

Dispersal of Little Egrets *Egretta garzetta* from Northern Spanish Atlantic Colonies

Author(s): Aitor Galarza, Fernando Arce, Juan G. Navedo and Juan Arizaga Source: Ardeola, 63(2):375-382. Published By: Spanish Society of Ornithology/BirdLife DOI: <u>http://dx.doi.org/10.13157/arla.63.2.2016.sc4</u> URL: <u>http://www.bioone.org/doi/full/10.13157/arla.63.2.2016.sc4</u>

BioOne (www.bioone.org) is a nonprofit, online aggregation of core research in the biological, ecological, and environmental sciences. BioOne provides a sustainable online platform for over 170 journals and books published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Web site, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at <u>www.bioone.org/</u>page/terms_of_use.

Usage of BioOne content is strictly limited to personal, educational, and noncommercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

DISPERSAL OF LITTLE EGRETS EGRETTA GARZETTA FROM NORTHERN SPANISH ATLANTIC COLONIES

DISPERSIÓN DE LA GARCETA COMÚN *EGRETTA GARZETTA* DESDE LAS COLONIAS ATLÁNTICAS DEL NORTE DE ESPAÑA

Aitor GALARZA^{1, 2, *}, Fernando ARCE³, Juan G. NAVEDO⁴ and Juan ARIZAGA²

SUMMARY.—We studied the movements of little egrets *Egretta garzetta* from breeding colonies in northern Spanish Atlantic estuaries using sighting data of colour-ringed birds. Data on 304 resightings of 95 out of 457 little egrets ringed as chicks in two colonies on the southern Bay of Biscay were analysed. Most egrets (68.9%) were observed less than 50 km from their natal colonies and thus exhibited low dispersal, supporting the view that these birds belong to a resident population breeding along the coasts of the Bay of Biscay. Nearly all resightings (95.5%) occurred in estuaries across an east-west axis corresponding to the Atlantic coast of northern Spain and had a west-biased dispersal direction. We suggest that the recently formed northern Atlantic Spanish population is a consequence of a westward colonisation pattern originating in the French Atlantic colonies.

Key words: estuaries, herons, Iberian Peninsula, natal dispersal, waterbirds.

RESUMEN.—Estudiamos los movimientos de garcetas comunes *Egretta garzetta* procedentes de dos colonias de cría situadas en estuarios del norte de España, mediante la utilización de observaciones de ejemplares marcados con anillas de color. Se analizaron 304 observaciones de 95 ejemplares diferentes, de un total de 457 pollos anillados. La mayoría de las garcetas (68,9%) se observaron a menos de 50 km de su colonia natal, lo que indica una reducida dispersión y apoya la idea de que estas garcetas pertenecen a una población residente que se reproduce a lo largo de las costas del golfo de Vizcaya. Casi todas las observaciones (95,5%) se produjeron en estuarios situados a lo largo del eje este-oeste de la costa atlántica del norte de España y tuvieron una dirección oeste predominante. Sugerimos que la recientemente formada población de la costa atlántica del norte de España procede de la colonización a partir de ejemplares de las colonias francesas.

Palabras clave: acuáticas, dispersión natal, estuarios, garzas, península Ibérica.

¹ Department of Sustainability and Environment, Biscay County Council, 48014 Bilbao, Spain.

² Department of Ornithology, Aranzadi Sciences Society, 20014 San Sebastián, Spain.

³ Institute for marine and Antarctic Studies, University of Tasmania, TAS 7001 Australia.

⁴ Instituto de Ciencias Marinas y Limnológicas, Universidad Austral de Chile, Valdivia, Chile.

^{*} Corresponding author: aitorgalarzai@gmail.com

INTRODUCTION

The study of avian dispersal is of central importance for understanding abundance and distribution patterns as well as the population dynamics and genetic flow between populations (Newton, 2010). Dispersal ability has a number of ecological consequences including the evolution of climatic niches of species (e.g. Sexton *et al.*, 2009), with new-ly established breeding colonies providing a good model for insights into associated colonisation patterns.

The little egret Egretta garzetta is an abundant heron breeding over much of the Old World and more recently in America (Kushlan and Hancock, 2005). In Western Europe, it mainly breeds within the circum-Mediterranean region, with an increasing tendency to colonise areas further north, mainly in mild zones within the Atlantic region from Spain to France and the United Kingdom (Marion et al., 2000; Holling, 2010). The Spanish little egret population is the largest in Europe (Marion et al., 2000). In Spain the breeding colonies are mainly in the southwest, at some major inland wetlands in northern (e.g., Ebro Valley) and southwestern river basins (e.g. Guadiana reservoirs), at some Mediterranean wetlands (including in the Balearics), and at a few marshlands along the northern Atlantic coast (Garrido et al., 2012). Little egrets have also become established in the Canary and the Chafarinas islands (Garrido, 2003). Three wetlands: Doñana National Park, the Albufera de Valencia and the Ebro Delta, host some 60% of the wintering and breeding Spanish populations (Garrido et al., 2012). The species was first recorded nesting on the northern Atlantic coast of Spain during the 1990s (Garrido et al., 2012). This area currently hosts a small breeding population of around 100 pairs, distributed between a number of small colonies on islets in or close to the estuaries where the birds feed (Garrido et al., 2012; Galarza and Arizaga, 2014).

In Europe, the status and ecology of little egret breeding populations is well documented in the Mediterranean area (Marion et al., 2000; Kushlan and Hancock, 2005) but little is known regarding the Atlantic population (Galarza and Arizaga, 2014). Movements of little egrets in Spain were analysed in the 1950s using data from chicks ringed in Doñana (Valverde and Weickert, 1956) and in a more recent study that considered birds from eight colonies in southern Spain (Bartolomé et al., 1996). Overall, the movements of Spanish little egrets cover a broad geographic range, mainly across the European Mediterranean wetlands from the Iberian Peninsula to Southern France, the Atlantic coast up to northwestern Iberia, and northwestern Africa down to the tropics, some also reaching the Macaronesian islands (Valverde and Weickert, 1956; Bartolomé et al., 1996). Dispersal ranges, however, seem to differ between populations (Bartolomé et al., 1996). In the case of the recently established Atlantic population in northern Spain (Garrido, 2003), dispersal patterns have remained entirely unknown, and may differ from those described for the Mediterranean populations (Bartolomé et al., 1996; Hafner et al., 1998; Fasola et al., 2002).

In this study we aimed to describe the movement patterns of little egrets breeding in northern Spain and to assess the dispersal of this Atlantic population. To this end, we used data from egrets colour-ringed as chicks at two of the main colonies currently existing in this region.

MATERIAL AND METHODS

A total of 457 little egret chicks were ringed at two breeding colonies, 70 km apart, on the Atlantic coast of northern Spain: Urdaibai Biosphere Reserve (Izaro island; 43° 25' N, 02° 41' W), and Santoña Marshes Natural Park (San Pedro island; 43° 29' N, 03° 31' W) (fig. 1). The Urdaibai colony is on a 3.2 ha island with a high proportion of bare soil with some vegetation patches chiefly composed by tree mallow *Lavatera arborea* and sea beet *Beta vulgaris*; the island also has a small clump of tamarisks *Tamarix gallica*. Little egrets nested on the ground at first but have since built their nests in sea beet and tree mallow. Since 2006, they have settled in the small tamarisks. Little egrets have nested at Urdaibai since at least the 1990s, with a colony size ranging from five (2006) to 32 (2003) pairs (Galarza and Arizaga, 2014). The Santoña colony is on a rocky,1.6 ha islet, with a dense vegetation patch of approximately 3,600 m² on its southern side, formed by common fig *Ficus carica*, elderberry *Sambucus nigra* and several other shrubs. The egrets nested in common figs during those seasons when we ringed them. This colony has been occupied since at least 2003, with nine (2003) to 50 (2009) nests reported (Navedo, 2003; De Vega and González Sánchez, 2014). In both cases foraging areas are situated 2-10 km from the breeding colony.



FIG. 1.—Geographical distribution of resightings of little egrets ringed as chicks in two colonies (Urdaibai and Santoña) on the northern Spanish Atlantic coast. Resightings within 0-10 km from the natal colonies were excluded.

[Distribución geográfica de las observaciones de garcetas comunes anilladas como pollos en dos colonias (Urdaibai y Santoña) de la costa atlántica del norte de España. Se excluyen las observaciones realizadas a 0-10 km de dichas colonias.].

RESULTS

Overall, 304 resighting events corresponding to 95 individual little egrets were recorded (20.8% of the rings fitted). This proportion was higher for the Urdaibai colony, but the difference between the colonies was not statistically significant ($\chi^2 = 2.86$; p = 0.090). The mean (\pm SD) dispersal distance was 38.9 \pm 121.4 km (median: 7; range: 2-515 km). Over half of the resightings (68.9%), excluding those within the breeding colonies, occurred within 50 km from the natal colony (fig. 2) and the majority (97.6%) of these were in the nearby marshes (2-10 km from the natal colony). Resightings of birds older than 1 year were more frequent within 50 km from the natal colony than elsewhere ($\chi^2_2 = 19.53$; p < 0.001) (fig. 2). About half of all resightings (51.3%) corresponded to birds in their first calendar year. Adults were observed outside the marshes close to their natal colony only during the non-breeding period, from August to March (excluding observations within the colonies) (fig. 3).

All resightings were within the Iberian Peninsula. Most (95.5%) were in estuaries across an east-west axis corresponding to the Atlantic coast of northern Spain (fig. 1). After excluding resightings from marshes near the two colonies where the birds were ringed (i.e. < 10 km away), we found that the dispersal directions were not uniformly distributed but were significantly west-biased, with a mean dispersal direction of 256° (Rayleigh's Uniformity Test, n = 60, Z = 24.5, P < 0.001;fig. 4). Only eight resightings, corresponding to two first-year birds, were outside this main dispersal direction and these seemed to follow the Ebro Valley, one bird being observed at Salburua (61 km away) and another at the Ebro Delta (410 km). The farthest resighting was a first-year bird observed 515 km to the West in O Grove, A Coruña. We observed 37 ringed individuals (25 of them in nests) at or near the colonies during the breeding period (8.1% of ringed birds). Natal dispersal (num-



FIG. 2.—Distance from natal colonies of resighting localities (white: > 1 year birds, black: first year birds).

[Distancia de los puntos de observación a las colonias de origen (blanco: > 1 año, negro: primer año calendario).]



FIG. 3.—Number of resightings of adult individuals (> 1 year) both beyond (black) and within (grey) the marshes close to the natal colonies (< 10 km) during the breeding (April-July), postbreeding (August-November) and wintering (December-March) periods.

[Número de observaciones de ejemplares adultos (> 1 año) realizadas fuera (negro) y dentro (gris) de las marismas cercanas a las colonias de origen (< 10 km) durante el periodo de reproducción (abril-julio), el posreproductivo (agosto-noviembre) y la invernada (diciembre-marzo).]

ber of birds born in a colony that breed in another colony) was limited to two birds ringed at Urdaibai and found breeding in Santoña during the following breeding season.



FIG. 4.—Frequency distribution of dispersal directions for little egrets from Atlantic Northern Spanish colonies. The perimeter circle shows the bearing in degrees. The inner axes show the number of dispersal events in each direction. Bold lines show the mean angle and 95% confidence interval.

[Distribución de frecuencias de las direcciones de dispersión de las garcetas comunes con origen en las colonias atlánticas del norte de España. El eje exterior muestra la posición en grados y el interior el número de eventos de dispersión en cada dirección. Las líneas en negrita muestran el ángulo medio y el intervalo de confianza del 95%.]

DISCUSSION

European little egret breeding populations have been considered mainly migratory with most birds moving to the Mediterranean and West Africa (Dugan, 1983; Hancock and Kushland, 1984). However, it has been reported that many birds are currently overwintering in Europe (Bartolomé *et al.*, 1996; Voisin *et al.*, 2005; Zwarts *et al.*, 2009), many of them close to their breeding colonies (Pineau, 1992; Hafner *et al.*, 1994). We observed that most of the little egrets from our study area remained very close to their natal colonies, supporting the idea that these birds belong to a largely resident population breeding along the Atlantic regions of western Europe (Voisin *et al.*, 2005), with a wintering dispersal range distinct from the eastern and western Iberian populations showed by Bartolomé *et al.* (1996) for southern Spanish populations. Moreover, the strong correlation between the sizes of the breeding and wintering populations at Urdaibai also suggests that little egrets behave mainly as residents in this region (Galarza and Arizaga, 2014).

The low rate of natal dispersal in our study (only two birds were observed breeding outside the natal colony) contrasts with the high rate recorded in the Camargue, France (Hafner et al., 1998; Fasola et al., 2002). Dispersal rates are highly variable in birds and presumably depend on the stability of habitats and food supplies (Newton, 2010). Although the role of the variations in environmental conditions in dispersal among colonial waterbirds is far from clear (Fasola et al., 2002), a low rate of competition for nest and/or foraging sites may explain, at least partially, the low natal dispersal rate. The little egret population in northern Spain is very small and comprises a few small colonies that are closely linked to well-separated estuaries with few intervening foraging areas (Galarza and Arizaga, 2014; Luengo et al., 2015). In this context of low competition, local recruitment is probably the most profitable strategy, both for juveniles and adults. When compared to little egrets breeding in the Camargue (Hafner et al., 1998), the annual apparent survival rate in the study population was slightly higher for adults (0.78) and lower for hatch-year birds (0.15)(Galarza and Arizaga, 2014). This low survival rate of young birds could also be a factor affecting the rate of natal dispersal.

Severe winters could affect little egret breeding populations by reducing foraging habitat availability and, as a consequence, increasing mortality (Tourenq *et al.*, 2000; Carruette and Rigaux, 2003; Voisin *et al.*, 2005).

However, winters are mild along the Atlantic coast of Northern Spain, with an inter-annual mean coldest temperature of around 7.6 °C and fewer than 10 days per year below 5° C (Usabiaga et al., 2004). Moreover, severe weather does not result in food shortage in estuaries because tidal movements ensure foraging habitat availability after freezing, unlike freshwater or stagnant brackish waters where ice can prevent access to prey for days. Therefore, the resident behaviour of the Atlantic little egret population could be related to the limited effect of low temperatures on prey availability in this region, which would reduce the need for dispersal. Resident behaviour could also reflect a lack of resource competition due to a low abundance of functional competitors (Navedo et al., 2007), especially the grey heron Ardea cinerea (Wood and Stillman, 2014), and also the low abundance of conspecifics at these estuaries. The study of population dynamics within the Urdaibai colony showed an unstable population size highly influenced by sporadic catastrophic events, including predation and hailstorms affecting breeding adults in the colonies, and still well below the carrying capacity of the estuarine foraging areas (Galarza and Arizaga, 2014).

Little egret breeding populations increased strongly in Europe during the last century, apparently benefiting from species- and habitat protection, new foraging habitats (rice fields and other artificial wetlands), a new abundant food resource: the Louisiana crayfish Procambarus clarkii, and climatic warming (Marion et al., 2000; Fasola et al., 2010; Newton, 2013; Fasola and Cardarelli, 2015). Following this population increase, some birds moved northwest and started to winter on the French Atlantic coast (Marion et al., 2000) with the first breeding colony established in Brittany in 1960 (Bargain, 1993). Marion et al. (2000) suggested that birds from this initial Atlantic breeding colony would be the founders of the colonies es-

tablished later in other European Atlantic regions, such as the Netherlands and the southern British Isles. This hypothesis is yet to be confirmed but the very local and coastal dispersal patterns described here for the two northern Spanish colonies may fit this scenario well. Conversely, our data does not support a pattern of colonisation by birds from other Iberian populations, which are probably geographically separated by the Cantabrian Mountains (Garrido et al., 2012). Moreover, this latter barrier may also have modulated the observed colonisation pattern, since the first breeding birds in northern Iberia became established in eastern regions whereas other colonies further west were founded some years later (Galarza, 1999; Lorenzo, 2011). The breeding of two little egrets from Urdaibai at Santoña in their first calendar year also suggests a westward colonisation pattern.

We cannot exclude some bias due to different resighting probabilities between regions or localities (Korner-Nievergelt et al., 2010), since the resighting effort was not uniformly spatially distributed. However, it is noteworthy that only one bird was observed in the Mediterranean, even though that region sees most of the little egret recoveries in Spain (SEO/BirdLife, 2012). Moreover, the three wetlands that host the bulk of the wintering and breeding little egret populations in the Iberian Peninsula (Doñana, La Albufera and Ebro Delta) are among the most popular haunts of birders. This suggests that the dispersal pattern revealed by our data is not due to biased sampling.

ACKNOWLEDGEMENTS.—We are grateful to the people who collaborated during the fieldwork, especially Jon Hidalgo, Ignacio García, Francisco Martínez, Txomin Díaz, Eneko Díez, Pablo Pérez, Alejandro Onrubia and David Arranz. We also wish to thank those birders that shared data on sightings. Ringing was authorised by the Biscay County Council and the Regional Government of Cantabria. The comments of Diego Gil, Pilar Rodríguez and two anonymous referees were of great value in improving an earlier version of this work. This research was partly funded by the Department of Sustainability and Environment of the Biscay County Council.

BIBLIOGRAPHY

- BARGAIN, B. 1993. Oiseaux de Bretagne. *Pen. Ar. Bed.*, 150: 12-14.
- BARTOLOMÉ, J., FERNÁNDEZ-CRUZ, M. and CAM-POS, F. 1996. Band recoveries of Spanish Little Egrets, *Egretta garzetta*. *Colonial Waterbirds*, 19: 220-225.
- CARRUETTE, P. and RIGAUX, T. 2003. Le vague de froid de l'hiver 2001/2002 et des incidences sur la population de Héron garde-boeufs *Bulbucus ibis*, d'Aigrette garzette *Egretta garzetta* et de Grande aigrette *Ardea alba* hivernant en Plaine Maritime Picarde. Numéro spécial *L'Avocette*: 131-135.
- DE VEGA, L. and GONZÁLEZ SÁNCHEZ, F. 2014. Censos de aves acuáticas en el Parque Natural de las Marismas de Santoña, Victoria y Joyel. Año 2014. SEO/BirdLife-Dirección General de Montes y Conservación de la Naturaleza del Gobierno de Cantabria.
- DUGAN, P. 1983. The conservation of herons during migration and in the wintering areas: a review of the present understanding and requirements for future research. In, P.R. Evans, H. Hafner and P. L'Hermite (Eds.): *Shorebirds and large waterbirds conservation*. Comission of the European Communities. Brussels.
- FASOLA, M. and CARDARELLI, E. 2015. Long term changes in the food resources of a guild of breeding Ardeinae (Aves) in Italy. *Italian J. Zoology*, 82: 231-250.
- FASOLA, M., HAFNER, H., KAYSER, Y., BENNETS, R. E. and CEZILLY, F. 2002. Individual dispersal among colonies of Little Egrets *Egretta garzetta*. *Ibis*, 144: 192-199.
- FASOLA, M., RUBOLINI, D., MERLI, E., BONCOM-PAGNI, E. and BRESSAN, U. 2010. Long-term trends of heron and egret populations in Italy, and the effects of climate, human-induced mortality, and habitat on population dynamics. *Popul. Ecol.*, 52: 59-72.
- GALARZA, A. 1999. Garceta Común Egretta garzetta. Noticiario Ornitológico. Ardeola, 46: 150.

- GALARZA, A. and ARIZAGA, J. 2014. Population dynamics of a colony of Little egrets *Egretta garzetta* at an estuary in Northern Spain. *Ardeola*, 61: 285-296.
- GARRIDO, J. R. 2003. Garceta común *Egretta garzetta*. In, R. Martí and J.C. del Moral (Eds.): *Atlas de las aves reproductoras en España*, pp. 114-115. Dirección General de Conservación de la Naturaleza-SEO/BirdLife. Madrid.
- GARRIDO, J. R., MOLINA, B. and DEL MORAL, J. C. 2012. Las Garzas en España, Población Reproductora e Invernante en 2010-2011 y Método de Censo. SEO/BirdLife. Madrid.
- HAFNER, H., KAYSER, Y., BOY, V., FASOLA, M., JULLIARD, A-C., PRADEL, R. and CÉCILLY, F. 1998. Local survival, natal dispersal, and recruiment in Little Egrets *Egretta garzetta*. Journal of Avian Biology, 29: 216-227.
- HAFNER, H., PINEAU, O. and KAYSER, Y. 1994. Ecological determinants of annual fluctuations in numbers of breeding Little Egrets *Egretta garzetta* in the Camargue, S. France. *D'Ecologie* (*Terre Vie*), 49: 53-62.
- HANCOCK, J. and KUSHLAND, J. 1984. *The Herons Handbook*. Croom Helm, London and Harper & Row. New York.
- HOLLING, M. 2010. Rare breeding birds in the United Kingdom in 2008. *British Birds*, 103: 482-538.
- KUSHLAN, J. A. and HANCOCK, J. A. 2005. *The Herons*. Oxford University Press. Oxford.
- LORENZO, M. 2011. Garceta Común Egretta garzetta. Noticiario Ornitológico. Ardeola, 58: 200-201.
- LUENGO, A., ETXANIZ, M. and AZPEITIA, N. 2015. First breeding of little egret *Egretta garzetta* L., 1776 in Gipuzkoa. *Munibe*, 63: 163-166.
- MARION, L., ULENAERS, P. and VAN VESSEM, J. 2000. *Herons in Europe*. In, J. A. Kushlan and H. Hafner (Eds.): *Heron Conservation*, pp. 1-31. Academic Press. London.
- NAVEDO, J. G. 2003. Garceta común *Egretta gar*zetta. Noticiario Ornitológico. Ardeola, 50: 341.
- NAVEDO, J. G., MASERO, J. A. and JUANES, J. A. 2007. Updating waterbird population estimates within the east atlantic flyway: status and trends of migratory waterbirds in Santoña marshes. *Ardeola*, 54: 237-249.
- NEWTON, I. 2010. *Bird Migration*. HarperCollins Publishers. London.

- NEWTON, I. 2013. *Bird Populations*. HarperCollins Publishers. London.
- PINEAU, O. 1992. Key wetlands for the conservation of Little Egrets breeding in the Camargue. In, C. M. Finlayson, G. E. Hollis and T. J. Davis (Eds.): *Managing Mediterranean Wetlands and their Birds*. IWRB Special Publication 20. Slimbridge, U.K.
- SEO/BIRDLIFE. 2012. Análisis preliminar del banco de anillamiento del Ministerio de Agricultura, Alimentación y Medio Ambiente, para la realización de un atlas de migración de aves de España. SEO/BirdLife-Fundación Biodiversidad. Madrid.
- SEXTON, J. P., MCINTYRE, P. J., ANGERT, A. L. and RICE, K. J. 2009. Evolution and ecology of species range limits. *Annual Review of Ecolo*gy, Evolution, and Systematics, 40: 415-436
- TOURENQ, C., BENNETTS, R., SADOUL, N., MESLEARD, F., KAYSER, Y. and HAFNER, H. 2000. Long-term population and colony patterns of four species of tree-nesting herons in the Camargue, South France. *Waterbirds*, 23: 236-245.
- USABIAGA, J. I., SÁENZ AGUIRRE, J., VALENCIA, V. and BORJA, Á. 2004. Climate and meteorology,

variability and its influence on the ocean. In, Á. Borja and M. Collins (Eds.): *Oceanography and marine environment of the Basque Country, Elsevier Oceanography Series*, 70: 75-91.

- VALVERDE, J. A. and WEICKERT, P. 1956. Sobre la migración de varias garzas españolas (Primeros datos del anillamiento en Doñana). *Munibe*, Año VIII, Cuad. 1º: 1-23.
- VOISIN, C., GODIN, J. and FLEURY, A. 2005. Status and behaviour of Little egrets wintering in western France. *British Birds*, 98: 468-475.
- WOOD, K.A. and STILLMAN, R. A. 2014. Do birds of a feather flock together? Comparing habitat preferences of piscivorous waterbirds in a lowland river catchment. *Hydrobiologia*, 738:87-95.
- ZWARTS, L., BIJLSMA, R. G., VAN DER KAMP, J. and WYMENGA, E. 2009. *Living on the edge: Wetlands and birds in a changing Sahel*. KNNV Publishing. Zeist.

Received: 25 August 2015 Accepted: 19 April 2016

Editor: Jesús Avilés