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## **Population size and status of Common Raven (*Corvus corax*) on the central-western islands of the Canarian archipelago**

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SIVERIO, M., E. I. GONZÁLEZ & F. SIVERIO (2010). Tamaño de la población y estatus del cuervo (*Corvus corax*) en las islas centro-occidentales del archipiélago canario. *VIERAEA* 38: 123-132.

**RESUMEN:** Durante la estación reproductora de 2009 (febrero-junio) se ha estudiado el tamaño de la población de cuervo en cuatro islas del archipiélago canario. En total fueron censadas 44 parejas: diez en Gran Canaria, 12 en Tenerife, 17 en La Palma y cinco en La Gomera. La mayoría de estas parejas tienen sus territorios en barrancos, roquedos y acantilados marinos, coincidiendo con enclaves donde aún existe actividad ganadera (rebaños de cabras y ovejas) o cabras asilvestradas. Es muy probable que el tamaño de la población flotante no supere al de las aves reproductoras. Se discuten las amenazas reales y potenciales.

**Palabras clave:** *Corvus corax*, censo, distribución, conservación, islas centro-occidentales, archipiélago canario.

**ABSTRACT:** During the 2009 breeding season (February-June) we studied the population size of Common Raven on four islands of the Canarian archipelago. A total of 44 pairs were censused: ten in Gran Canaria, 12 in Tenerife, 17 in La Palma and five in La Gomera. Most of these pairs have their territories in ravines, gullies and sea cliffs, coinciding with or close to areas where livestock is still being raised (herds of goats and sheep) or presence of feral goats. The size of the floating population is unlikely to exceed that of the breeding birds. We also discuss real and potential threats.

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Key words: *Corvus corax*, census, distribution, conservation, central-western islands, Canarian archipelago.

## INTRODUCTION

The distribution of Common Raven (*Corvus corax*) in the Canary Islands includes all islands and the islets of Alegranza, Montaña Clara and La Graciosa (Nogales & Nieves, 2007). During the nineteenth century and early decades of the twentieth this species was very abundant, but it seems that since then a number of factors (reduction of livestock, uncontrolled use of pesticides, establishment of monocultivations, etc.) have negatively affected its population dynamics (Nogales, 1992). Today, various studies reveal its decline on some islands (Carrascal & Palomino, 2005; Carrascal *et al.*, 2008; Nogales & Nieves, 2007; Siverio *et al.*, 2007), and its conservation status (IUCN) is “In Danger” (Barone, 2004). The aim of this paper is to update the information on the population size of the Common Raven on the islands where a more unfavorable status has been previously assumed, compare the results with those of previous studies and discuss the probable factors of threat.

## STUDY AREA AND METHODS

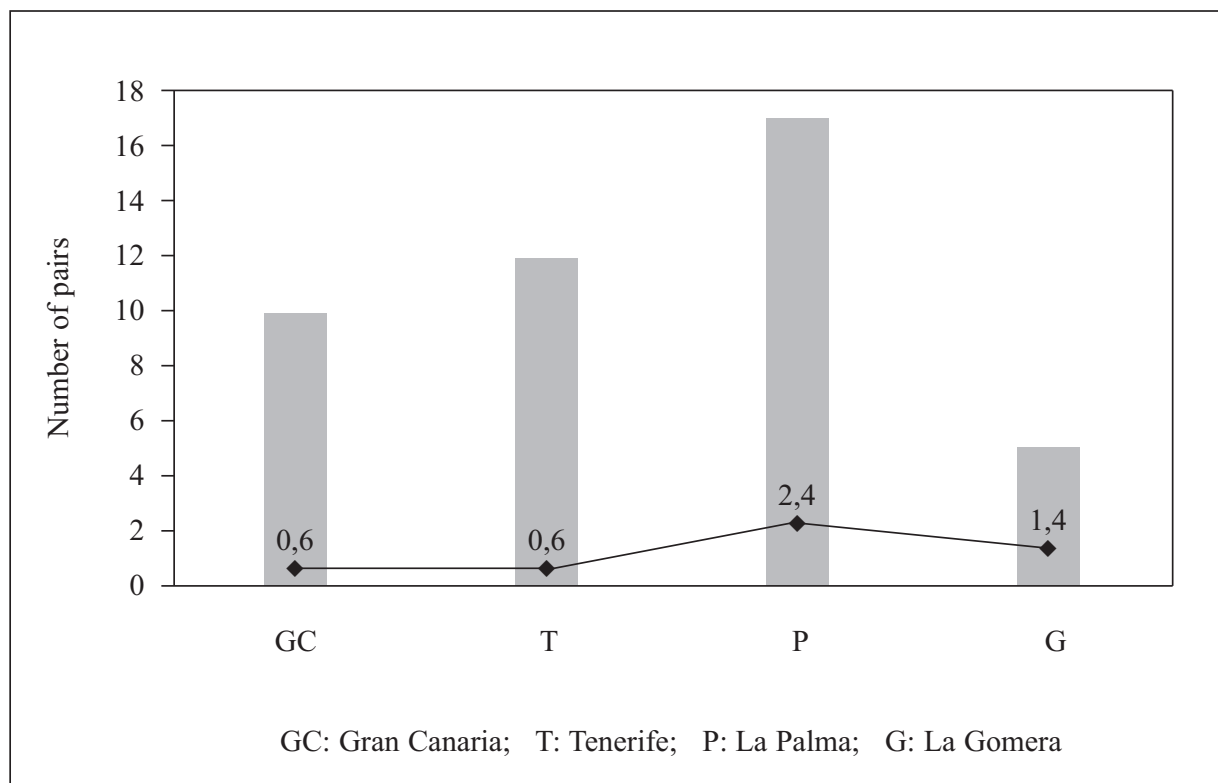
The study area is limited to four of the seven islands of the Canarian archipelago (27°-29° N and 13°-18°W), two located in the central sector (Gran Canaria and Tenerife, with 1,655 and 2,034 km<sup>2</sup>, respectively) and two in the West (La Palma and La Gomera, with 708 and 370 km<sup>2</sup>).

The fieldwork was carried out between February and June 2009, which months cover the breeding season (Nogales, 1995; Siverio *et al.*, 2007). This consisted in a network of observation points (OP) in ravines, inland and marine cliffs, etc., which are the habitats chosen by Common Ravens to build their nests (Nogales, 1994 and 1995; Siverio *et al.*, 2007). The average time (in minutes) spent on each OP was  $48 \pm 2$  SE (Gran Canaria,  $n = 50$ ),  $87 \pm 13$  SE (Tenerife,  $n = 42$ ),  $48 \pm 14$  SE (La Palma,  $n = 67$ ) and  $58 \pm 4$  SE (La Gomera,  $n = 60$ ). When one or two birds showing territorial behavior were observed (courtship, slide towards a cliff, harassment towards other species or conspecifics, etc.) from a considerable distance ( $\sim 1$  km), or from an angle that did not allow us to see all the surroundings, we surveyed the area in question with much more intensity. Thus, breeding territories were established on the basis of: i) direct observation of nests, ii) adult with nest material or food entering a particular site in the rock-wall, iii) listening to chicks still unable to fly, and iv) observation of chicks making their first flights. The material used was the typical in these studies: telescope, binoculars, GPS receiver and mapping (scale 1: 25.000).

## RESULTS

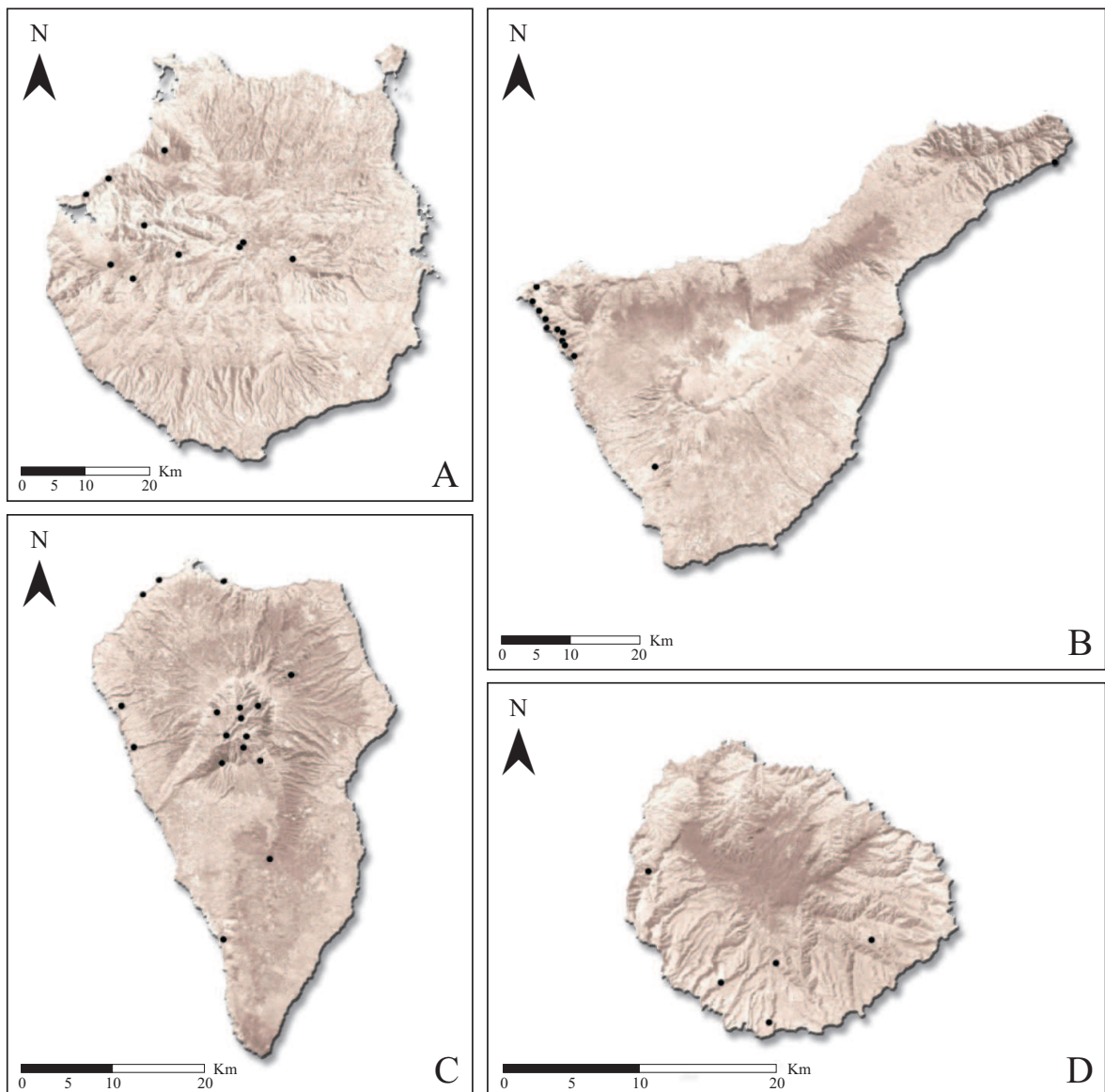
**Population size and distribution**

In the four islands we censused a minimum of 44 territorial pairs of Common Ravens (Figure 1). The density was very low and only slightly exceeded two pairs/100 km<sup>2</sup> on the island of La Palma (Figure 1), although in two specific areas, the Parque Rural de Teno (area: 80.63 km<sup>2</sup>; Tenerife) and Parque Nacional de la Caldera de Taburiente (area: 46.9 km<sup>2</sup>; La Palma), the density found can be regarded as moderate (12.4 pairs/100 km<sup>2</sup>) and high (19.2 pairs/100 km<sup>2</sup>), respectively.



**Figure 1.** Number of territorial pairs (columns) and density (line; pairs/100 km<sup>2</sup>) of Common Ravens (*Corvus corax*) on the four islands studied (2009).

In Gran Canaria the distribution includes the central and western sectors of the island (Figure 2A). Except for a nest that was not observed, two were located in coastal cliffs and the rest in ravines and inland rock-walls in the vicinity of pine tree forest of *Pinus canariensis*. In Tenerife, the territories were found in the most rugged massifs of the island: Teno, NW; Anaga, NE; and Adeje, SW (Figure 2B). Save for the pair of Adeje, whose nest is situated in a ravine wall which is nearly 5 km from the coast, the rest had their nests on sea cliffs or in nearby ravine walls. The distribution in La Palma was more homogeneous, since territories were located in the centre, north, south and west sectors



**Figure 2.** Relative distribution of Common Raven (*Corvus corax*) pairs on the islands of Gran Canaria (A), Tenerife (B), La Palma, (C) and La Gomera (D).

(Figure 2C). The nests were placed on sea cliffs, ravine walls, inland rock-walls (P. N. de la Caldera de Taburiente) and at least two in Canary Pine Tree. In La Gomera, all pairs were settled in ravines located in the Eastern, Southern and Western sides of the island (Figure 2D).

On each of the islands, almost all the territories are situated within pasture zones (grazing of goats and sheep) or zones where feral goats (*Capra hircus*) still exist: 90% in Gran Canaria, 91% in Tenerife, 35.3% in La Palma, and 100% in La Gomera. By pooling the data we found a significant association between the nests and the presence of livestock in a 4 km radius ( $\chi^2_1 = 7,38$ ;  $P = 0,006$ ).

### Non-breeding population

In general, sightings of the non-breeding population took place in enclaves that are relatively far from the breeding territories, and their number ranged from one to 11 birds (Annex 1). Most of the sightings were made at recreational and camping areas, or in their surroundings (2.5 km radius), as well as other sites where birds could also find anthropogenic food resources readily available (Annex 1).

## DISCUSSION

### Population size and distribution

With the exception of Tenerife (Martín, 1987; Barone *et al.*, 2001), the estimates of the number of pairs of Common Ravens that had been made on the islands comprised in this study were based on the observation of individuals (Nogales, 1992; Nogales & Nieves, 2007), i.e., without differentiating between breeding birds and floating population. However, it is clear that the population has experienced a sharp regression in the last 25 years. So, with variations depending on the island and period, the population has declined between 32-43% and 95% (Table 1).

Period	Island	Number of pairs	Source	Current decrease (%)
1997-03	GC	20-25	Nogales & Nieves (2007)	50-60
1980 <sup>a</sup>	T	70-80	Martín (1987)	83-85
1997-03	P	20-25	Nogales & Nieves (2007)	32-43
1980 <sup>a</sup>	G	100	Nogales (1992)	95

**Table 1.** Estimated reduction in the number of pairs of Common Raven (*Corvus corax*) on the central-western islands of the Canarian archipelago calculated on the basis of previous studies and current results. <sup>a</sup>Decade. GC: Gran Canaria; T: Tenerife; P: La Palma; G: La Gomera.

It is probable that in the course of the present study some pairs may have gone unnoticed in Gran Canaria ( $\leq 4$ ), especially in the steep ravines of the Southwest, where difficult access to OP hindered their repetition. Also in La Palma and La Gomera a similar number of pairs could have gone unnoticed. In fact, in La Gomera two pairs, of which we confirmed breeding in 2008, were not observed during this study period: one in the coastal cliffs of Alajeró (pers. obs.) and another in Teguerquenche, Valle Gran Rey (G. Bethencourt & Ó. M. Afonso, pers. comm.). In Tenerife, on the contrary, the data of our survey are more accurate, specially considering that 321 OP were carried out, without success in the detection of established pairs, during the same period by R. Barone (*in litt.*) on Parque Natural de la Corona Forestal (forest area surrounding the centre of the island).

The distribution of Common Raven populations, or higher densities of these, is in many cases associated with areas where cattle herding generates various trophic resources (Dare, 1986; Nogales, 1994; Ratcliffe, 1997; Delestrade, 2002; Siverio *et al.*, 2007, among others). In this study, many of the breeding territories are located in areas where shepherding activities are developed. One of the clearest examples is seen in Teno (Tenerife), where, besides the high availability of sites to nest building, the herding of goats and sheep is still almost traditional, and the number of Common Raven pairs has increased in recent years (Siverio *et al.*, 2007; this study). However, despite the absence of livestock, the density found in P. N. de la Caldera de Taburiente (La Palma) was very high (19.2 pairs/100 km<sup>2</sup>), presumably due to the regular presence of carrion, which is a consequence of the trapping program, currently taking place, of the Barbary Sheep (*Ammotragus lervia*) introduced in 1972. Between 1992 and 1994, there were two pairs of Common Raven less in this national park (Delgado, 2004), and the current density is comparable to that of sectors of Corsica with higher densities (17 and 20 pairs/100 km<sup>2</sup>; Delestrade, 2002). Apart from these areas, some pairs have also been found in Gran Canaria and La Palma nesting near recreational and camping areas, as well as sites of touristic interest, where they can get food (generated waste). The proximity between nests and these anthropogenic food sources can be related to the physiological costs of foraging, to a higher rate of food supply and to an increased watch of the territory (Webb *et al.*, 2004).

### **Non-breeding population**

The non-breeding population is composed mostly of young birds, which do not defend territory, and during the autumn-winter period form flocks that disperse during spring and summer (Ratcliffe, 1997). These individuals, with a marked opportunistic behaviour, often take advantage of food resources provided by dumps (Restani *et al.*, 2001; Delestrade, 2002; Sara & Busalacchi, 2003; Rösner *et al.*, 2005). However, during this study we did not observe Common Ravens, neither breeders nor floaters, at the insular dumps, although in the recent past they were often seen at the uncontrolled ones (Martín, 1987; Nogales, 1992; pers. obs.). In some modern dumps the huge concentrations of Yellow-legged Gulls (*Larus michahellis*) may limit the presence of Common Ravens. Nowadays, recreational and camping areas, especially those located in pine forests, are the places where immature often gather to feed on food scraps left by humans (Siverio *et al.*, 2007, this study). In higher numbers, but for the same purpose, concentrations of Common Ravens and other corvids have also been documented in recreational areas of the German Alps (Storch & Leidenberger, 2003).

The size of the non-breeding population can be roughly estimated taking into account the average productivity (2.33) known for Tenerife (Siverio *et al.*, 2007) and a mortality rate of 47% in the first year and somewhat lower in the following (see Ratcliffe, 1997 for the British Isles). Thus, during the breeding season the floating population in Gran Canaria could be composed by about 23 birds, by 30 in Tenerife, by 40 in La Palma, and by 13 in La Gomera. However, juvenile mortality appears to be much higher in our study area than indicated by Ratcliffe (1997), since otherwise the number of territorial pairs would be greater. That is, very few ravens reach reproductive age (three years old; Ratcliffe, 1997) and many of those that do, probably mate with widowed individuals (Siverio *et al.*, 2007).

## Threats and conservation

Despite not knowing the exact number of factors involved in juvenile and adult mortality and the degree of their incidence, these could be impeding the growth of the scarce raven populations of the islands. In this sense, many of the threats identified in the past (Nogales, 1992) still occur, as is the case of reduced food resources, the impact of power lines, the use of toxic substances, poaching and habitat loss, among others (Barone, 2004; Lorenzo & Ginovés, 2007; Nogales & Nieves, 2007). In fact, during this study, in a protected natural area of Tenerife we found several plastic bags of rodenticide placed out of control, while in La Gomera we found a dead Common Raven possibly due to the ingestion of some kind of poison. Similarly, illegal hunting also was confirmed: a wounded bird by shooting in Gran Canaria after the breeding season of 2009 (CRFS-Tafira/Cabildo Insular de Gran Canaria, pers. comm.). In general, as suggested by studies that deal with mortality, birds killed by shooting or poisoning are hard to find because they can be hidden by the offenders or by the rugged habitat (González *et al.*, 2007; Margalida *et al.*, 2008). Moreover, taking into account the scavenging habits of ravens, lead poisoning may be a fact when they feed on animals that have been killed and uncollected by hunters or from those left in the field, as is the case of Barbary Sheep carcasses in the P. N. de la Caldera de Taburiente. This type of poisoning has been detected in the Egyptian Vulture (*Neophron percnopterus*) population in Fuerteventura (Gangoso *et al.*, 2009), and precisely with the Common Raven in other regions (Craighead & Bedrosian, 2008). Lead exposure could be sub-lethal, but affects the body's systems of many species, causing physiological, biochemical and behavioral changes (Fisher *et al.*, 2006 and references therein). On the other hand, the master plans of use and management (PRUG) of some natural protected areas consider the eradication of feral goats or a limitation of grazing. Such action, aimed mainly at the recovery of endemic and endangered flora species, could be counter-productive to the scanty Common Raven populations, presumably because the carcasses of these ungulates have replaced in the food chain those of native species (e.g. sea birds), which are now extinct or more limited (see Gangoso *et al.*, 2006).

The recovery of the raven populations of the islands should include studies on their biology and ecology to help understand their dynamics, as well as the initiation of a supplementary feeding points program, SFP (see Siverio *et al.*, 2007). The SFP should be considered especially if the eradication of feral goats or a grazing control in protected natural areas is carried out. In other species of scavengers, SFP has increased the survival rate of non-breeders due to the decline in poisonings (Oro *et al.*, 2008). However, in the concrete case of territorial pairs, it is appropriate that supplementary feeding should be, a priori, set up by territory if a productivity decrease is noticed (see González *et al.*, 2006). Finally, awareness campaigns aimed at mitigating the use of poisons and poaching should be addressed to farmers and hunters.

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Date	Locality	Island	IFR	Flock size
03/04/2009	Pico de Las Nieves	GC	b	10
04/04/2009*	Finca de Tirma	GC	c	10
30/04/2009	Degollada del Humo	GC	a	6
30/04/2009	Moriscos	GC	-	5
14/02/2009	Santiago del Teide	T	a	10
24/02/2009	Degollada de Cherfe	T	b	11
28/03/2009	Las Lajas	T	a	1
07/04/2009*	Montaña de Guaza	T	c	3
19/04/2009*	El Jaral	T	c	1
19/04/2009**	El Contador	T	a	2
18/05/2009	Chío	T	a	8
02/06/2009	Chó Pancho	T	a	2
18/03/2009***	Puntagorda	P	c	11
13/05/2009	Barranco de Garome	P	b	2
07/06/2009	Taguluche	G	c	3

**Annex 1.** Relevant observations of non-breeding Common Ravens (*Corvus corax*) on the studied islands (GC: Gran Canaria, T: Tenerife, P: La Palma, G: La Gomera) and its coincidence with human infrastructure that generate potential food resources (IFR): a) recreational or camping area; b) tourist vantage point; and c) goats or poultry farm. \* J. J. Hernández (pers. comm.) \*\* J. Martín (pers. comm.) \*\*\* F. M. Medina (pers. comm.).