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Exotic, introduced and invasive avifauna on Tenerife: are these species a serious threat?

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RESUMEN: Se revisa la situación de avifauna exótica en Tenerife desde que se empezó a citar al final de los años 80. Se actualiza y analiza el estatus de estas especies de aves proporcionando datos nuevos, años 2005-2006, sobre la distribución de poblaciones aparentemente estables. La literatura no deja claro cuantas especies están presentes en Tenerife (rango de 1-9) y sugiere que las introducciones fueron de 4 ordenes (i.e. Galliformes, Columbiformes, Psittaciformes y Passeriformes) pertenecientes a 7 familias (Numidae, Phasianidae, Columbidae, Psittacidae, Estrildidae, Fringillidae y Sturnidae). Sin embargo, en la actualidad sólo mantienen poblaciones estables en Tenerife 5 especies (*Alectoris barbara*, *Streptopelia roseogrisea*, *Myiopsitta monachus*, *Psittacula krameri* y *Nandayus nenday*) pertenecientes a los ordenes Galliformes, Columbiformes y Psittaciformes. Se concluye que el proceso de introducciones en Tenerife es principalmente “accidental” con algunas introducciones voluntarias con fines cinegéticos en el siglo XV. Toda la avifauna exótica, introducida accidentalmente en Tenerife, se ha mantenido asociada a zonas urbanas, un hábitat subóptimo para estas aves. El orden de los Passeriformes ha tenido problemas en establecerse en Tenerife y los Psittaciformes son el orden más exitoso, el cual se debería de monitorizar y controlar en un futuro no muy lejano.

Palabras clave: aves exóticas, *Psittacula krameri*, *Myiopsitta monachus*, introducción, invasiva, distribución, Tenerife, islas Canarias.

ABSTRACT: I review the exotic avifauna of Tenerife since records began in the late 1980's and update and analyse the actual status of these bird species by providing new data, from 2005-2006, of the distribution of these apparently self-sustaining populations. A literature search did not make clear how many species are present on Tenerife (range 1-9) and suggested that all introductions to this island were of species from 4 orders (i.e. Galliformes, Columbiformes, Psittaciformes and Passeriformes) belonging to 7 families (Numidae, Phasianidae, Columbidae,

Psittacidae, Estrildidae, Fringillidae and Sturnidae). However, only 5 introduced species (*Alectoris barbara*, *Streptopelia roseogrisea*, *Myiopsitta monachus*, *Psittacula krameri* and *Nandayus nenday*) belonging to the orders Galliformes, Columbiformes and Psittaciformes show self-sustaining populations on Tenerife today. It is concluded that the introduction process on Tenerife is mainly “accidental” with some voluntary introductions for recreational hunting in the 15th century. All exotic, accidentally introduced, avifauna to Tenerife has always been associated with urban habitats which are suboptimal. Passeriformes appear to find it difficult to become established on Tenerife. Psittaciformes are the most successful order, and need to be monitored and possibly controlled in the near future.

Key words: exotic birds, *Psittacula krameri*, *Myiopsitta monachus*, introduction, invasive, avifauna, distribution, Tenerife, Canary Islands.

INTRODUCTION

Numerous species of birds have been introduced to remote oceanic archipelagos by a variety of groups and for a variety of reasons (e.g. recreational hunting, for food, as an attempt at biological control, etc.) (Drake *et al.*, 1989). For example at least 140 species of 14 different orders of birds have been introduced to the six main Hawaiian islands (Pratt *et al.*, 1987). Most of these species (79%) were Galliformes, Columbiformes and Passeriformes, which came from six continents. The introductions were carried out by a variety of agents including state and local governments, private citizens, and the acclimatization society (Moulton *et al.*, 2001).

There are several hypotheses proposed to answer the question: Why do some species become self sustaining after introduction and others fail?. The “introduction history hypothesis” was suggested by Simberloff and Boecklen (1991) who argued that whenever and wherever a given species is introduced, it tends to either always succeed or always fail (this leads to an “all-or-none” pattern in the distribution of birds introduced onto a series of islands). Another factor that might influence the outcome of introductions is the “effort invested” in the introduction process (Griffith *et al.*, 1989) and several authors have reported a positive relationship between the size of the native geographic range of a species and its average abundance (e.g. Brown, 1984).

The Canary Islands have had several exotic & invasive (non-native) bird introductions (see e.g. Garcia-del-Rey, 2001). On this archipelago, several bird introductions have been made from the fifteenth century onward, for hunting purposes [e.g. see Barbary Partridge *Alectoris barbara*, Helmeted Guineafowl *Numida meleagris* and Common Turkey *Meleagris gallopavo* (Emmerson *et al.*, 1994)] but most exotic birds have been accidentally introduced in the wild on the Canaries [e.g. families Psittacidae and Estrildidae (Emmerson *et al.*, 1994; Martín, 1987; Pérez Padrón, 1983)].

Despite some preliminary data presented for the main island of Tenerife on this subject, more than 13 years ago (Lorenzo, 1993), no systematic full island study has been published so far for Tenerife. Taking into account the data presented in the main ornithological books, it is far from being clear how many bird species have self-sustaining populations on Tenerife today [e.g. c. 31 by Martín & Lorenzo (2001), 11 by Izquierdo *et al.*, (2004) or 5 by Garcia-del-Rey (2001)].

The aim of this study is to present a long term review of the situation of the exotic birds on Tenerife. I also aim to update and analyse the situation of these bird species by providing new data collected in 2005 and 2006. Some recommendations for future control of these birds are also given.

STUDY AREA AND METHODS

I used Martín (1987), Moreno (1988), Emmerson *et al.* (1994), Garcia-del-Rey (2000), Rodríguez Luengo (2001), Sánchez (2002), Garcia-del-Rey (2001), Martín & Lorenzo (2001), Izquierdo *et al.* (2004) and Clarke (2006) to compile the lists of non-native birds introduced to the island of Tenerife. Those publications that did not segregate the introduced species by islands were not included (e.g. Heinzel *et al.*, 1995).

This investigation was carried out on the island of Tenerife (28°20'N-16°20'E) on those areas not covered by native forests or Alpine shrub, as no bird introductions have ever been claimed on these areas (see e.g. Martín & Lorenzo, 2001). Field work was conducted, by the author, from January 2005 to December 2006. The units of distribution are the 2.5 x 2.5 km squares of the National Grids of Spain (Mapa Topográfico Nacional de España, 1:25.000 from Ministerio de Fomento, Instituto Geográfico Nacional, U.T.M. WGS 84). A total of 187 squares were sampled on this island. To increase detectability of more elusive species, all birds seen and/or heard were recorded in each square during early morning visits 7:00 to 11:00 a.m. local time. No surveys were done on mornings when strong wind or rain conditions prevailed. Similar effort was applied to each of the squares by walking at a speed of 1-2 km/h. On the maps (Figs. 1-4), all dots (group present) and triangles (individual observations) are placed centrally in the squares. For some coastal squares with very little land the dot may appear, therefore, to be in the sea. All maps were prepared with Arcview Gis 3.2. The common, scientific names and order of species follow Garcia-del-Rey (2001).

Exotic, introduced or invasive bird species is defined as in Garcia-del-Rey (2001) (that is, species introduced by man that nowadays have apparently self-sustaining populations).

Literature search

The list of exotic, introduced (non-native) bird species provided by the different authors can be seen on Table I. From these data it can be extracted that all introductions to Tenerife were of species from 4 orders (i.e. Galliformes, Columbiformes, Psittaciformes and Passeriformes) belonging to 7 families (Numidae, Phasianidae, Columbidae, Psittacidae, Estrildidae, Fringillidae and Sturnidae). However, 3 species have caused some confusion as their origin is not clear (i.e. Serin *Serinus serinus*, Collared Dove *Streptopelia decaocto* and Barbary Partridge *Alectoris barbara*) (see interrogations on Table I). It has not been confirmed yet (e.g. by molecular analysis), where these species come from, although it is widely accepted by all authors (see Table I), now, that only Barbary Partridge *Alectoris barbara* has been introduced by man on Tenerife. The range of the number of introduced species to Tenerife, according to the published data from the past 20 years is 1 to 9.

RESULTS

The main results of this study are summarized on section 11 in Table I. As suggested by the literature search, all introductions to Tenerife were from species belonging to 4 orders (Galliformes, Columbiformes, Psittaciformes and Passeriformes) but some significant changes are observed.

From the Galliformes, Helmeted Guineafowl *Numida meleagris* failed to become established (i.e. no self-sustaining populations were found during the course of this study). The Columbiformes still have the feral form “risoria” of Barbary Dove *Streptopelia roseogrisea* introduced in the wild (see distribution on Fig. 4). From the Psittaciformes (family Psittacidae), Budgerigar *Melopsittacus undulatus* and Senegal Parrot *Poicephalus senegalus* has failed to become established on Tenerife. However, a new exotic parakeet has become established as a possible self-sustaining population in the south of the island (see Nanday Parakeet *Nandayus nenday* on Fig. 3). Both Monk Parakeet *Myiopsitta monachus* and Ring-necked Parakeet *Psittacula krameri* still have well established populations on Tenerife, (see Fig. 1 & 2). From the Passeriformes none of the Estrildidae (i.e. Common Waxbill *Estrilda astrild*, Orange-cheeked Waxbill *Estrilda melpoda*, Black-rumped Waxbill *Estrilda troglodytes*) were

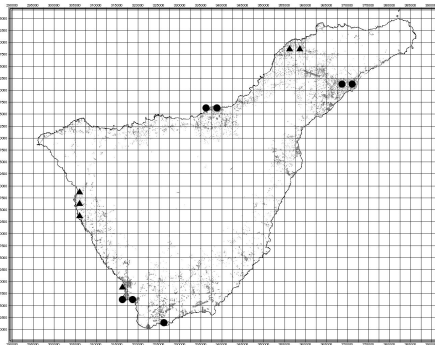


Figure 1. Distribution of Monk Parakeet *Myiopsitta monachus* on Tenerife.

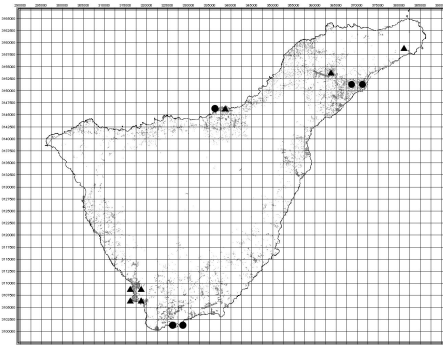


Figure 2. Distribution of Ring-necked Parakeet *Psittacula krameri* on Tenerife.

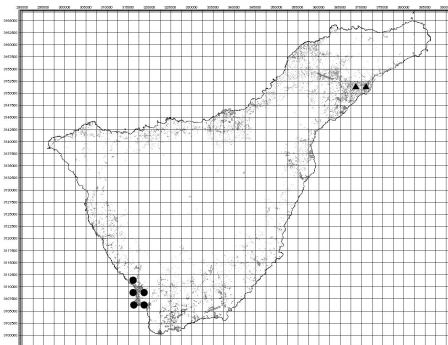


Figure 3. Distribution of Nanday Parakeet *Nandayus nenday* on Tenerife.

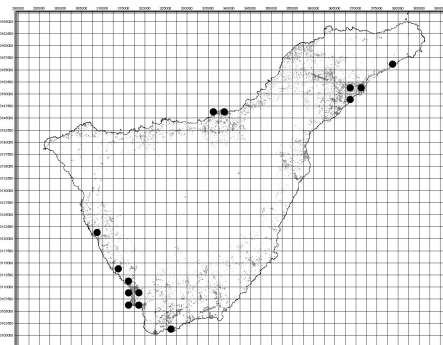


Figure 4. Distribution of Barbary Dove *Streptopelia roseogrisea* “risoria” on Tenerife.

Circle = apparently self-sustaining population; Triangle = observations of 1-5 individuals.

Table I. List of exotic, introduced (non-native) bird species on the island of Tenerife by different authors (x= introduced species; ?= origin/status not clear; N= breeding not confirmed; e= eradicated; E= extinct).

Order	Family	Scientific name	Common english name	Common spanish name	References											
					1	2	3	4	5	6	7	8	9	10	11	
Galliformes	Numidae	<i>Numida meleagris</i>	Helmeted Guineafowl	Pintada Común	x	x	x		x	x		x	x	x	E	
	Phasianidae	<i>Alectoris barbara</i>	Barbary Partridge	Perdiz Moruna	?	?			?	?		x	x	x	x	
Columbiformes	Columbidae	<i>Streptopelia roseogrisea</i>	Barbary Dove	Tórtola de Collar	x		x	x	x	x	x	x	x	x	x	
		<i>Streptopelia decaocto</i>	Collared Dove	Tórtola Turca			x		?	?		?	x			
Psittaciformes	Psittacidae	<i>Melopsittacus undulatus</i>	Budgerigar	Periquito Común			x		x	x		x	x	x	E	
		<i>Myiopsitta monachus</i>	Monk Parakeet	Cotorra Argentina			x	x	x	x	x	x	x	x	x	
		<i>Poicephalus senegalus</i>	Senegal Parrot	Lorito Senegalés			x		x	x		x	x	x	E	
		<i>Psittacula krameri</i>	Ring-necked Parakeet	Cotorra de Kramer		?	x	x	x	x	x	x	x	x	x	x
Passeriformes	Estrildidae	<i>Nandayus nenday</i>	Nanday Parakeet	Aratinga Ñanday											x	
		<i>Estrilda astrild</i>	Common Waxbill	Estrilda Común		N	N		N			E	N	N	E	
		<i>Estrilda melpoda</i>	Orange-cheeked Waxbill	Estrilda de Carita Naranja			N		N	x			x	N	E	E
		<i>Estrilda troglodytes</i>	Black-rumped Waxbill	Astrilda Culinegra			N		N				N	N		E
		Fringillidae	<i>Serinus serinus</i>	Serin	Verdecillo		?				?		?	?		
	Sturnidae	<i>Acridotheres tristis</i>	Common Myna	Miná Común			x	x	x	x	x	x	x	x	e	

* 1= (Martín, 1987), 2= (Moreno, 1988), 3= (Emmerson *et al.*, 1994), 4= (Garcia-del-Rey, 2000), 5= (Rodríguez Luengo 2001), 6= (Sánchez, 2002), 7= (Garcia-del-Rey, 2001), 8= (Martín & Lorenzo, 2001), 9= (Izquierdo *et al.*, 2004), 10= (Clarke, 2006), 11= this study.

detected during the present study and the population of Common Myna *Acridotheres tristis* (Sturnidae) was not longer present on the capital of Tenerife.

Therefore, at the present time, 5 introduced species (*Alectoris barbara*, *Streptopelia roseogrisea*, *Myiopsitta monachus*, *Psittacula krameri* and *Nandayus nenday*) belonging to 3 families (Phasianidae, Columbidae, Psittacidae) and 3 orders (Galliformes, Columbiformes and Psittaciformes) show self-sustaining populations on Tenerife. All species accidentally introduced (except *Alectoris barbara*, introduced for hunting purposes) also show a strong preference for urban habitats (see shaded areas on Fig. 1-4) and have never been formally recorded outside this anthropogenic habitat type.

DISCUSSION

The results of the present study suggest that the introduction process on Tenerife is mainly “accidental” (e.g. for Columbiformes and Psittaciformes) but there have been some voluntary introductions for recreational hunting (Galliformes). These three orders correspond also with most introductions on the Hawaiian islands (Moulton *et al.*, 2001). From the Galliformes introduced on the Canaries, Helmeted Guineafowl *Numida meleagris* has been introduced successfully in other Atlantic island archipelagos (e.g. Cape Verde Islands [Cape Verde Islands, Hazevoet (1995)], but for unknown reasons, this species has failed to become established on Tenerife, since first cited by Martín (1987). On the contrary Barbary Partridge *Alectoris barbara* is currently distributed on all main ecosystems on this island since first introduced in the 15th century (Rodríguez Luengo 2001). According to Moulton *et al.* (2001) these two species did not succeed on the archipelago of Hawaii.

When compared to Hawaii, the non-native Columbiformes are well underrepresented on Tenerife (1 vs 4 species) but the Psittaciformes have long (*c.* 12 years) been established on this island (see Table I). From the Psittacidae, Budgerigar *Melopsittacus undulatus* and Senegal Parrot *Poicephalus senegalus* have failed, despite the huge numbers imported every year (e.g. 2500 Budgerigars from 2004-2006, Victor Falcon-Perera *in litt*). However, both Monk *Myiopsitta monachus* and Ring-necked Parakeets *Psittacula krameri* have self-sustaining populations on Tenerife since first cited in the early 1990s (Emmerson *et al.*, 1994). A new addition to the list is Nanday Parakeet *Nandayus nenday* found in the south of Tenerife with a colony of around 60 birds (E. Garcia-del-Rey unpublished data). This species was first cited to breed in the Canaries by Heinzel *et al.* (1995).

My results suggest that all these exotic avifauna have maintained their self-sustaining populations near urbanized areas, particularly occupying parks and gardens of coastal cities and tourist resorts (pers. obs. & this study), a suboptimal habitat type for the parakeets (Del Hoyo *et al.*, 1997). A total of 35 Ring-necked Parakeets were ringed by EGDR on Tenerife during 2003-2006 and all showed extremely low weights suggesting that these were suffering from severe food constraints (Sociedad Ornitológica Canaria unpublished data). Both Monk *Myiopsitta monachus* and Nanday Parakeets *Nandayus nenday* have failed on Hawaii (Moulton *et al.*, 2001). Therefore, the parrots (Psittacidae) are the most successful taxa introduced on Tenerife. It has not been quantified yet if any of these exotic species can compete or even threaten the native flora and fauna in both nonnative and native habitats of Tenerife.

Elsewhere (e.g. Hawaii) it has been found that passerine species have a higher success rate of introduction than nonpasserine orders (e.g. Galliformes, Columbiformes and Psittaciformes) but this pattern was not observed on Tenerife. My results suggest that passerines (i.e. Passeriformes) tend to fail on Tenerife (with the exception of Common Myna *Acridotheres tristis*, well established in Hawaii but eradicated from Tenerife at the beginning of this century). Even other natural passerine colonisations to Tenerife, as Serin *Serinus serinus* and Starling *Sturnus vulgaris*, have failed to expand their ranges (Garcia-del-Rey, 2001) since first established on the island. For example, all the Estrildidae (3 different species) recorded for Tenerife (Emmerson *et al.*, 1994) have failed to establish self-sustaining populations since records began (Moreno, 1988). On the contrary the Estrildidae are represented by the Common Waxbill on Gran Canaria (Canary Islands), Santiago (Cape Verde) and O'ahu (Hawaii). Only 1 out of the 37 species of Passeriformes cited in Martín & Lorenzo (2001) has been found to breed on several years on Tenerife (i.e. Red-whiskered Bulbul *Pycnonotus jocosus*, Beatriz Fariña pers. comm.) in the last two decades. The reasons why this pattern is observed on Tenerife merit further research.

As the list of exotic/invasive species to Tenerife has decreased from 9 to 5 since 1988, so has the risk of any of these species to colonize native areas of this island (a 56% decrease in the last 20 years). In these two decades there have been no Galliformes introductions on Tenerife but many parrots and parakeets do escape from captivity every year from many different locations (e.g. zoos, private collections, etc.). As the anthropogenic habitats of coastal Tenerife increases rapidly in size, with so much uncontrolled development (Fernandez-Palacios *et al.*, 2004), so might the number and species of parrots and parakeets and their effects on native species. Therefore, special attention should be kept to the Psittaciformes and more quantitative data should be collected (e.g. how many birds are seen at a particular date, when are they first seen, what type of habitat are they found to occupy, have they been able to breed, etc.).

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