

## STATUS AND DISTRIBUTION OF BREEDING SEABIRDS IN THE NORTHERN ISLETS OF LANZAROTE, CANARY ISLANDS

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Rodríguez B., de León L., Martín A., Alonso J. & Nogales M. 2003. Status and distribution of breeding seabirds in the northern islets of Lanzarote, Canary Islands. *Atlantic Seabirds* 5(2): 41-56. *We describe the results of a survey of breeding seabirds carried out between 2000 and 2002 in the northern islets of Lanzarote, Canary Islands, with particular emphasis on their status and distribution. For White-faced Storm-petrel Pelagodroma marina, Madeiran Storm-petrel Oceanodroma castro, Lesser Black-backed Gull Larus [fuscus] graellsii and Yellow-legged Gull Larus cachinnans atlantis, some new colonies were discovered on different islets. All species have maintained their numbers over the last 15 years, with the exception of the Yellow-legged Gull, which has undergone a well-documented increase; in 1987, about 400 breeding pairs were estimated but during the present study, almost 1000 pairs were counted. In addition, some comments on threats to these seabird populations are presented. On La Graciosa, feral cats are a major predator of the European Storm-petrel population, killing more than 50 birds during this study alone.*

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### INTRODUCTION

The most important sites for seabirds in the Canarian archipelago are small uninhabited rocks or islets, generally where no introduced predators are present, such as Roques de Salmor (El Hierro), Roques de Anaga (Tenerife), Isla de Lobos (Fuerteventura) and especially the northern islets of Lanzarote (known as the Chinijo Archipelago; Martín & Hernández 1985; Martín & Nogales 1993; Martín & Lorenzo 2001). On the islets of Lanzarote, eight seabird species regularly breed: Bulwer's Petrel *Bulweria bulwerii*, Cory's Shearwater *Calonectris diomedea borealis*<sup>1</sup>, Little Shearwater *Puffinus assimilis*, White-faced Storm-petrel *Pelagodroma marina*, European Storm-petrel *Hydrobates pelagicus*, Madeiran Storm-petrel *Oceanodroma castro*, Lesser Black-backed Gull *Larus fuscus graellsii*<sup>2</sup> and Yellow-legged Gull *Larus cachinnans atlantis*<sup>3</sup>

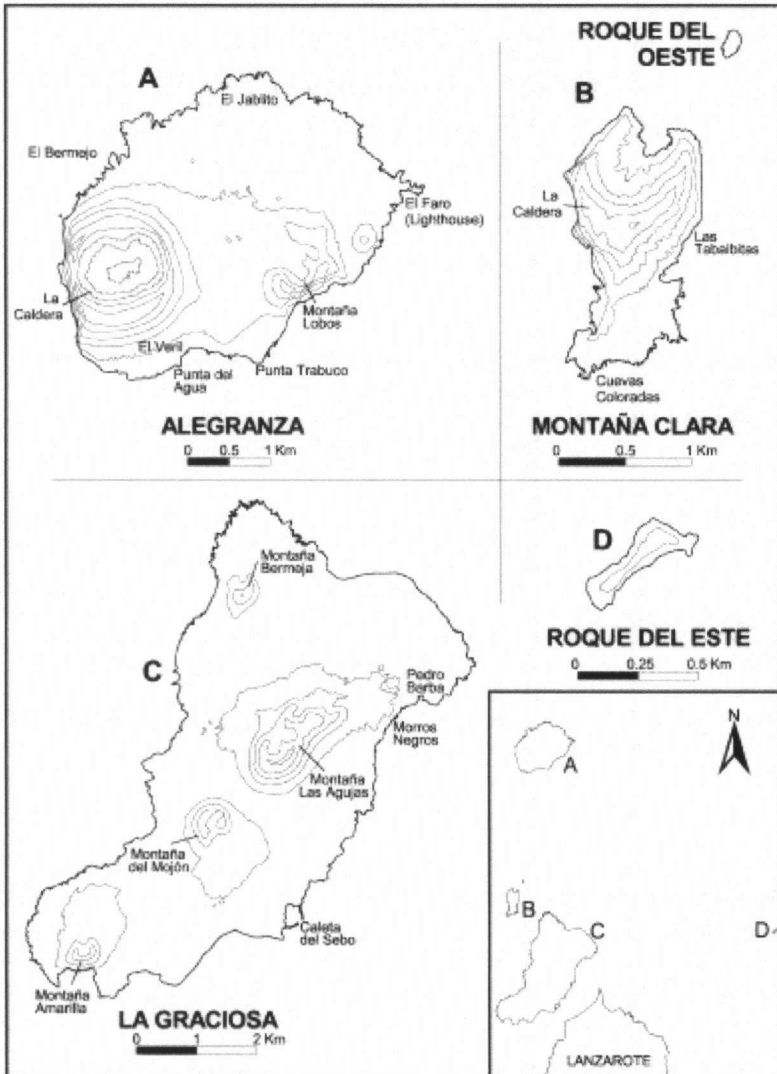


Figure 1. Maps of the northern islets of Lanzarote, Canary Islands, showing the locations of place names mentioned in the text .

Figuur 1. Ligging van de eilandjes ten noorden van Lanzarote (Canarische Eilanden), inclusief de namen van de plaatsen die in de tekst genoemd worden.

The Procellariiformes colonies present in the Chinijo Archipelago are of national importance and include the only extant colony of the White-faced Storm-petrel (Viada 1998; Martín & Lorenzo 2001; Martí & Del Moral 2003). Furthermore, the only Spanish colonies of Bulwer's Petrel, Little Shearwater and Madeiran Storm-petrel occur in the Canaries (Martí & Del Moral 2003). The breeding populations of Cory's Shearwater in this small archipelago represent at least 10% of the whole Macaronesian population (Granadeiro *et al.* 1997). The only known colonies of the European Storm-petrel in the Macaronesian archipelagos are located in the Canaries, and 34% of this population breeds in the Chinijo archipelago (Nogales *et al.* 1993).

Historically in La Graciosa, the extinct shearwater *Puffinus holeae* bred 25 000 years ago; this was a medium sized shearwater that nested in the eastern Canary Islands (Walker *et al.* 1990; Alcover & McMinn 1995). According to Torriani (1978), on the shearwater harvest, it is possible that this species survived on La Graciosa until the 16<sup>th</sup> century (Martín & Lorenzo 2001).

The importance of the Chinijo Archipelago for seabirds was first noted by Bannerman (1914a,b), who carried out an expedition with the principal aim of exploring these little-known islets and studying their birds. More recently, Lovegrove (1971) also provided new data on the distribution and abundance of seabirds.

The most recent available information on the status and distribution of the breeding seabirds on the Chinijo Archipelago was obtained from an extensive census carried out in the Canarian Archipelago during 1987 (Martín *et al.* 1987; Hernández *et al.* 1990; Delgado *et al.* 1992; Nogales *et al.* 1993). This paper reports the results of seabird surveys in these islets over a two year period (2000-2002); updated information of the status and distribution of the seabirds is presented.

## METHODS

**Study area** The Canary Islands constitute a volcanic archipelago (27°37'-29°25'N, 13°20'-18°10'W) that is located 100 km off the Atlantic coast of north-west Africa. It comprises seven major islands and some small islets and rocks. The northern archipelago of Lanzarote consists of three islets and two small rocks: La Graciosa (with an area of 27 km<sup>2</sup> and 266 m altitude), Montaña Clara (1.3 km<sup>2</sup> and 256 m), Alegranza (10.2 km<sup>2</sup> and 289 m), Roque del Este (0.06 km<sup>2</sup> and 84 m) and Roque del Oeste (0.01 km<sup>2</sup> and 41 m; Martín & Lorenzo 2001; Fig. 1). The coastline is predominantly rocky with boulder shore, and cliffs up to 200 m. In some areas of La Graciosa, sandy beaches occur, formed by the accumulation of marine deposits. The climate is subtropical and oceanic. Oceanographic conditions in this archipelago are influenced by marine

*Table 1. Total length of coastline, length of coastline surveyed (i.e. of suitable potential habitat) and proportion of the total suitable habitat surveyed for each islet of the Chinijo Archipelago.*

*Tabel 1. Totale lengte van de kustlijn, lengte van geïnventariseerde kustlijn (i.e. potentieel broedhabitat) en aandeel van de potentiële broedhabitat van ieder eilandje in de Chinijo Archipel.*

Islet	Total length of coastline (km)	Length (km) and proportion (%) of suitable coastline surveyed
Roque del Este	1.4	1.4 (100)
Alegranza	20	18.7 (93)
Roque del Oeste	0.6	0.6 (100)
Montaña Clara	8.9	6.6 (74)
La Graciosa	37.5	37.5 (100)

upwelling that occurs off the north-west African coast. All islets are now uninhabited, except La Graciosa where approximately 650 people live (most of them employed in fishing). This archipelago, together with "Riscos de Famara" (Lanzarote), constitutes a natural park, harbouring several endemic plant and animal species. The xeric vegetation is dominated by some shrub species (see Kunkel 1971; Marrero 1991).

**Survey methods** Fieldwork was carried out from July 2000 to July 2002 in three distinct periods, coinciding with egg-laying to the unfledged young period of each target species (autumn for Madeiran Storm-petrel; spring for Little Shearwater, White-faced Storm-petrel and Yellow-legged Gull; and summer for Bulwer's Petrel, Cory's Shearwater, European Storm-petrel and Lesser Black-backed Gull).

All the islets are small enough to allow a complete survey of all suitable habitats for each species. In general, the most suitable breeding habitat for Procellariiformes comprises rocky coasts, volcanic caves, boulder beaches, volcanic badlands, dry stone walls, terrain plains (mainly for Cory's Shearwater) and sandy areas (especially for White-faced Storm-petrel). All potential coastal sectors for each target species were surveyed in the different islets (Table 1). Interior areas were surveyed by three to 10 observers, following line transects 50 m apart in all suitable areas, for Bulwer's Petrel and Cory's Shearwater burrows, and also for counting gull nests.

In the case of the Procellariiformes, only burrows with signs of occupation were counted (i.e. containing faeces, tracks, odour, eggshells, etc.), flashlights being used to inspect the insides of burrows. It is difficult to estimate exactly the number of breeding pairs in a colony, since only a fraction of the

breeding birds are detected. Some burrows may go unnoticed and others are occupied by immature pre-breeders that merely visit the colonies. Furthermore, certainly for the Cory's Shearwater, more than one pair might breed in many of the burrows or caves. In order to estimate their populations, therefore, burrows were classified in three different types with respect to their occupation, following the method employed by Martín *et al.* (1991) in Alegranza.

Due to the methodological problems and the limitations mentioned, we made only crude estimates of the sizes of Procellariiform populations. These were obtained by a combination of direct nest counts (all species) and captures in mist nets (small Procellariiformes), entrance control burrows (Cory's Shearwater) or by nocturnal listening (Little Shearwater and Madeiran Storm-petrel).

For the small Procellariiformes, mist netting (using 9 m nets) began just after nightfall. The duration of these sessions lasted between 2 and 3 hours, and repeated at least twice in each colony. All birds captured were ringed, but the small sample size did not allow us to use capture-recapture methods for estimating colony sizes.

Nocturnal listening (mainly on moonless nights) at potential sites for Little Shearwater and Madeiran Storm-petrel was carried out by between two and 10 fieldworkers. In areas where a nest was found, breeding was assumed when regular nocturnal activity was recorded and estimates were made based on the intensity of birds calling in flight. Calling rate and abundance range of Little Shearwater followed the estimation method applied by Monteiro *et al.* (1999). In the case of the Madeiran Storm-petrel, calling rate and maximum number of captured birds in selected colonies was used to estimate the total number of birds. For the small population of the White-faced Storm-petrel, an endoscope was employed to explore the interior of burrows excavated in sandy areas.

Due to the ease of detecting gull colonies, situated mainly on the slopes of the mountains, these areas were carefully censused. Whenever possible, gull nests were counted individually but at inaccessible places, binoculars were used to estimate the number of pairs based on breeding behaviour of the adults.

## RESULTS AND DISCUSSION

Results are presented for each species in turn and for each islet. Table 2 summarises population size estimates made over the previous three decades.

**Bulwer's Petrel** With the exceptions of Fuerteventura and Gran Canaria, where no precise data exist, this small Procellariiforme breeds in all other Canary Islands. The overall estimate of the whole Canarian population

Table 2. Estimated number of breeding pairs of each seabird species in the northern islets of Lanzarote, 2000-2002 (this study) and in recent decades.

Tabel 2. Schatting van het aantal broedpaar per soort op de eilandjes ten noorden van Lanzarote in 2000-2002 (deze studie), vergeleken met de afgelopen decennia.

Species	Roque del Este	Alegranza	Roque del Oeste	Montaña Clara	La Graciosa
<b>Bulwer's Petrel</b>					
Lovegrove (1971)	-	-	-	c. 100	-
Hernández <i>et al.</i> (1990)*	-	75-100	10	>100	-
Concepción (1992)	-	100-130	-	>100	-
PRESENT STUDY	-	150-200	10	100-130	5?
<b>Cory's Shearwater</b>					
le Grand <i>et al.</i> (1984)	10-15	-	-	-	-
Martin <i>et al.</i> (1987)	<50	-	25	1000	c. 160
Martin <i>et al.</i> (1991)*	-	8000-10 000	-	-	-
Concepción (1992)	8-10	9000-12 000	3-4	600-800	50
PRESENT STUDY	50	10 000-12 000	25	1000-1500	300
<b>Little Shearwater</b>					
Martin & Lorenzo (2001)*	-	some pairs	-	<50	-
PRESENT STUDY	-	10?	-	20-50	-
<b>White-faced Storm-petrel</b>					
Martin <i>et al.</i> (1989)*	-	-	-	10	-
PRESENT STUDY	-	10-15	-	30-40	?
<b>European Storm-petrel</b>					
Delgado <i>et al.</i> (1985)	<10	>100	-	c. 50	1
Nogales <i>et al.</i> (1993)*	20-30	hundreds	20-30	>100	-
PRESENT STUDY	20-30	200-300	10	100	10-20
<b>Madeiran Storm-petrel</b>					
Delgado <i>et al.</i> (1989)*	-	some pairs	-	some tens	-
Concepción (1992)	1	50-70	-	20-40	-
PRESENT STUDY	5	50-100	10	50-70	?
<b>Lesse Black-backed Gull</b>					
Grande & Palacios (2002)	-	>5	-	-	-
PRESENT STUDY	-	10	-	5	-
<b>Yellow-legged Gull</b>					
Lovegrove (1971)	c. 20	-	-	c. 20	-
le Grand <i>et al.</i> (1984)	15-20	-	-	-	-
Delgado <i>et al.</i> (1992)*	35-40	35-41	1	235-245	-
PRESENT STUDY	20	200	-	800	10-20

\* data refer to 1987

is about 1000 pairs (Hernández *et al.* 1990), representing 13% of the total population of the Macaronesian archipelagos (Zino *et al.* 1994).

*Alegranza* A total of 143 burrows was counted, located mainly in the north of the islet. The largest colony is situated near El Bermejo (Fig. 1): Some pairs occasionally breed in burrows excavated by the White-faced Storm-petrel (as occurs in Montaña Clara) and usually breed on "badlands" situated centrally. Although our data do not allow us to determine the precise population, it is possible that there are about 150-200 pairs.

*Roque del Oeste* Only seven occupied nests were located and the total population is probably not more than 10 pairs; this accords with the data of Hernández *et al.* (1990) (Table 2).

*Montaña Clara* The species breeds widespread but mainly in Cuevas Coloradas and north-west rocky areas of the interior of La Caldera. A total of 99 burrows with breeding evidence was counted, but the actual size of the population is greater (Table 2).

*La Graciosa* The species seems to be very scarce here, and was detected only by the presence of wing and feather remains, probably a consequence of feral cat predation. These were observed in three different sites (only one with breeding evidence) on the west coast between Montaña Amarilla and Montaña Bermeja.

**Cory's Shearwater** This is the most common seabird in the Canary Islands with a total estimated population of more than 30 000 breeding pairs (Le Grand *et al.* 1984; Martín & Lorenzo 2001). The Alegranza colony is the largest in the Canaries with more than 10 000 pairs (Martín *et al.* 1991; Table 2) and one of the most important in the world together with Selvagem Grande, Zembra Island, and some islands of the Azores archipelago (Monteiro *et al.* 1996; Mougín *et al.* 1996; Thibault 1993). It is important to highlight the recovery of eight birds in Alegranza, some of them nesting, originally ringed in Selvagem Grande (Martín & Lorenzo 2001; *pers. obs.*), indicating a link between these colonies.

*Roque del Este* This site was thoroughly searched and the minimum population is 47 pairs. In a census carried out in 1987, only 31 occupied burrows were located, and a total of no more than 50 pairs were estimated (Martín *et al.* 1987).

*Alegranza* Although the species breeds widespreadly, the most significant concentrations are located along the north coast and the southern part between El Veril and Punta Trabuco. A total of 6 308 apparently occupied burrows was counted, but given that at least 37 individuals birds entered a single burrow in one night, the true population size might be around 10 000-12 000 pairs.

*Roque del Oeste* This site was accurately surveyed; 25 pairs were located.

*Montaña Clara* The species breeds widely here, although the main population is located in the interior of La Caldera and close to Cuevas Coloradas. A total of 917 occupied burrows was counted; in some of them (situated in Cuevas Coloradas), up to 53 individuals were observed entering. The population can be estimated at 1 000-1 500 pairs.

*La Graciosa* Currently, some individuals are still killed and consumed by local people. Despite the surface of the islet, only 290 occupied burrows were counted. The main colonies are situated in Montaña Amarilla, Montaña de las Agujas, Montaña del Mojón and Morros Negros. The total population is about 300 pairs.

**Little Shearwater** Although there are signs of the presence of this poorly known species in all the Canary Islands, the only breeding records exist on Alegranza, Montaña Clara, Lanzarote, Tenerife and La Gomera; the population was estimated at around 400 pairs in 1987 (Martín & Lorenzo 2001).

*Alegranza* The species occurs in two different places: near the lighthouse and at Punta del Agua. Previously, it occurred also in Montaña de Lobos and in some places along the north coast (Lovegrove 1971, Martín & Lorenzo 2001). It was more abundant in the past according to A. Pallarés (*pers. comm.*), referring to the harvesting of young in Montaña de Lobos (in the period 1957-1969).

*Montaña Clara* Although the Little Shearwater is scarce on this islet, this is nevertheless one of the most important Canarian colonies. Only five occupied burrows were recorded but in six different places we discovered signs of its presence. Given the relatively high number of individuals heard in La Caldera, the population size must be higher, perhaps 20-50. The presence of a small colony in La Caldera was previously noted by Bannerman (1914a,b) and by Lovegrove (1971).

*La Graciosa* No breeding records exist on this island although one individual was observed in flight in Caleta del Sebo on 15 March 2001. In the past, Bannerman (1914a,b) mentioned a small colony that has been deserted at the time of his visit. According to Lovegrove (1971), the species bred on the islet but no details were presented.

**White-faced Storm-petrel** Until the present survey, the only known small colony of this species in the Canarian Archipelago was located in a small sandy area of Montaña Clara (Martín *et al.* 1989). During this study, we confirmed breeding on Alegranza for the first time; there is some circumstantial evidence that it also occurs on La Graciosa.



**Alegranza** In August 2001, a new colony was discovered near El Jablito, the only place of organic sands on the islet. A total of 23 burrows was counted but only five were apparently occupied that year (Table 2). In one burrow, we collected an abandoned egg. On another visit to the colony on 7 June 2002, we counted 35 burrows, and six individuals were captured with two mist nets in 2 hours. Other suitable parts of the islet might repay closer study. The only previous information on the species is a sighting of two live individuals plus two others depredated by Barn Owls *Tyto alba* (O. Trujillo *pers. comm.*; *pers. obs.*).

**Montaña Clara** The first breeding record in the Canaries was obtained on this islet in 1987, with an estimate of about 10 breeding pairs (Martín *et al.* 1989). The only known colony is situated in the sandy areas of the southern plateau and consists of 30-40 breeding pairs. During spring 2000, a total of 90 burrows was counted but only 34 were occupied (F. Rodríguez *pers. comm.*). It is possible that all small chicks of that year were killed by the endemic Canarian Shrew *Crociodura canariensis*.

**La Graciosa** Although this island contains much suitable habitat for the White-faced Storm-petrel, no breeding data are available. During the present study, only three dead individuals, apparently depredated by feral cats *Felis catus*, were found (J. Cabrera *pers. comm.*; *pers. obs.*). However, in sandy areas of the north-east we observed a hole, which according to its appearance, dimensions and situation, could have been a burrow of this species. It is possible that further and more exhaustive investigation might reveal the existence of new colonies.

**European Storm-petrel** The Canarian population breeds in the northern islets of Lanzarote, Isla de Lobos (Fuerteventura), Roques de Anaga (Tenerife), La Gomera and Roques de Salmor (El Hierro), and was estimated to number more than 1000 breeding pairs in 1987 (Nogales *et al.* 1993; Table 2). The Chinijo Archipelago and Roques de Salmor constitute the largest breeding colonies of the Canaries (Martín & Hernández 1985; Nogales *et al.* 1993).

**Roque del Este** Eighteen occupied nests were located and the population could be around 20-30 breeding pairs.

**Alegranza** Of all Canarian sites, the species is probably most numerous here (Nogales *et al.* 1993). It breeds in several places on the northern and southern coasts but scattered pairs also nest in other localities such as La Caldera and Montaña de Lobos. A total of 190 occupied burrows was counted, mainly near El Bermejo. Although it is difficult to assess the actual population size, our data agree well with previous estimates of several hundred pairs (Table 2).

**Roque del Oeste** Only five occupied nests were found and it is likely that no more than ten pairs breed.

*Montaña Clara* A total of 31 occupied burrows was counted, mainly located in the area known as El Bermejo. True population size might be about 100 pairs given the abundance of tracks and individuals that enter some of the Cuevas Coloradas caves.

*La Graciosa* At least eight pairs bred in August 2000, all in the same cave near Montaña Bermeja. It was also detected in two places along the north coast and near Pedro Barba.

**Madeiran Storm-petrel** This species breeds on Lanzarote and surrounding islets and rocks, and also on some small rocks off Tenerife and El Hierro; however, potential sites (rocks and other areas that are inaccessible from land) in other parts of the islands have not been examined in winter (the breeding season) due to difficult sea conditions. The estimated population in the Canaries numbers about 300 pairs (Delgado *et al.* 1989). In other Macaronesian archipelagos (Azores and Madeira), the existence of two types that breed in different seasons, cool and hot (Monteiro & Furness 1998; Nunes 2000), has been confirmed. In the Canary Islands, this storm-petrel breeds in autumn (cool season), but calling birds have also been heard on Alegranza and Montaña Clara in July-August (Martín & Lorenzo 2001; *pers. obs.*). Furthermore, the capture of one individual with a brood patch on Alegranza in August 2001, suggests the existence of a small hot season population.

*Roque del Este* The first breeding record was obtained on 18 October 2000 when one abandoned egg was collected in a crevice. The only previous information on its presence comes from a dead individual and another observed inside a burrow (Concepción 1992). The number of breeding pairs must be very small (Table 2).

*Alegranza* It occurs in many places on the islet, but mainly along the north coast, and in the area between El Veril and Punta Trabuco. Only one individual was observed incubating in El Veril. Other evidence of its presence consists of nocturnal calls and individuals captured in mist nets. Our results do not allow us to derive an accurate estimate of total population size, but it is possible that 50-100 pairs breed.

*Roque del Oeste* In November 2000, one individual was recorded incubating and at least three more were observed inside their holes; these data constitute the first breeding record on this rock.

*Montaña Clara* Nocturnal calls and mist net captures indicate that Madeiran Storm-petrels are widely distributed here; they seem to favour the southern part of the islet. However, only one breeding record was obtained. Again it is very difficult to estimate population size but according to Delgado *et al.* (1989) only about 10 pairs breed on the islet (Table 2).

*La Graciosa* The only record obtained from this islet was of an individual calling at night in October 2000 in the north, possibly indicating the existence of a few breeding pairs.

**Lesser Black-backed Gull** Until spring 2001, the Lesser Black-backed Gull was considered solely as a winter visitor to the Canaries; 22 individuals ringed in the United Kingdom, Denmark, Norway, the Netherlands and Iceland have been recovered in the archipelago (Martín & Lorenzo 2001). Godman (1872) commented on the possibility that this species might breed in the archipelago given its abundance. Bannerman (1912) suggested that they bred on Alegranza, although in his later publications he did not mention it (Bannerman 1914a, 1919).

*Alegranza* Since spring 2001, we have observed some individuals exhibiting breeding behaviour in the Yellow-legged Gull colonies. On 4 May 2001, one nest containing three eggs, and two birds apparently guarding another nest, were discovered in La Caldera (Grande & Palacios 2002). In June 2002, four nests with eggs were located in a Yellow-legged Gull colony in a plain near El Faro. From observations of individuals during the breeding season, it is possible that the population comprised 10 breeding pairs.

*Montaña Clara* The first breeding record on this islet was on 6 June 2002 in La Caldera when two nests with eggs were located. Before this, birds were observed in pairs on many occasions during 2000-2001.

The western part of the breeding range of the Lesser Black-backed Gull has expanded since the early 20<sup>th</sup> century (Pons & Yésou 1997). These breeding records in the Chinijo Archipelago might be the first step in colonization of the other Canary Islands.

**Yellow-legged Gull** Until recently, the Yellow-legged Gull was the only gull breeding regularly in the Canary Islands (Martín & Lorenzo 2001). The population was estimated in 1987 at 4 000-4 700 pairs (Delgado *et al.* 1992), but now is certainly higher. In previous decades, the species increased not only in the Canaries (Delgado *et al.* 1992), but throughout most of its breeding range (Cramp & Simmons 1983; Carrera 1997; Skornik 1997).

*Roque del Este* A total of 16 nests was counted on 18 May 2001, situated mainly in the north-east of the rock.

*Alegranza* The number of breeding pairs increased from 35-45 in 1987 to 181 counted in 2001 (Delgado *et al.* 1992; Table 2). The distribution has grown from the northern top of La Caldera to the base and to other areas in the centre of the islet where scattered pairs breed. It is interesting to note the establishment of a relatively large, new colony near El Faro, where a few pairs of Lesser Black-backed Gull also breed.

*Roque del Oeste* No breeding evidence was found during this study but in August 1987, one nest was recorded (Delgado *et al.* 1992).

*Montaña Clara* A total of 792 nests was counted, most of them located in La Caldera and Las Tabaibitas. In common with Alegranza, the number of breeding pairs has increased notably (Table 2); some nests are located on the eastern plateau.

*La Graciosa* Until our discovery of five occupied nests in Montaña Amarilla in July 2002, the Yellow-legged Gull was considered to be a common non-breeding visitor.

### THREATS AND CONSERVATION

Seabird populations on the northern islets of Lanzarote have been negatively affected by some human activities, with introduced predators and human exploitation being of particular importance.

Introduced predators, mainly domestic cats and rats *Rattus* spp., are one of the major conservation threats to seabirds throughout the world (Moors & Atkinson 1984; Burger & Gochfeld 1994). Small petrels are particularly affected because of their small size and vulnerability to predators.

In Alegranza, the presence of feral cats in the past may have been an important threat to seabirds, but in the last 20 years only a few individuals have been present, and their impact was probably minimal because they fed mainly on rabbits *Oryctolagus cuniculus* and mice (Nogales *et al.* 1992). The last cat on this islet was removed in 1998. On La Graciosa, feral cats are still very abundant and the available evidence indicates that they are the main cause of the recorded decreases in the size of breeding seabird populations. Delgado *et al.* (1985) noted the likely role of cats in the destruction of the main European Storm-petrel colony of this islet in 1983, and in September 2000 and August 2001, the remains of at least 54 individuals of this species were found dead together in the same place.

Natural predators such as Eleonora's Falcon *Falco eleonorae*, the Barn Owl, and the Common Raven *Corvus corax* are known to kill adults or chicks mainly of small Procellariiformes (Martín *et al.* 1989; Delgado 1993; Nogales & Hernández 1994; *pers. obs.*) but although they can be locally important, their overall impact is small. However, in Montaña Clara the Canarian Shrew reputedly preys heavily upon White-faced Storm-petrel chicks, and the Yellow-legged Gull predation might become an important threat if its population increases further.

Damage to vegetation, competition or destruction of the breeding sites is the most important effect of alien herbivores on seabirds (Bell 1995; Priddel *et al.* 2000). On the islet of Montaña Clara, rabbits may have destroyed some

burrows of the White-faced Storm-petrel (Martín *et al.* 1989), but a rabbit eradication plan has been implemented recently, and is thought to have been successful. In Alegranza, however, rabbits remain plentiful and they could affect the small colony of this species here.

The long-established tradition of harvesting well-grown chicks of the Little Shearwater and especially Cory's Shearwater for food, oil or feathers on these islets no longer occurs (Martín & Nogales 1993; Martín & Lorenzo 2001). On Alegranza, at the end of the 19<sup>th</sup> century, 12 000 Cory's Shearwater chicks were caught annually; the slaughter was reduced to half that number during the middle of 20<sup>th</sup> century (Hernández-Pacheco 2002; de la Hoz 1962). On Montaña Clara, Little Shearwaters – called “tahoce” – were collected as chicks by people from Lanzarote (Bannerman 1914a) and this also occurred on Alegranza in the period 1957-1969 (A. Pallarés *pers. comm.*). On Alegranza, Bulwer's Petrels also were harvested in great numbers (Bolle 1855). This exploitation clearly indicates that these species were more abundant in the past and perhaps current populations are only now exhibiting a slow recovery. All these species are now legally protected but some Cory's Shearwaters are still captured illegally, mainly on Alegranza and La Graciosa.

These islets, together with the nearby cliffs of Famara (Lanzarote), have constituted a Natural Park since 1986; in addition, Montaña Clara, Roque del Oeste and Roque del Este were declared a Natural Reserve in 1994, with access allowed only for research and conservation purposes. This region has now also been recognised as an Important Bird Area (Viada 1998) and as a Special Protection Area under the EU Birds Directive (EEC 1979).

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#### AANTALLEN EN VERSPREIDING VAN BROEDENDE ZEEVOGELS TEN NOORDEN VAN LANZAROTE OP DE CANARISCHE EILANDEN

Dit artikel beschrijft de resultaten van een inventarisatie van broedende zeevogels die in 2000-2002 werd uitgevoerd op eilandjes ten noorden van Lanzarote (figuur 1). De nadruk van de inventarisatie lag op het vaststellen van de aantallen en verspreiding. Aantalsschattingen werden gemaakt van

Bulwers Stormvogel *Bulweria bulwerii*, Kuhls Pijlstormvogel *Calonectris borealis*, Kleine Pijlstormvogel *Puffinus assimilis baroli*, Bont Stormvogeltje *Pelagodroma marina*, Stormvogeltje *Hydrobates pelagicus*, Madeira Stormvogeltje *Oceanodroma castro*, Kleine Mantelmeeuw *Larus graellsii* en Geelpootmeeuw *Larus michahellis atlantis* (tabel 2). Op verschillende eilandjes werden nieuwe kolonies ontdekt van Bont Stormvogeltje, Madeira Stormvogeltje, Kleine Mantelmeeuw en Geelpootmeeuw. De aantallen van alle soorten zijn de laatste 15 jaar vrijwel gelijk gebleven, uitgezonderd de Geelpootmeeuw. De toename van deze soort is goed gedocumenteerd: in 1987 werd de populatie geschat op 400 paar, in 2003 werden ca 1000 paar geteld. Dit artikel eindigt met een paragraaf over bedreigingen van de beschreven zeevogelpopulaties. Op La Graciosa zijn verwilderde katten een belangrijke predator van Stormvogeltjes; tijdens de inventarisatie in 2000-2001 alleen al werden restanten van meer dan 50 dode vogels gevonden.

## REFERENCES

- Alcover J.A. & McMinn M. 1995. Fossil birds from the Canary Islands. *Cour. Forsch. Inst. Senckenb.* 181: 207-213.
- Bannerman D.A. 1912. The birds of Gran Canaria. *Ibis* 9: 557-627.
- Bannerman D.A. 1914a. An ornithological expedition to the eastern Canary Islands. Part I. *Ibis* 10: 38-90.
- Bannerman D.A. 1914b. The distribution and nidification of the tubinares in the North Atlantic Islands. *Ibis* 10: 438-494.
- Bannerman D.A. 1919. List of the birds of the Canary Islands, with detailed reference to the migratory species and the accidental visitors. Part 7. *Ibis* 11: 708-774.
- Bell B.D. 1995. The effects of goats and rabbits on breeding seabirds: methods of eradication and control. *Bol. Mus. Mun. Funchal* 4: 83-89.
- Bolle C. 1855. Bemerkungen über die Vögel der canarischen Inseln. *J. Orn.* 3: 171-181.
- Burger J. & Gochfeld M. 1994. Predation and effects of humans on islands-nesting seabirds. In: Nettleship, D.N., Burger J. & Gochfeld M. (eds) *Seabirds on islands, threats, case studies and action plans*. pp. 39-67. *Birdlife International*, Cambridge.
- Carrera E. 1997. Gaviota Patiamarilla. In: Purroy, F. (ed) *Atlas de las aves de España (1975-1995)*. pp. 212-213. *Lynx Edicions*, Barcelona.
- Concepción D. 1992. Avifauna del Parque Nacional de Timanfaya. Censo y Análisis. *Red de Parques Nacionales*, Icona, Madrid.
- Cramp S. & Simmons K.E.L. 1983. *The Birds of the Western Palearctic*, 3. Oxford University Press, Oxford.
- De la Hoz A. 1962. Lanzarote. Gobierno Civil de Las Palmas, Cabildo Insular de Gran Canaria y Ayuntamientos y Cabildo Insular de Lanzarote, Madrid.
- Delgado G. 1993. Variación estacional de la dieta de *Tyto alba gracilirostris* (Hartert, 1905) en la isla de Alegranza (Lanzarote, Islas Canarias) (Aves: Tytonidae). *Vieraea* 22: 133-137.
- Delgado G., Hernández E., Martín A., Trujillo O. & Díaz G. 1985. Datos preliminares sobre la distribución y reproducción del Paíño común (*Hydrobates pelagicus*) en las Islas Canarias. *Asturmatu* 4: 19-20.
- Delgado G., Martín A., Nogales M., Quilis V., Hernández E., Trujillo O. & Santana F. 1989. Nuevos datos sobre el Paíño de Madeira (*Oceanodroma castro*) en las Islas Canarias. In: López-Jurado C. (ed) *Aves marinas*. pp. 137-145. *G.I.A.M.*, Formentera.
- Delgado G., Martín A., Nogales M., Quilis V., Hernández E. & Trujillo O. 1992. Distribution and population status of the Herring Gull *Larus argentatus* in the Canary Islands. *Seabird* 14: 55-59.
- EEC (1979) Council Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds. *Official Journal L103* (25.4.1979): 1-18.
- Godman F.D. 1872. Notes on the resident and migratory birds of Madeira and the Canaries. *Ibis* 3: 158-177 and 209-224.

- Granadeiro J.P., Massa, B. & Lo Valvo, M.L. 1997. Cory's Shearwater. In: Hagemeyer W.J. & Blair M.J. (eds) The EBCC Atlas of European breeding birds. their distribution and abundance: p. 20. T & A.D. Poyser, London.
- Grande J.M. & Palacios C.-J. 2002. First breeding record of the Lesser Black-backed Gull in the Macaronesic archipelago, North Atlantic; a large spread in its breeding range. *Waterbirds* 25: 388-389.
- Hernández E., Martín A., Nogales M., Quilis V., Delgado G. & Trujillo O. 1990. Distribution and status of Bulwer's Petrel (*Bulweria bulwerii* Jardine & Selby, 1828) in the Canary Islands. *Bol. Mus. Mun. Funchal* 42: 5-16.
- Hernández-Pacheco E. 2002. Por los campos de lava. Relatos de una expedición científica a Lanzarote y a las isletas canarias. Descripción e historia geológica [1907-1908]. Fundación César Manrique, Madrid.
- Kunkel G. 1971. La vegetación de La Graciosa y notas sobre Alegranza, Montaña Clara y el Roque del Infierno. *Monogr. Biol. Canar.* 2: 1-67.
- Le Grand G., Emmerson K. & Martín A. 1984. The status and conservation of Seabirds in the Macaronesian Islands. In: Croxall, J.P, Evans P.G.H. & Schreiber R.W. (eds) Status and Conservation of the World's Seabirds. pp 377-391. ICBP Technical Publication No. 2, Cambridge.
- Lovegrove R. 1971. B.O.U. supported expedition to northeast Canary Islands. July-August 1970. *Ibis* 113: 269-272.
- Marrero A. 1991. La flora y vegetación del Parque Natural de los islotes del norte de Lanzarote y Risco de Famara. Su situación actual. In: Comunicações apresentadas nas 1<sup>as</sup> Jornadas Atlânticas de Protecção do Meio Ambiente. pp 195-211. Angra do Heroísmo, Azores.
- Martí R. & Del Moral J.C. (eds) 2003. Atlas de las Aves Reproductoras de España. Dirección General de Conservación de la Naturaleza-Sociedad Española de Ornitología, Madrid.
- Martín A. & Hernández E. 1985. Importante colonia de aves marinas en los Roques de Salmor (Isla de El Hierro, Canarias). *Ardeola* 32: 123-127.
- Martín A. & Lorenzo J.A. 2001. Aves del archipiélago canario. Francisco Lemus Editor, La Laguna.
- Martín A. & Nogales M. 1993. The ornithological importance of the island of Alegranza (Canary Islands). *Bol. Mus. Mun. Funchal Sup.* Nº 2: 167-179.
- Martín A., Delgado G., Nogales M., Quilis V., Trujillo O., Hernández E. & Santana F. 1989. Premières donnés sur la nidification du Puffin des Anglais (*Puffinus puffinus*), du Pétrel-Frégate (*Pelagodroma marina*) et de la Sterne de Dougall (*Sterna dougallii*) aux îles Canaries. *L'Oiseau et R.F.O.* 59: 73-83.
- Martín A., Nogales M., Quilis V., Delgado G., Hernández E. & Trujillo O. 1991. La Colonie de Puffin Cendré (*Calonectris diomedea*) de l'île d'Alegranza (Lanzarote/Illes Canaries). *Bol. Mus. Mun. Funchal* 43: 107-120.
- Martín A., Nogales M., Quilis V., Delgado G., Hernández G., Trujillo O. & Santana F. 1987. Distribución y status de las aves marinas nidificantes en el archipiélago canario con vistas a su conservación. Universidad de La Laguna. Unpublished report.
- Monteiro L.R. & Furness R.W. 1998. Speciation through temporal segregation of Madeiran storm petrel (*Oceanodroma castro*) populations in the Azores?. *Phil. Trans. R. Soc. London B* 353: 945-953.
- Monteiro L.R., Ramos J.A. & Furness R.W. 1996. Past and present status and conservation of seabirds breeding in the Azores Archipelago. *Biol. Conserv.* 78: 319-328.
- Monteiro L.R., Ramos J.A., Pereira J.C., Monteiro P.R., Feio R.S., Thompson D.R., Bearhop S., Furness R.W., Laranjo M., Hilton G., Neves V.C., Groz M.P. & Thompson K.R. 1999. Status and distribution of Fea's Petrel, Bulwer's Petrel, Manx Shearwater, Little Shearwater and Band-Rumped Storm-Petrel in the Azores Archipelago. *Waterbirds* 22: 358-366.
- Moors P.J. & Atkinson I.A.E. 1984. Predation on seabirds by introduced animals, and factors affecting its severity. In: Croxall, J.P, Evans P.G.H. & Schreiber R.W. (eds) Status and

- Conservation of the World's Seabirds. pp 667-690. ICBP Technical Publication No. 2, Cambridge.
- Mougin J.-L., Granadeiro J.P. & Oliveira P. 1996. L'évolution des effectifs reproducteurs chez le Puffin Cendré *Calonectris diomedea borealis* de Selvagem Grande (30°09'N, 15°52'W) de 1992 à 1995. Bol. Mus. Mun. Funchal 48: 171-178.
- Nogales M. & Hernández E.C. 1994. Interinsular variations in the spring and summer diet of the Raven *Corvus corax* in the Canary Islands. Ibis 136: 441-447.
- Nogales M., Rodríguez J.L., Delgado G., Quilis V. & Trujillo O. 1992. The diet of Feral Cat (*Felis catus* L. 1758) on Alegranza Island (North of Lanzarote, Canary Islands). Folia Zool. 41: 209-212.
- Nogales M., Martín A., Quilis V., Hernández E., Delgado G. & Trujillo O. 1993. Estatus y distribución del Paíño Común (*Hydrobates pelagicus*) en las Islas Canarias. In: Aguilar J.S., Monbailliu X. & Paterson A.M. (eds) Estatus y Conservación de Aves Marinas. pp. 15-24. SEO/BirdLife-Medmaravis, Madrid.
- Nunes M. 2000. Madeiran Storm-petrel (*Oceanodroma castro*) in the Desertas Islands (Madeira Archipelago): a new case of two distinct populations breeding annually? Arquipelago. Life and Marine Sciences Sup. 2 (Part A): 175-179.
- Pons J.-M. & Yésou P. 1997. Lesser Black-backed Gull. In: Hagermeijer W.J. & Blair M.J. (eds) The EBCC Atlas of European breeding birds. Their distribution and abundance. pp. 336-337. T & A.D. Poyser, London.
- Priddel D., Carlile N. & Wheeler R. 2000. Erradication of European rabbit (*Oryctolagus cuniculus*) from Cabbage Tree Island, NSW, Australia, to protect the breeding habitat of Gould's petrel (*Pterodroma leucoptera leucoptera*). Biol. Conserv. 94: 115-125.
- Sangster G., Hazevoet C.J., van den Berg A.B., Roselaar C.S. & Sluys R. 1999. Dutch avifaunal list: species concepts, taxonomic instability, and taxonomic changes in 1977-1998. Ardea 87: 139-165.
- Skornik I. 1997. Yellow-legged Gull. In: Hagermeijer W.J. & Blair M.J. (eds) The EBCC Atlas of European breeding birds. Their distribution and abundance. pp. 340-341. T & A.D. Poyser, London.
- Thibault J.-C. 1993. Breeding distribution and numbers of Cory's Shearwater (*Calonectris diomedea*) in the Mediterranean. In: Aguilar J.S., Monbailliu X. & Paterson A.M. (eds) Estatus y Conservación de Aves Marinas. pp. 25-35. Seo/BirdLife-Medmaravis, Madrid.
- Torriani L. 1978. Descripción e historia del reino de las Islas Canarias antes Afortunadas, con el parecer de sus fortificaciones, 1599. Goya, Santa Cruz de Tenerife.
- Viada C. 1998. Áreas importantes para las aves en España. Monografía N° 5 SEO/BirdLife, Madrid.
- Walker C.A., Wragg G.M. & Harrison C.J.O. 1990. A new shearwater from the Pleistocene of the Canary Islands and its bearing on the evolution of certain *Puffinus* shearwaters. Hist. Biol. 3: 203-224.
- Zino F., Biscoito M.J. & Zino P.A. 1994. Bulwer's Petrel. In: Tucker M.G. & Heath M.F. (eds) Birds in Europe. Their Conservation Status. pp. 64-65. BirdLife Conservation Series N° 3, BirdLife International, Cambridge.

<sup>1</sup> *Calonectris diomedea borealis* is considered as *Calonectris borealis* on the Dutch List (Sangster et al. 1999).

<sup>2</sup> *Larus fuscus graellsii* together with *L. f. intermedius* are considered conspecific and known as *Larus graellsii* on the Dutch List (Sangster et al. 1999).

<sup>3</sup> *Larus cachinnans atlantis* is considered as *Larus michahellis atlantis* on the Dutch List (Sangster et al. 1999).