked Parakeet in Mahe Island, Seychelles, 545 ind. were shot in 2012. The last known wild ring-necked parakeet was culled in the Morne Blanc region of Mahé in August 2017 (Bunbury et al., 2019).

Funding: This research received no external funding.

Conflicts of Interest: The author declares no conflicts of interest.

References

1. Ahmad, F.; Sahi, D.N. Food and feeding habits of the Common Myna, *Acridotheres tristis* (Family: Sturnidae) at Jammu, Jammu and Kashmir. *Ecoscan* 2012, 6, 69–72.
2. Akram, N.; Khan, H.A.; Javed, M. Inhibiting the House Crow (*Corvus splendens*) damage on maize growth stages with reflecting ribbons in farmland. *J. Anim. Plant Sci*., 2013, 23, 182–189.
3. Ali, S. *The Book of Indian Birds*, 13th ed. Oxford University Press, New Dehli, India, 2002.
4. Anderson, T.R. *Biology of the Ubiquitous House Sparrow: From Genes to Populations*. Oxford University Press, Oxford, 2006.
5. Avery, M. L.; Tillman, E. A. *Alien birds in North America-challenges for wildlife managers*, 2005.
6. Bednarczuk E., Feare C. J., Lovibond S., Tatayah V., Jones C.G. 2010. Attempted eradication of house sparrows *Passer domesticus* from Round Island (Mauritius), Indian Ocean *Conserv. Evid*. 7: 75-86.
7. BirdLife International. Invasive alien species have been implicated in nearly half of recent bird extinctions. In: *BirdLife State of the World's Birds*. 2010 www.birdlife.org/datazone/sowb/casestudy/127.

8. BirdLife International. Rock Dove: *Columba livia*. The IUCN Red List of Threatened Species 2016. Available at: https://www.iucnredlist.org/ species/22690066/86070297.
9. Blackburn, T.M.; Lockwood, J.L.; Cassey, P. *Avian Invasions*. Oxford University Press, New York, 2009.
10. Blackburn, T.M.; Duncan, R.P. Determinants of establishment success in introduced birds. *Nature* 2001, 414: 195–197.
11. Blackburn, T.M., Lockwood, J.L. and Cassey, P. *Avian Invasions: The Ecology and Evolution of Exotic Birds*. Oxford University Press, Oxford, 2009.
12. Brochier, B.; Vangeluwe, D.; van den Berg, T. Alien invasive birds. *Rev. sci. tech. Off. int. Epiz*., 2010, 29 (2), 217-226.
13. Brown, C.J. Invasive alien birds in South West Africa/Namibia. In: Brown, C.J., Macdonald, I.A.W. and Brown, S.E. (eds) *Invasive Alien Organisms in South West Africa Namibia*. South African National Scientific Programs Report, 1985, 119: 41–43.
14. Brook, B.W.; Sodhi, N.S.; Malcolm, C.K.S.; Lim, H.C. Abundance and projected control of invasive house crows in Singapore. *J. Wildl. Manag*. 2003, 67, 808–816.
15. Brooke, R.K.; Lloyd, R.H.; De Viltiers, A.L. Alien and translocated terrestrial vertebrates in South Africa. In: *The Ecology and Management of Biological Invasions in Southern Africa*, eds. I.A.W Mac Donald, EJ. Kruger, A.A. Ferrar, pp. 63-74. Oxford University Press, Cape Town, 1986.
16. Bunbury, N.; Mahoune, T.; Raguain, H.; Richards, H.; Fleischer-Dogley, F. Red-whiskered Bulbul eradicated from Aldabra. *Aliens: Invas. Spec. Bull*. 2013, 33, 7-8.
17. Bunbury, N. et al. Five eradications, three species, three islands: overview, insights and recommendations from invasive bird eradications in the Seychelles. In: *Island Invasives 2017 Conference*. IUCN, International Union for Conservation of Nature, 2019, 282-288.
18. Butler, C.J. *Population biology of the introduced Rose-ringed Parakeet Psittacula krameri in the UK*. Ph.D. thesis, University of Oxford, Oxford, 2003.
19. Canning, G. Eradication of the invasive common myna, *Acridotheres tristis*, from Fregate Island, Seychelles. *Phelsuma* 2011, 19: 43-53.
20. Carié, P. Note sur l'acclimatation du Bulbul (*Octocompsa jocosa* L.) à l'île Maurice. Bulletin de la Société Nationale d'acclimatation 1910, 57: 462–464.
21. Cheke, A. The timing of arrival of humans and their commensal animals on Western Indian Ocean oceanic islands. *Phelsuma* 2010, 18, 38-69.
22. Chiron, F.; Shirley, S.; Kark, S. Human-related processes drive the richness of exotic birds in Europe. *Proc. Roy. Soc. B: Biol. Sci*., 2009, 276(1654), 47-53.
23. Clark, N.J.; Olsson-Pons, S.; Ishtiaq, F.; Clegg, S.M. Specialist enemies, generalist weapons and the potential spread of exotic pathogens: malaria para sites in a highly invasive bird. *Intern. J. Parasitol*. 2015, 45, 891–899.
24. Clements, J.F.; Schulenberg, T.S.; Iliff, M.J.; Roberson, D.; Fredericks, T.A.; et al. *The eBird/Clements checklist of birds of the world: 2018*. www.birds.cornell.edu/clementschecklist/download/
25. Clergeau, P.; Mandon-Dalger, I. Fast colonization of an introduced bird: the case of *Pycnonotus jocosus* on the Mascarene Islands. *Biotropica* 2001, 33, 542–546.
26. Clergeau, P., Lay, G.L. and Mandon-Dalger, I. Intégrer les analyses géographiques, écologiques et sociales pour gérer la faune sauvage. In: Legay, J.M. (ed.) *L'Interdisciplinarité dans les Sciences de la Vie*. Édition Cemagref, Antony Cedex, France, pp. 103–113, 2006.
27. Cox, G. W. 1999. *Alien Species in North America and Hawaii: Impacts on Natural Ecosystems*. Island Press, Washington, DC.
28. Craig, A.J.F.K. Common Myna. In: Hockey, P.A.R., Dean, W.R.J. and Ryan, P.G. (eds) *Roberts Birds of Southern Africa*, 7th edn. Trustees of the John Voelker Bird Book Fund, Cape Town, p. 972, 2005.
29. Craig, A. J., Edwards, S. Counting Common Starlings: is *Sturnus vulgaris* invasive in rural South Africa? *Ostrich*, 2012, 95(1), 1-9.
30. Crowl, T.A.; Crist, T.O.; Parmenter, R.R.; Belovsky, G.; Lugo, A.E. The spread of invasive species and infectious disease as drivers of ecosystem change. *Front. Ecol. Environ*. 6, 2008, 238–246.
31. Cunningham, P. Is Namibia on the brink of being invaded by Common Starling *Sturnus vulgaris*? *Biodiv. Observ*. 2016, 7: 76: 1–2.

32. Dean, W.R.J. Alien birds in southern Africa: what factors determine success? *S. Afr. J. Sci.* 2000, 96, 9–14.
33. Dean, W.R.J. Rock Dove. In: Hockey, P.A.R., Dean, W.R.J. and Ryan, P. (eds) *Roberts Birds of Southern Africa*, 7th ed. Trustees of the John Voelker Bird Book Fund, Cape Town, pp. 276–277, 2005a.
34. Dean, W.R.J. House Crow. In: Hockey, P.A.R., Dean, W.R.J. and Ryan, P. (eds) *Roberts Birds of Southern Africa*, 7th ed. Trustees of the John Voelker Bird Book Fund, Cape Town, pp.721–722, 2005b.
35. Dean, W.R.J. House Sparrow. In: Hockey, P.A.R., Dean, W.R.J. and Ryan, P.G. (eds) *Roberts Birds of Southern Africa*, 7th ed. Trustees of the John Voelker Bird Book Fund, Cape Town, pp. 1082–1083, 2005c.
36. Douthwaite, R. Common Myna – a new bird species for Zambia. Kafue River Trust, 2015. http://www.kafuerivertrust.org/commonmyna-a-new-bird-species-for-zambia-2/
37. Downs, C. T., & Hart, L. A. (Eds.). (2020). *Invasive birds: global trends and impacts*. CABI.
38. Dyer, E.E.; Cassey, P.; Redding, D.W.; Collen, B.; Franks, V.; Gaston, K.J. et al. The global distribution and drivers of alien bird species richness. *PLoS Biology*, 2017, *15*(1), e2000942.
39. Dyer, E.E., Redding, D.W. and Blackburn, T.M. The global avian invasions atlas, a database of alien bird distributions worldwide. *Sci. Data* 2017, 4, 170041.
40. Earlé, R.; Grobler, N. *First Atlas of Bird Distribution in the Orange Free State*. National Museum, Bloemfontein, South Africa, 1987.
41. Engel, J.; Willard, D. The mynas are coming! A summary of common myna records in Namibia. *Biodiv. Observ.*, 2017, 8: 47-51.
42. Feare, C.J. The use of Starlicide in preliminary trials to control invasive Common Myna Acridotheres tristis populations on St Helena and Ascension islands, Atlantic Ocean. *Conserv. Evid*. 2010, 7: 52–61.
43. Feare C.J.; van der Woude, J.; Greenwell, P.; Edwards, H.; Taylor, J.A.; Larose, C.S., Ahlen, P-A; West, J.; Chadwick, W.; Pandey, S.; Raines, K.; Garcia, F.; Komdeur, J.; de Groene, A. Eradication of common mynas from Denis Island, Seychelles. *Pest Manag Sci*. 2016, 73: 295–304, https://doi.org/10.1002/ps.4263
44. Feare, C.J.; Waters, J.; Fenn, S.R.; Larose, C.S.; Retief, T.; Havemann, C. et al. Eradication of invasive common mynas *Acridotheres tristis* from North Island, Seychelles, with recommendations for planning eradication attempts elsewhere. *Manag. Biol. Invas.* 2021, 12(3).
45. Feare, C.J.; Lebarbenchonb, C.; Dietrichc, M.; Larosed, C.S. Predation of seabird eggs by Common Mynas *Acridotheres tristis* on Bird Island, Seychelles, and its broader implications. *Bull. ABC* 2015, 22(2): 162-170.
46. Feare, C. and Craig, A. 1998. *Starlings and Mynas*. Helm, London.
47. Feare, C. J., Mungroo, Y. (1990). The status and management of the House Crow *Corvus splendens* (Vieillot) in Mauritius. *Biol. Conserv. 51*(1), 63-70.
48. Feare, C.J.; van der Woude, J.; Greenwell, P.; Edwards, H.; Taylor, J.A.; Larose, C.S.; Ahlen, P-A.; West, J.; Chadwick, W.; Pandey, S.; Raines, K.; Garcia, F.; Komdeur, J.; de Groene, A. Eradication of common mynas from Denis Island, Seychelles. *Pest Manag. Sci*. 2016, 73: 295–304, https://doi.org/10.1002/ps.4263
49. Feare, C.J.; Waters, J.; Fenn, S.R.; Larose, C.S.; Retief, T.; Havemann, C.; Ahlen, P.-A.; Waters, C.; Little, M.K.; Atkinson, S.; Searle, B.; Mokhobo, E.; de Groene, A.; Accouche, W. Eradication of invasive common mynas *Acridotheres tristis* from North Island, Seychelles, with recommendations for planning eradication attempts elsewhere. *Manag. Biol. Invas.* 2021, 12(3): 700–715, https://doi.org/10.3391/mbi.2021.12.3.12
50. Gaertner, M.; Larson, B.M.; Irlich, U.M.; Holmes, P.M.; Stafford, L.; van Wilgen, B.W.; Richardson, D.M. Managing invasive species in cities: a framework from Cape Town, South Africa. *Landsc. Urban Plan*. 2016, 151, 1–9.
51. Garrett, K.L.; Shuford, W.D.; Gill, R.E.; Handel, C.M. Introducing change: A current look at naturalized bird species in western North America. *Trends and Traditions: Avifaunal Change in Western North America* 2018, 3, 116-130.
52. Gebhardt, E. Die gegenwärtige Verbreitung von Haussperling, Star und Buchfink in Südafrika. *J. Orn.* 1954, 95, 58–60.
53. Gebhardt, E. Europäische Vögel in überseeischen Ländern. *Bonner Zool. Beitr.* 1959, 10, 310–342.
54. Genovesi P.; Shine, C. European strategy on invasive alien species. Nature and environment, 137. Council of Europe Publ., Strasbourg: 1-67, 2004.
55. Glyphis, J.P.; Milton, S.J.; Siegfried, W.R. Dispersal of *Acacia cyclops* by birds. *Oecologia* 1981, 48: 138–141.

56. Goodman, S.M.; Raselimanana, A.P.; Andriniaina, H.A.; Gauthier, N.E.; Ravaojanahary, F.F.; Sylvestre, M.H.; Raherilalao, M.J. The distribution and ecology of invasive alien vertebrate species in the greater Toamasina region, central eastern Madagascar. *Malagasy Nature* 2017, 12: 95-109.
57. Grandi, G.; Menchetti, M.; Mori, E. Vertical segregation by breeding ring-necked parakeets *Psittacula krameri* in northern Italy. *Urban Ecosyst*. 2018, 21: 1011–1017.
58. Haag-Wackernagel, D.; Moch, H. Health hazards posed by feral pigeons. J. Infection 2004, 48, 307–313.
59. Harrison, J.A.; Allan, D.G.; Underhill, L.G.; Brown, C.J.; Tree, A.J.; Parker, V.; Herremans, M. (eds). *The Atlas of Southern African Birds*. Vol. 2. BirdLife South Africa, Johannesburg, South Africa, 1997.
60. Hart, L.A.; Downs, C.T. Public surveys of Rose-ringed Parakeets, *Psittacula krameri*, in the Durban Metropolitan area, South Africa. *Afr. Zool*. 2014, 49, 283–289.
61. Hawkins, C.L.; Bacher, S.; Essl, F.; Hulme, P.E.; Jeschke, J.M.; et al. Framework and guidelines for implementing the proposed IUCN Environmental Impact Classification for Alien Taxa (EICAT). *Divers. Distrib*. 2015, 21, 1360–1363.
62. Hayes, K.R.; Barry, S.C. Are there any consistent predictors of invasion success? *Biol. Invas*. 2008, 10, 483–506.
63. Hernández-Brito, D.; Carrete, M.; Popa-Lisseanu, A.G.; Ibáñez, C.; Tella, J.L. Crowding in the city: losing and winning competitors of an invasive bird. *PLoS One* 2014, 9, e100593.
64. Hernández-Brito, D.; Carrete, M.; Ibáñez, C.; Juste, J.; Tella, J.L. Nest-site competition and killing by invasive parakeets cause the decline of a threatened bat population. *Roy. Soc. Open Sci*. 2018, 5: 172-177.
65. Hilton, G.M.; Cuthbert, R.J. The catastrophic impact of invasive mammalian predators on birds of the UK Overseas Territories: a review and synthesis. *Ibis*, 2010, 152(3), 443-458.
66. Hockey, P.A.R.; Dean, W.R.J.; Ryan, P.G. *Roberts Birds of Southern Africa*, 7th edn. Trustees of the John Voelker Bird Book Fund, Cape Town, 2005.
67. Hockey, P.A.R.; Underhill, L.G.; Neatherway, M.; Ryan, P.G. *Atlas of the birds of the Southwestern Cape*. Cape Bird Club, 1989.
68. Iriarte, J. Invasive vertebrate species in Chile and their control and monitoring by governmental agencies. *Rev. Chilena Hist. Natur*. 2005, 78, 143–151.
69. Islam, K.; Williams, R.N. Red-vented Bulbul (*Pycnonotus cafer*) and Red-whiskered Bulbul (*Pycnonotus jocosus*). In: Poole, A. and Gill, F. (eds) *Birds of North America: Life Histories for the 21st Century*. Cornell Lab of Ornithology, Ithaca, New York, and the Academy of Natural Sciences, Philadelphia, Pennsylvania, 2000. http://bna.birds.cornell.edu/bna/species/520bdoi:10.2173/bna.520.
70. Iqbal, M. First record of Rose-ringed Parakeet *Psittacula krameri* for Indonesia. *BirdingAsia* 2017, 25: 73–74.
71. IUCN Invasive Species Specialist Group. *Global Invasive Species Database*, 2015. www.iucngisd.org/gisd/search.php.
72. Jeschke, J.M. Across islands and continents, mammals are more successful invaders than birds. *Divers. Distribut*. 2008, 14: 913–916.
73. Johnston, R.F. Geographic size variation in rock pigeons, *Columba livia*. *Ital. J. Zool.* 1992, 59(1), 111-116.
74. Johnston, R.F.; Garrett, K.L. Population trends of introduced birds in western North America. *Stud. Avian Biol*. 1994, 15: 221–231.
75. Jones, C.G. Parrot on the way to extinction. *Oryx* 1980, 15: 350–354.
76. Joubert, H.J. Starlings and others. *Ostrich* 1945, 16, 214–216.
77. Kamel, A.M. Potential impacts of invasive House Crows (*Corvus splendens*) bird species in Ismailia Governorate, Egypt: ecology, control and risk management. *J. Life Sci. Technol.* 2014, 2, 86–89.
78. Kark, S.; Solarz, W.; Chiron, F.; Clergeau, P.; Shirley, S. Alien birds, amphibians and reptiles of Europe. *Handbook of alien species in Europe*, 2009, 105-118.
79. Khan, H.A.; Javed, M.; Zeeshan, M. Damage assessment and management strategies for House Crow (*Corvus splendens* L) on the seedling stages of maize and wheat in an irrigated agricultural farmland of Punjab, Pakistan. J. Entomol. Zool. Stud. 2015, 3: 151–155.
80. Kolar, C.S.; Lodge, D.M. Progress in invasion biology: predicting invaders. *Tren. Ecol. Evol*. 2001, 16, 199–204.

81. Komdeur, J. Breeding of the Seychelles Magpie Robin *Copsychus sechellarum* and implications for its conservation. *Ibis* 1996, 138, 485–498. doi:10.1111/j.1474-919X.1996.tb08069.x
82. Kopij, G. Breeding bird community of the UOFS campus, Bloemfontein. *Mirafra* 1994, 11 (1): 8-15.
83. Kopij, G. Birds of Bethlehem, Free State province, South Africa. *Mirafra* 1997 14 (3/4): 5-12.
84. Kopij, G. Birds of Maseru. *NUL J. Res. (Roma, Lesotho)* 2000, 8: 104–151.
85. Kopij, G. *Atlas of Birds of Bloemfontein*. Department of Biology, National University of Lesotho/Free State Bird Club, Roma (Lesotho)/Bloemfontein (RSA), 2001a.
86. Kopij, G. *Birds of Roma Valley, Lesotho*. Roma (Lesotho): Department of Biology, National University of Lesotho, 2001b.
87. Kopij, G. *The Structure of Assemblages and Dietary Relationships in Birds in South African Grasslands*. Wydawnictwo Akademii Rolniczej we Wrocławiu, Wrocław, 2006.
88. Kopij, G. Segregation in sympatrically nesting Red-winged Starling *Onychognathus morio* (L.) and European Starling *Sturnus vulgaris* L. *Pol. J. Ecol*. 2009, 57: 589–595.
89. Kopij, G. Avian Assemblages in Urban Habitats in North–central Namibia. *Intern. Sci. Technol. J. Nam.* 2014a, 3(1): 64–81.
90. Kopij, G. Avian communities of a Mixed Mopane–Acacia Savanna in the Cuvelai Drainage System, North–Central Namibia, During the Dry and Wet Season. *Vest. Zool*. 2014b, 48(4): 269–274.
91. Kopij, G. The status of sparrows in Lesotho, southern Africa. *Intern. St. Sparrows* 2014c, 38: 20–24.
92. Kopij, G. Avian diversity in an urbanized South African grassland. *Zool. Ecol*. 2015, 25(2): 87–100.
93. Kopij, G. Birds of Katima Mulilo town, Zambezi Region, Namibia. *Intern. Sci. Technol. J. Nam.* 2016, 7: 85–102.
94. Kopij, G. Provisional atlas of breeding birds of Swakopmund in the coastal Namib Desert. *Lanioturdus* 2018a, 51(2): 2–12.
95. Kopij, G. Atlas of breeding birds of Kasane. *Babbler* 2018b, 64: 3–15.
96. Kopij, G. Population density and structure of birds breeding in an urban habitat dominated by large baobabs (*Adansonia digitata*), Northern Namibia. *Bios. Divers*. 2019, 27: 354–360.
97. Kopij, G. Structure of the breeding bird community along the urban gradient in a town on the Zambezi River, north–eastern Namibia. *Biologija* 2020, 66: 1–9.
98. Kopij, G. Structure of avian communities of suburbs of Rundu and Grootfontein, NE Namibia. *Berkut* 2021a, 30(1): 20-24.
99. Kopij, G. Population density and structure of a breeding bird community in a suburban habitat in the Cuvelai drainage system, northern Namibia. *Arxius Misc. Zool*. 2021b, 19: 313–320, doi: https://doi.org/10.32800/amz.2021.19.0313.
100. Kopij, G. Seasonal changes in the structure of an avian community in an urban habitat in northern Namibia. *Biologija* 2021c, 67(4): 197-204.
101. Kopij, G. Provisional atlas of breeding birds of Hentjes Bay in the coastal Namib Desert. *Nam. J. Envir*. 2022a, 6C: 1-6. https://www.nje.org.na/index.php/nje/article/view/volume6-kopij.
102. Kopij, G. Avian diversity in urban habitats in the arid zone of Namibia. *Lanioturdus* 2022b, 55(1): 23-27.
103. Kopij, G. Structure of breeding bird assemblages in the city of Windhoek, Namibia. *Arxius Misc. Zool.* 2023a, 21: 19-38. https://doi.org/10.32800/amz.2023.21.0019.
104. Kopij, G. Provisional atlas of breeding birds of Walvis Bay in the coastal Namib Desert. *Biologija* 2023b, 69(4): 151-160. https://doi.org/10.6001/biologija.2023.69.4.3
105. Krull, C.R.; Galbraith, J.A.; Glen, A.S.; Nathan, H.W.; Stow, A.; Maclean, N.; Holwell, G.I. Invasive vertebrates in Australia and New Zealand. *Austral Ark. The State of Wildlife in Australia and New Zealand* 2014, 197-226.
106. Langrand, O.; Sinclair, J.C. Additions and supplements to the Madagascar avifauna. Ostrich,1994, 65: 302-310
107. Leven, M.R.; Corlett, R.T. Invasive birds in Hong Kong, China. *Orn. Sci*. 2004, 3: 43–55.
108. Lever, C. *Naturalised Birds of the World*. Longman Scientific and Technical, London, 1987.
109. Lever, C. *Naturalised Birds of the World*. Poyser, London, 2005.
110. Lincoln, F.C. The military use of the homing pigeon. Wilson Bulletin 2027, 39: 67–74.

111. Linnebjerg, J.F., Hansen, D.M., Bunbury, N., Olesen, J.M. Diet composition of the invasive Red-whiskered Bulbul *Pycnonotus jocosus* in Mauritius. *J. tropic. Ecol*. 2010, 26: 347–350.
112. Liversidge, R. The spread of the European Starling in the Eastern Cape. Ostrich 1962, 33: 13–16.
113. Liversidge, R. Alien bird species introduced into southern Africa. In Proceedings of the Birds and Man Symposium, ed. L. J. Bunning, pp. 31-44, 1985.
114. Long, J.L. Introduced Birds of the World: *The Worldwide History, Distribution and Influence of Birds Introduced to New Environments*. Universe Books, New York, 1981.
115. Martin-Albarracin V.L., Amico G.C., Simberloff D., Nuñez M.A. Impact of Non-Native Birds on Native Ecosystems: A Global Analysis. *PLoS ONE* 2015, 10 (11): e0143070. doi:10.1371/journal.pone.0143070.
116. Mashao, M.; Mhlongo, S.N.; Nsibande, S.P.; Nxumalo, M.M.; Mncube, N.A. Records and distribution of House Crow *Corvus splendens* within the eThekwini Municipality from August 2019 to August 2023. *Biodiv. Observ*. 2023, 13: 289–292
117. Meininger, P.L.; Mullie, W.C.; Bruun, B. The spread of the House Crow, *Corvus splendens*, with special reference to the occurrence in Egypt. *Gerfaut* 1980, 70, 245–250.
118. Mentil. L.; Battisti, C.; Carpaneto, G.M. The impact of *Psittacula krameri* (Scopoli, 1769) on orchards: first quantitative evidence for Southern Europe. *Belg. J. Zool*.148: 129–134.
119. Meyerson, L.A.; Mooney, H.A. Invasive alien species in an era of globalization. *Front. Ecol. Envir*. 2007, 5, 199–208.
120. Millett, J.; Climo, G.; Shah, N.J. Eradication of the common myna *Acridotheres tristis* populations in the granitic Seychelles: successes, failures and lessons learned. *Adv. Verteb. Pest Manag*. 2004, 3: 169–183.
121. Mo, M. The Red-whiskered Bulbul *Pycnonotus jocosus* in Australia – a global perspective, history of introduction, current status and potential impacts. *Aust. Zool*. 2015, 37, 461–471.
122. Moulton, M. P.; Cropper Jr., W. P. A comparison of success rates of introduced passeriform birds in New Zealand, Australia and the United States. *PeerJ*. 2014, 2, e509.
123. Nebot, J. First report on the rose-ringed parakeet (*Psittacula krameri*) in Venezuela and preliminary observations on its behaviour. *Orn. Neotropic*. 1999, 10: 115–117.
124. Nxele, B.; Shivambu, C. House Crow (*Corvus splendens*) eradication measures from eThekwini Municipality, KwaZulu-Natal, South Africa. *J. Biodiv. Manag. Forest*. 2018, 7: 1–5.
125. Nyári, Á.; Ryall, C.; Townsend Peterson, A. Global invasive potential of the House Crow *Corvus splendens* based on ecological niche modelling. *J. avian Biol*. 2006, 37: 306–311.
126. Ottens, G. Background and development of the Dutch population House Crows *Corvus splendens*. *Limosa* 2003, 76: 69–74.
127. Ottens, G.; Ryall, C. House Crows in the Netherlands and Europe. *Dutch Birding* 2003, 25: 312–319.
128. Pârâu, L.G.; Strubbe, D.; Mori, E.; Menchetti, M.; Ancillotto, L.; Kleunen, A.V.; et al. Rose-ringed parakeet *Psittacula krameri* populations and numbers in Europe: a complete overview. *Open Orn. J*. 2016, 9(1).
129. Peacock, M.P.; van Rensburg, B.J.; Robertson, M.P. The distribution and spread of the invasive alien Common Myna, *Acridotheres tristis* L. (Aves: Sturnidae), in southern Africa. *S. Afr. J. Sci*. 2007, 103: 465–473.
130. Perrin, R.; Cowgill, R. Rose-ringed parakeet *Psittacula krameri*. In: Hockey P.A.; Dean, W.R., Ryan, P.G.; Maree, S.; Brickman, B.M. (eds), *Roberts birds of southern Africa*, 7th ed. Cape Town: Trustees of the John Voelcker Bird Book Fund, pp 229–230, 2005.
131. Phair, D.J. *Dispersal strategies, rapid geographic range expansion and their effects on invasive European starlings, Sturnus vulgaris, in South Africa and Australia* (Doctoral dissertation, Stellenbosch University), 2015.
132. Pisanu, B.; Laroucau, K.; Aaziz, R.; Vorimore, F.; Le Gros, A.; Chapuis, J.L.; Clergeau, P. *Chlamydia avium* detection from a Ring-necked Parakeet (*Psittacula krameri*) in France. *J. Exot. Pet Medic*. 2018, 27: 68–74. https://doi.org/10.1053/j.jepm.2018.02.035.
133. Przybylska, K.; Haidt, A.; Myczko, Ł.; Ekner-Grzyb, A.; Rosin, Z.M.; et al. Local and landscape-level factors affecting the density and distribution of the Feral Pigeon *Columba livia* var. *domestica* in an urban environment. *Acta orn.* 2012, 47, 37–45.
134. Puttoo, M.; Archer, T. Control and/or eradication of Indian crows (*Corvus splendens*) in Mauritius. *Agric. Sugar Rev. Mauritius* 2004, 83, 209–399.
135. Quickelberge, C.D. Birds of the Transkei. Durban Natural History Museum, Durban, South Africa, 1989.

136. Rose, E.; Nagel, P.; Haag-Wackernagel, D. Spatio-temporal use of the urban habitat by feral Pigeons (*Columba livia*). *Beh. Ecol. Sociobiol*. 2006, 60, 242–254.
137. Ryall, C. Predation and harassment of native bird species by the Indian House Crow *Corvus splendens* in Mombasa, Kenya. *Scopus* 1992, 16, 1–8.
138. Ryall, C. Further records of range extension in the House Crow *Corvus splendens*. *Bull. B.O.C.*, 2002, 122, 231–240.
139. Ryall, C. Further records and updates of range extension in House Crow *Corvus splendens*. *Bull. B.O.C.* 2010, 130, 246–254.
140. Ryall, C. Further records and updates of range expansion in House Crow *Corvus splendens*. *Bull. B.O.C.* 2016 136(1).
141. Ryall, C.; Reid, C. The Indian House Crow in Mombasa. *Swara* 1987, 10, 9–12.
142. Sacchi, R.; Gentilli, A.; Razzetti, E.; Barbieri, F. Effects of building features on density and flock distribution of feral Pigeons *Columba livia* var. *domestica* in an urban environment. *Can. J. Zool.* 2002, 80, 48–54.
143. Schrey, A.W.; Liebl, A.L.; Richards, C.L.; Martin, L.B. Range expansion of house sparrows (*Passer domesticus*) in Kenya: evidence of genetic admixture and human-mediated dispersal. *J. Hered*. 2014, 105, 60–69.
144. Shimba, M.J., Jonah, F.E. Nest success of the Indian House Crow *Corvus splendens*: an urban invasive bird species in Dar es Salaam, Tanzania. *Ostrich* 2016, 88, 27–31.
145. Shivambu, T.C.; Shivambu, N.; Downs, C.T. Impact assessment of seven alien invasive bird species already introduced to South Africa. *Biol. Invas*. 2020, 22: 1829–1847. https://doi.org/10.1007/s10530-020-02221-9.
146. Shivambu, T.C.; Shivambu, N.; Downs, C.T. Population estimates of non-native rose-ringed parakeets *Psittacula krameri* (Scopoli, 1769) in the Durban Metropole, KwaZulu-Natal Province, South Africa. *Urban Ecosyst.*, 2021, 24(4), 649-659.
147. Shwartz, A.; Strubbe, D.; Butler, C.J.; Matthysen, E.; Kark, S. The effect of enemy-release and climate conditions on invasive birds: a regional test using the Rose-ringed Parakeet (*Psittacula krameri*) as a case study. *Diver. Distrib*. 2009, 15, 310–318.
148. Simberloff, D.; Von Holle, B. Positive interactions of nonindigenous species: invasional meltdown? *Biolog. Invas*. 1999, 1: 21–32.
149. Sinclair, I. Birds of the Indian Ocean Islands. Penguin Random House, South Africa, 2013.
150. Skead, C.J. Life-history Notes on East Cape Bird Species 1940–1990. Algoa Regional Services Council, Port Elizabeth, South Africa, 1995
151. Sol, D.; Bartomeus, I.; Griffin, A.S. The paradox of invasion in birds: competitive superiority or ecological opportunism? *Oecologia* 2012, 169: 553–564.
152. Sol, D.; Lefebvre, L. Behavioural flexibility predicts invasion success in birds introduced to New Zealand. *Oikos* 2000, 90: 599–605.
153. Stern, C.A. and Dickinson, J.L. Pigeons. In: Michael, D.B. and Janice, M. (eds) Encyclopedia of Animal Behavior. Academic Press, London, pp. 723–730, 2010.
154. Stephens K. Impacts of invasive birds: assessing the incidence and extent of hybridization between invasive Mallard Ducks (*Anas platyrhynchos*) and native Yellow-billed Ducks (*Anas undulata*) in South Africa. M.Sc. thesis. Stellenbosch: Stellenbosch University, 2019.
155. Strubbe, D.; Matthysen, E. Experimental evidence for nest-site competition between invasive Ring-necked Parakeets (*Psittacula krameri*) and native nuthatches (*Sitta europaea*). *Biol. Conserv.* 2009, 142: 1588–1594.
156. Suleiman, A.; Meier, G.; Haverson, P. Confirmed eradication of the House Crow from Socotra Island, Republic of Yemen. *Wildlife Middle East* 2009, 4: 1–12.
157. Suleiman, A.S.; Taleb, N. Eradication of the house crow *Corvus splendens* on Socotra, Yemen. *Sandgrouse* 32: 136–140.
158. Suliman, A.S., Meier, G.G.; Haverson, P.J. Eradication of the House Crow from Socotra Island, Yemen. In: Veitch, C.R., Clout, M.N. and Towns, D.R. (eds) *Island Invasives: Eradication and Management*. IUCN, Gland, Switzerland, pp. 361–363, 2011.
159. Summers-Smith, J.D. *The House Sparrow*, 1st ed. Collins, London, 1963.
160. Summers-Smith, J.D. *The Sparrows: A Study of the Genus Passer*. A. & C. Black Publishers, London, 1988.
161. Summers-Smith, J.D. In Search of Sparrows. Academic Press. London, 1992.

 doi:10.20944/preprints202501.1827.v1

162. Summers-Smith, J.D. The decline of the House Sparrow: a review. *British Birds* 96: 439–446, 2023.
163. Summers-Smith, J.D. The decline of the house sparrow: A review. *British Birds* 96: 439-446, 2003.
164. Symes, C.T. Founder populations and the current status of exotic parrots in South Africa. *Ostrich*, *85*(3), 235-244, 2014.
165. Thompson, N. Common Mynas in Namibia. *Lanioturdus* 47(1): 8-9, 2014.
166. Trezza, F.R.; da Costa Nerantzoulis, I.; Cianciullo, S.; Mabilana, H.; Macamo, C.; Attorre, F.; Bento, C.M.; Perazzi, P.R. Presence of the alien Rose-ringed Parakeet *Psittacula krameri* (Psittacidae) in Mozambique, *Ostrich* 2023, 94: 129-134, doi:10.2989/00306525.2023.2251690.
167. Tyler, S.J. Common Mynahs continue to spread. *Babbler* 2015, 61: 39-40.
168. Uranie, S. *Eradication success – Seychelles wins war against invasive Red-whiskered Bulbul. Seychelles News Agency*, 2015. www. seychellesnewsagency.com/articles.
169. Yap, C.A.M.; Sodhi, N.S. Southeast Asian invasive birds: ecology, impact and management. *Orn. Sci.* 2004, 3: 57–67.
170. Yemen, A.; Suleiman, S.; Taleb, N. Eradication of the House Crow *Corvus splendens* on Socotra, *Sandgrouse* 2010, 32: 136-140.
171. van der Merwe, F. 'n Nalatenskap van Rhodes: Europese spreeus verdring gryskopspegte. *Afr. Wildl*. 1984, 38: 152–157.
172. Vall-llosera, M., Cassey, P. Leaky doors: Private captivity as a prominent source of bird introductions in Australia. *PLoS ONE* 2017, 12(2): e0172851. doi:10.1371/journal.pone.0172851
173. van Rensburg, B.J.; Peacock, D.S.; Robertson, M.P. Biotic homogenization and alien bird species along an urban gradient in South Africa. *Landsc. Urban Plan*. 2009, 92: 233–241.
174. Vierke, J. Die Besiedlung Sudafrikas durch den Haussperling (*Passer domesticus*). *J. Orn*. 1970, 111: 94–103.
175. Vincent, A.W. On the breeding habits of some African birds. Ibis 1949, 91: 483–507
176. Walther, B.A. First documented nesting of the Red-whiskered Bulbul *Pycnonotus jocosus* in Taiwan. *Taiwan J. Biodiv*. 2011, 13: 121–133.
177. Weber W.J. *Health Hazards from Pigeons, Starlings and English Sparrows: Diseases and Parasites Associated with Pigeons, Starlings, and English Sparrows which Affect Domestic Animals.* Thomson Publications, Fresno, California, 1979.
178. Williamson, M.; Fitter, A. The varying success of invaders. *Ecology* 1996, 77: 1661–1666.
179. Winterbottom, J.M.; Liversidge, R. The European Starling in the South West Cape. *Ostrich* 1954, 25, 89–96.
180. Witmer, G.W.; Burke, P.W.; Pitt, W.C.; Avery, M. L. Management of invasive vertebrates in the United States: an overview, 2007.