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Colonization of the Yellow-legged gull in the southeastern Bay of Biscay and efficacy of deterring systems on landfill site

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ABSTRACT

On the French Basque Coast (southwest of France), the Yellow-legged gull *Larus michahellis* has undergone a widespread demographic and geographical increase in the last decade, originally by population breeding in northern Iberia. The demographic increase seems to be due to a combination of several factors: the establishment of a landfill close to the coast and the availability of nesting sites.

Birds foraging on landfill sites affect day-to-day site operation. In recent years, thousands of gulls were present daily on the landfill site and have used waste as another feeding opportunity. Management methods were used to limit access of birds to the landfill site and to control the population to a natural dynamic. Distress calls and pyrotechnic means were used on the landfill site for 11 months. Abundance, behavior, efficacy of the deterring systems and distribution along the whole coast were studied.

Initial results showed a significant decrease in the abundance of gulls on the landfill site. A change in their behavior was also noted with a reduction in resting and feeding birds. This, combined with the uninterrupted, random, deterring system at the landfill site showed an efficient measure to control gulls population. Monitoring along the coast did not show any significant impact on common resting sites.

Despite these promising results, we cannot exclude a new opportunistic response from the gulls. In addition, the proximity of Spanish colonies requires cross-border management for effective control of the population. Long-term monitoring is needed both at the landfill site to measure possible habituation and at the nesting sites to assess breeding success after one year of deterring actions.

1. Introduction

Gulls are often found to be superabundant due to their adaptable, opportunistic and gregarious nature which makes them highly adapted to living in man-modified habitats (Blokpoel and Spaans, 1991). In France, the Yellow-legged gull *Larus michahellis* has also undergone a population explosion over the past 30 years, notably on the northern shores of the Mediterranean Sea (Yésou and Beaubrun, 1995; Thibault et al., 1996). This gull, whose breeding range extends from the Azores to the Aral sea, is the most common and wide-spread larid of the Mediterranean basin and includes at least 120,000 nesting pairs in the western Mediterranean (Pérennou et al., 1996). On the Atlantic coast, the geographical distribution of gulls during breeding and non-breeding season has also been extended. The global population of Yellow-legged gulls was estimated to be 235,000 pairs in the late 1990s (Heath et al., 2000) including 42,000 in France and less than 200 pairs on the Atlantic coast until 2000 (Vidal et al., 2004).

The demographic increase is due to a combination of three main factors (Oro et al., 1995; Oro, 1999; Duhem et al., 2008): the establishment of a number of peri-urban open-air landfills; the development of industrial fisheries; and the protection of several areas where the species breed, in particular certain islets. Landfills provide an abundant food supply, particularly during the non-breeding period, but they generate impacts at both individual and population levels, with consequences translated to ecosystem functioning (Oro et al., 2013).

Some control programmes have already been implemented around the world. Various methods are used: destroying eggs (Engeman et al., 2012); culling adults (Bosch et al., 2000); use of distress calls, pyrotechnics, blank ammunition, hawks, wailers and helium-filled bird-scaring kites (Baxter, 2000; Cook et al., 2008;

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Soldatini et al., 2008; Thiériot et al., 2012).

The Basque coast and northwest Iberian coast (Cantabrian; Bay of Biscay) have also been heavily colonized by the Yellow-legged gull since the second half of the 20th century, with nearly 100,000 pairs breeding in Iberia (Arizaga et al., 2009). Currently, two sub-species are recognized as breeding in Iberia (Pons et al., 2004): *L. m. michahellis*, present around the Mediterranean basin, and *L. m. lusitanius*, on the Atlantic coast from the southeastern Bay of Biscay to central Portugal. Previous studies have shown movements of Mediterranean Yellow-legged gulls to the Bay of Biscay, related to their foraging behavior during the non-breeding season, whereas *L. m. lusitanicus* appears to be resident (Munilla, 1997; Martínez-Abrain et al., 2002; Arizaga et al., 2009; Galarza et al., 2012).

The French Basque Yellow-legged gulls colonies (Bay of Biscay; south-west of France) have been established since 1996 and underwent a sharp population increase between 1996 and 2013 (Castège et al., 2013). This population explosion, also observed along the Spanish Basque coast where large new colonies appeared during the same period, is partly linked to the high availability of food in three landfills: Urteta and San Marcos in Spain (Arizaga et al., 2009) and Zaluaga Bi in France (CSDU - Centre de Stockage des Déchets Ultimes - Ultimate Waste Storage Center). The San Marcos landfill closed in 2008, so gulls began to use the Urteta landfill where falconry is implemented since 2010 (Arizaga et al., 2013a). Some studies had already proven that geographic variation in diet is correlated with the distance of colonies to important feeding locations, such as harbors, fishing areas, refuse tips or crops (Moreno et al., 2009; Ramos et al., 2009).

Birds foraging on landfill sites affect day-to-day site operation. *Via* predation, the Yellow-legged gull has also played a role in the attrition of a small population of European Storm petrels *Hydrobates pelagicus*, already decreasing in relation with the climate change (Hémery et al., 1995; Castège and Hémery, 2009; Castège et al., 2009). This kind of threat is often due to particular individuals which specialize in killing European Storm petrels (Sanz-Aguilar et al., 2009).

For 11 months, deterring systems were used at the CSDU landfill site to reduce the nuisance and damage caused by the increasing population of gulls. The present work describes the colonization of the Yellow-legged gull in the southeastern Bay of Biscay and presents the results of the deterring actions, their efficacy and potential effect on the Yellow-legged gull population in the area.

2. Materials and methods

2.1. Study area and survey

The study area is located along the French Basque coast (southwest of France) in the southern half of the Bay of Biscay. Three different surveys were conducted: (1) colonization by breeding gulls since 2001, (2) spatial distribution of gulls on the French Basque coast during breeding and wintering periods since 2006 and (3) response to deterring systems on the landfill site since 2013. Data on ringed birds are opportunistic as we recorded their presence regardless monitoring or period. Sometimes age classes could not be distinguished because gulls were too numerous on the landfill. Therefore, these data are not used in this study.

2.1.1. Breeding gulls monitoring

Two colonies are established in this area, at a distance of 20 km: Biarritz and Hendaye (Fig. 1). First observation of breeding pairs has been referenced in Hendaye in 1996 (Milon and Castège, 2015) but, then, data were not available until 2001. Between 2001 and 2013, all nests (breeding pairs) were counted in Biarritz and Hendaye, in April and July, by which time almost all clutches have been completed, directly on colonies or by using a telescope from the coast. The breeding population is expressed in numbers of nests.

2.1.2. Whole population monitoring

The second survey was conducted during the breeding and wintering periods at six stations (Fig. 1): Biarritz, Saint-Jean-de-Luz, the Cliff, Hendaye, Txingudi bay and the CSDU, the only landfill site where constant, highly predictable and significant food sources are available (St Péé sur Nivelle, ca. 6 km inland). Research effort was equal in all stations in terms of time and people sampling.

Data were collected since 2006 on randomly selected days and time periods, from sunrise to the end of the day. Several samples were recorded each month, according to observers' availability. Exceptionally and beyond our control, there was no monitoring in winter 2006 on the landfill site. The abundance of Yellow-legged gulls in the study area was weighted by the sampling effort and expressed as mean numbers of individuals per count. Daily and annual mean abundances were used to carry out descriptive analyses.

2.2. Deterring systems at the landfill

The CSDU was created and has been in operation since 2003. It has a storage capacity of one million tons and aims to eliminate 50,000 tons of waste per year from the surrounding communities. It is located almost 6 km inland and has attracted gulls since its creation. Wastes were dumped and compacted in an area covering approximately 2500 m^2. Birds used this area from the first hour of daylight to the end of the day. Additional observations of Yellow-legged gull behavior were made (resting, feeding, in site flight and out site flight).

For 11 months (from April 2013 to March 2014), deterring actions were used on the CSDU site to limit the access of birds to the landfill and to control the population dynamics. The deterring actions combined pyrotechnics and distress calls (natural or man-made calls) from the trash compactor or a static point. There was a break every day between 1 p.m. and 2 p.m. First sights of habituation were observed in October 2013. Therefore management was adapted through uninterrupted deterring actions. In addition, pyrotechnic shots outside the landfill were performed to deter huge groups of gulls resting on nearby fields.

Gulls experienced two different deterring treatments during the study period: “simple deterring systems”, implemented in April 2013 until September 2013 and “uninterrupted deterring systems”, from October 2013 to March 2014. A break of two months in the visual counts was made (January and February 2014). A control period, from March 2013 to April 2013 (6 weeks) was applied before the implementation of the deterring systems.

2.3. Statistical analysis

Efficacy of the deterring systems was assessed by the *E* index (established by Soldatini et al., 2008) using the following formula:

$$E = [(N - nFD) - (nFD - nR)]/N$$

With:

- initial number of birds (N): the total number of birds counted prior to the treatment;
- number of departures (nFD): total number of birds that took off in response to the signal;