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Results from ringing chicks of Audouin's Gulls *Larus audouinii* at Aspretto colony (Corsica) and controls in Corsica of chicks ringed in Italy

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Key Words: *Larus audouinii*, Corsica, dispersal, survival, Audouin's Gull

The Audouin's Gull *Larus audouinii* breeds in the gulf of Ajaccio (Corsica, France ; 41°55' N, 08° 47' E) in a Natura 2000 area (SPA FR9412001, FR9410096), with 38 to 59 pairs. The ringing of young birds with alphabetical colour rings began in 2000 and 293 birds have been ringed in 9 years. Many birds have been controlled and these controls allow to map their dispersal and to estimate their survival and degree of philopatry. Furthermore, the controls in Ajaccio of birds ringed outside Corsica show exchanges between colonies. We have also estimated the age of first reproduction, the breeding success according to age and the sex-ratio in relation to the origin of birds.

The majority of Corsican Audouin's gulls are in Morocco in autumn and winter (Figures 1 & 2) and a first winter bird has been seen as south as Senegambia). In spring, a number of Corsican-born birds stay in Italy and Spain.

Most of the foreign birds seen at Aspretto are coming from Italian islands, above all Sardinian islands and Tuscany, also from Apulia (Figure 3). Despite the high number of birds ringed in the Ebro delta, Spain, only two Spanish Audouin's Gulls were seen at Aspretto. Six chicks ringed in Italy settled to breed on the study colony.

Corsican birds do not return to the colony in their first-year (Figure 4). First breeding occurs in the third or fourth year. Reproductive success is very low (Figure 5).

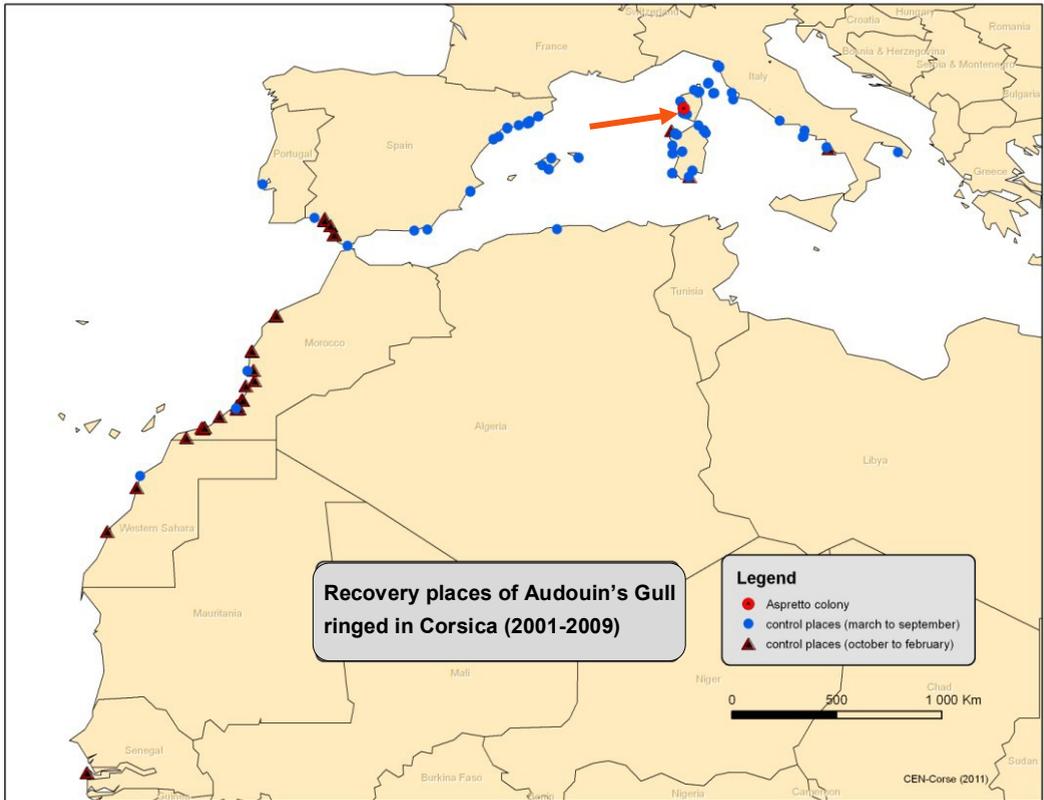


Figure 1. Map showing observations of Audouin's Gulls ringed as chicks at Aspetto colony (Corsica: red spot).

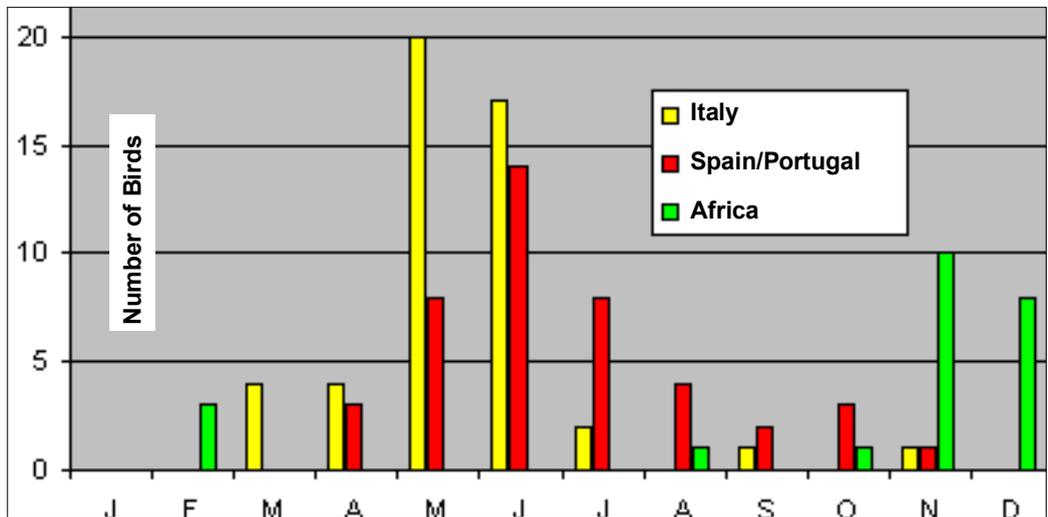


Figure 2. Number of Audouin's Gulls ringed as chicks at Aspetto colony (Corsica) observed by month in Italy (yellow), Spain/Portugal (red) and Africa (green).

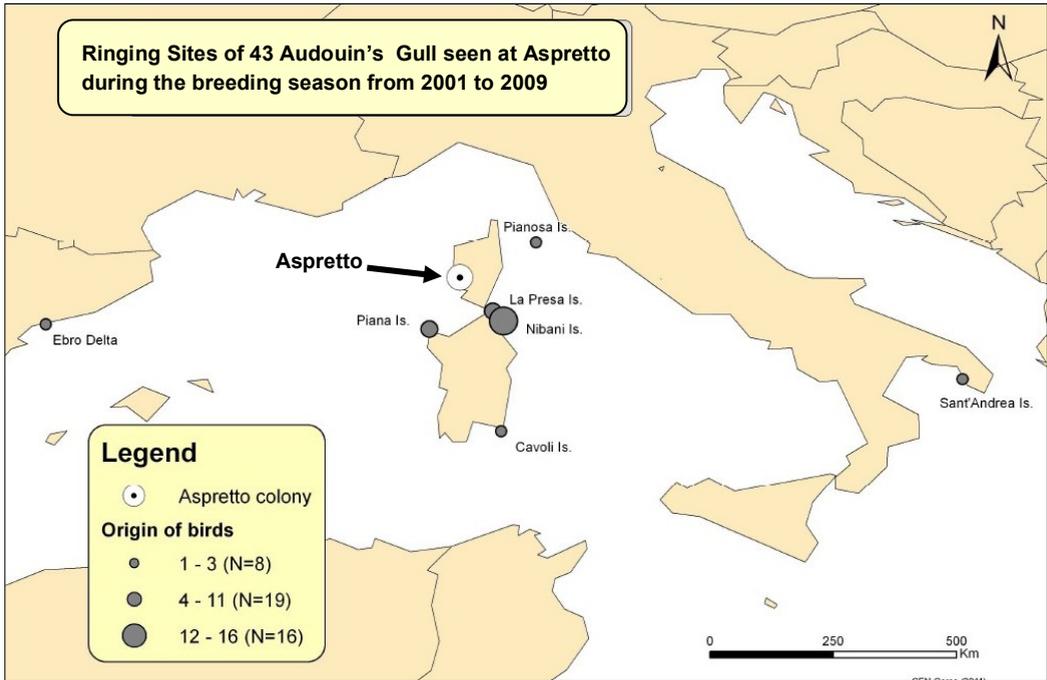


Figure 3. Sites in Italy and Spain where Audouin's Gulls were ringed and observed at Aspretto (Corsica).

Age class	Rate of global recapture	Rate of local recapture
First year	7 %	0 %
Second year	26 %	between 0% et 84%
Third year and more	64 %	64 %

Table 1. Recapture rate for Audouin's Gulls *Larus audouinii* ringed at Aspretto, Corsica, as calculated with M-Surge software (Lebreton *et al.* 1992, Choquet *et al.* 2004).

Age class	Global survival	Confidence interval	Local survival	Confidence interval
First year	0.64	0,52 – 0,74	0,46	0,36 – 0,56
Second year and more	0.87	0,81 – 0,92	0,9	0,83 – 0,95

Table 2. Global survival of Audouin's Gulls ringed at Aspretto, Corsica.

The probability of control of Audouin's gulls ringed as chicks at Aspretto increases with age (Table 1). The calculated survival for first-year Corsican birds (0,64, Table 2) seems to be lower than that calculated in the Ebro delta (0,79 according to Oro 1998), but this value might be underestimated. For second-year and older birds, no comparison is possible with Ebro delta since the used age-class

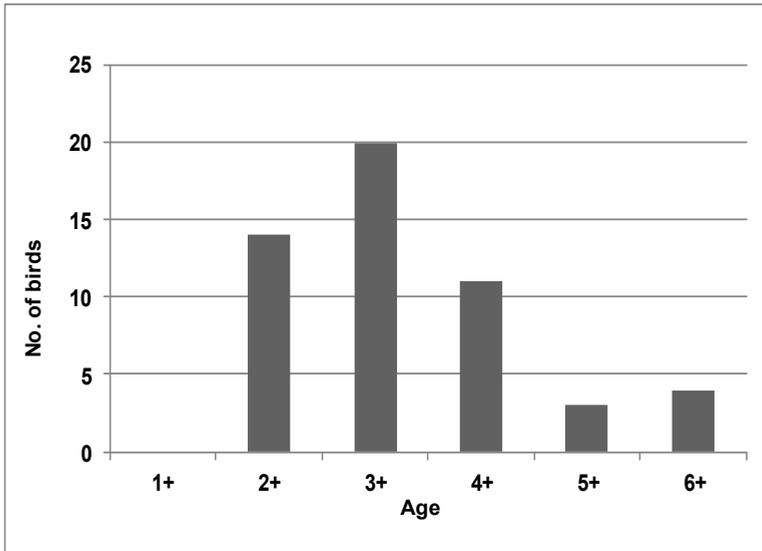


Figure 4. Age of the first return to the colony of Audouin's Gulls (N= 60),

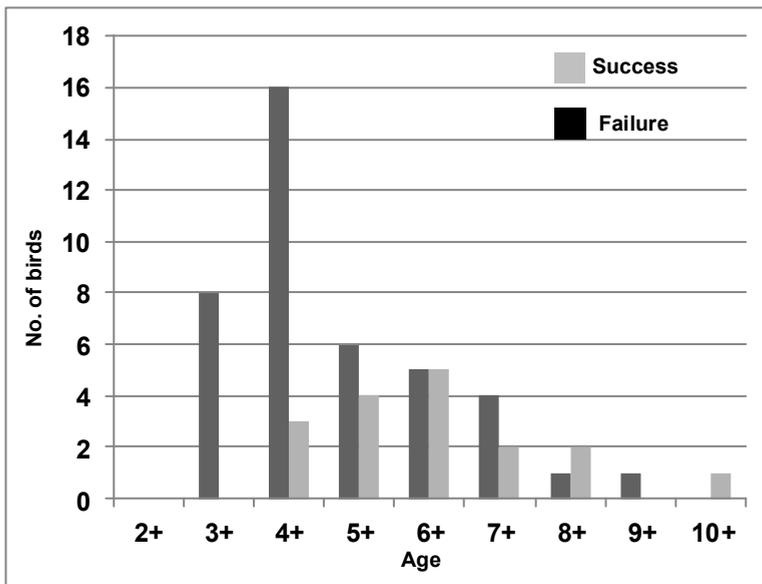


Figure 5. Breeding success of Audouin's Gulls ringed at Aspretto or in Italy in relation to age.

system differs. In any case, our sample size needs to increase in order to obtain more precise results, particularly through smaller confidence indexes.

Figure 5 shows that 84.7% of the ringed chicks at Aspretto and controlled at this colony were males. The recruitment of females from Italian colonies indicates exchange between colonies

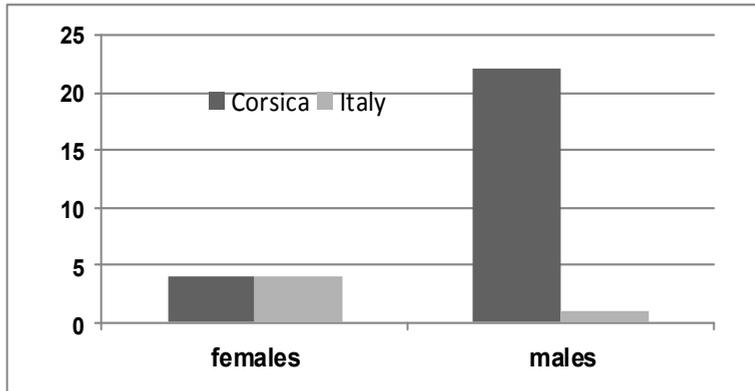


Figure 6. Sex-ratio of ringed Audouin's Gulls breeding at Aspretto, Corsica (N=31: 22 males and 4 females ringed in Corsica and 1 male and 4 females ringed in Italy).

around Corsica, Sardinian and Tuscan archipelagos. We expect that the continuation of the ringing programme and more intensive reading of coded rings at breeding colonies (both in Corsica and in Italy) will improve the estimate of survival rates. It will also allow to compare the local survival of males and females, which might help to understand the apparent sex-biased philopatry. Overall, a better knowledge of reproduction failures and exchanges between colonies should help us to understand the mechanism of desertion of colonies.

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Estimating the breeding success of Audouin's Gull *Larus audouinii* at the main Italian colony (Laguna di Nora, Sardinia)

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Summary: Reproductive parameters obtained in 2009-2011 at the main Italian colony of Audouin's Gull *Larus audouinii* (Laguna di Nora, south Sardinia, ca. 30 % of the Italian population) are presented. Resightings of colour-ringed juveniles and census of dead chicks allowed annual productivity to be calculated with two mark-recapture methods. A large and steady decrease of this crucial breeding parameter, not related to colony size, was observed. More than 0.7 chick/pair were fledged in 2009, but only ca. 0.2 chick/pair in 2011. Bad weather after hatching and food shortage are the likely causes of this particularly poor breeding performance at Nora colony in two out of three investigated seasons.

Key Words. Audouin's Gull, *Larus audouinii*, breeding success, Lincoln method, Sardinia

Introduction

Audouin's Gull *Larus audouinii* is a species of conservation concern, with a world distribution confined to the Mediterranean basin. It is currently classified as Near Threatened at the global level (BirdLife International 2012), following the population increase which has taken place in the western Mediterranean basin during the last 30 years, and as Lower Risk/Near Threatened at the national level (Peronace *et al.* 2012). After Spain, Italy is the second important country for this species (Oro *et al.* 2000). Size and distribution of the Italian breeding colonies are regularly assessed; annual totals do not show any clear trend, with large fluctuations in some years (Serra *et al.* 2001, ISPRA unpublished). Information on breeding success and on factors that affect it are scanty. Estimating annual productivity requires counts of fledged birds (see e.g. Craik 2000 and Martinez-Abraín *et al.* 2003 for examples referring to gull species). As a general rule, counts of newly-fledged individuals may be relatively easy when colonies are located on small islands, where juveniles gather on coastal rocks soon after fledging. It can be more problematic, however, in coastal salt-marsh habitats due to dense vegetation which may hide an important part of juveniles. In this context, the aim of this work is to provide data on breeding success obtained through two different survey protocols based on the simplest mark-recapture method (the Lincoln method: Bibby *et al.* 1992).



Figure 1. Nora Lagoon. Colony (rectangle) and roosting site (circle) of Audouin's Gulls.

Study area and methods

The breeding colony at the Laguna di Nora ($38^{\circ}59'N$ $09^{\circ}00'E$) was chosen to investigate the main breeding parameters in the three years 2009-2011. This site accounts for about 30% of the Italian population (ISPRA unpublished). It is a 55 Ha coastal lagoon located along the southern coast of Sardinia, separated from the sea by a dam created in 1957 for fish farming (Figure 1). During the 1980s, 11 artificial islets (with an approximate total surface of 1.7 Ha) were built to act as winter shelters for fish. They are now abandoned and totally overgrown by salt scrub vegetation (*Halimione portulacoides* and *Arthrocnemum* sp.). These islets constitute an area protected from terrestrial predators and external disturbance. The colony of Audouin's gull likely settled there in the mid 1990s (G. Ollano pers. comm.); it has been monitored regularly only since 2003. Observers can easily approach the breeding site, but counts of nests or chicks from the outside is not possible, as most are hidden by scrubby vegetation. After fledging, part of juveniles first gather in a resting area close to the colony, where ring-reading is possible, but they quickly disperse along a wider coastal area. Hence, counts of fledged individuals invariably refer to an unknown portion of juveniles and cannot be used to calculate annual productivity.

The colony was monitored as follows:

- (a) a complete count of nests and their contents performed around mid-incubation period (15-16 May) by three teams of two people each, to minimize the time spent in the colony;

- (b) a second visit to the colony carried out one month later, to mark all visible chicks with darvic and metal rings within a time of 30-45 minutes; during this visit all dead chicks are counted and removed;
- (c) one or more telescope sessions carried out in the days following fledging, to read rings and assess the frequency of marked juveniles in flocks of known size roosting close to the colony;
- (d) a third visit to the colony after all fledglings have left, to count chicks that had died after the ringing session.

The number of fledged juveniles (P) was then estimated as:

Method 1 ("live juveniles"): frequency of marked birds among fledged juveniles: $P = (A/B) \times (I-IM)$ where A = total number of juveniles checked for rings during the telescope session; B = number of ringed juveniles; I = total number of ringed chicks; IM = number of ringed chicks that had died before fledging.

Method 2 ("dead chicks"): frequency of marked birds among dead fledglings: $P = I \times M/IM$ where I = total number of ringed chicks; M = number of chicks that had died after ringing and before fledging; IM = number of ringed chicks that died before fledging.

	2009	2010	2011
Estimated start of laying	10-20 Apr	15-20 Apr	7-18 Apr
Number of nests	550	605	493
Number of laid eggs	1176	1464	1070
Mean clutch size \pm sd (range)	2.1 \pm 1 (0-4)	2.4 \pm 0.9 (0-4)	2.1 \pm 1 (0-5)
% nests with eggs	90.0%	92.7%	88.4%
% nests without egg	10.0%	7.3%	11.6%
% nests with 1 egg	14.7%	6.7%	12.9%
% nests with 2 eggs	33.6%	25.1%	34.4%
% nests with 3 eggs	41.3%	60.7%	40.7%
% nests with 4 eggs	0.4%	0.2%	0.2%
% nests with 5 eggs	0.0%	0.0%	0.2%
Number of ringed chicks	77	94	66
Number of fledglings (method "live juveniles")	408	204-230	81-84
Mean number of fledglings/pair (method "live juveniles")	0.74	0.34-0.38	0.16-0.17
Number of fledglings (method "dead chicks")	394	226	116-125
Mean number of fledglings/pair (method "dead chicks")	0.72	0.37	0.23-0.25

Table 1. Reproductive parameters of Audouin's Gull at Laguna di Nora, Sardinia, in 2009-2011

Start of egg-laying was estimated from the age of hatched broods during the count of nests, and an incubation period of 26-33 days (Cramp and Simmons 1983). During nest counts, eggs outside nest cups were also counted and are included in the “Number of laid eggs” value. However, mean clutch size was calculated using eggs inside nests only.

Results and discussion

The results obtained in the 2009 to 2011 breeding seasons are summarized in Table 1. Annual counts ranged between 493 (2011) and 605 pairs (2010). The average clutch size and the percentage of nests without eggs showed small differences among the three investigated seasons (2.06-2.40 eggs/pair and 7.28-11.60 % respectively), whereas productivity showed much larger between-years fluctuations (0.16-0.74 using ring readings on juveniles, 0.23-0.72 using dead chicks).

The 2010 breeding season had the highest number of breeding pairs and the highest proportion of large clutches (three or more eggs, ca. 61%). Both 2009 and 2011 had a much lower frequency of large clutches (slightly higher than 40%), and a higher proportion of small ones (1-2 eggs). Reproductive success showed a steady decrease over the three years, with values which roughly halved each year and reached a very low level in the last investigated season. As a result, 2010 and 2011 were featured by a very poor breeding outcome. Indeed, the number of fledged birds was dramatically affected by limiting factors acting during the rearing period. These limiting factors, still to be fully identified, likely include food shortage, but also adverse weather after hatching.

The two methods used to estimate the annual productivity gave similar results, with differences of less than 5% in two of the investigated seasons (2009 and 2010); differences were much larger in 2011 (>30%). The poor correspondence between the two methods in 2011 is likely to be attributed to an inadequate sampling of fledged birds. In 2011 only one successful telescope session could be performed on a reduced sample of juveniles, since soon after fledging the usual roosting area was flooded and birds no longer used it. We suggest that both methods allow reliable estimates of the number of fledged young in Audouin's Gull colonies. Values obtained with the two methods are similar, provided that a sufficient sample of fledged birds are checked before they leave their natal colony (Method 1) or that all dead chicks are counted before and after fledging (Method 2).

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Abundance and predictability of local waste food may keep juveniles Yellow-legged Gull *Larus michahellis* in their natal areas

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Summary: We analysed recoveries of juvenile Yellow-legged Gulls *Larus michahellis* ringed in the coastal city of Livorno, Italy. We assessed whether the availability of food resources affect the movements of juvenile gulls raised in the urban area. Results showed that juveniles tend to remain close to their natal area, limiting or delaying their movements towards northern wintering quarter.

Key Words: *Larus michahellis*, Yellow-legged Gull, juvenile, dispersal, recoveries, food availability

Introduction

In the Mediterranean basin most juvenile Yellow-legged Gulls *Larus michahellis*, once fledged, show a tendency to move towards richer North-European feeding areas and then return to natal areas after three or four years (Isenmann 1973, Yésou 1985, Snow & Perrins 1998, Bricchetti & Fracasso 2006). On one hand, these dispersive movements seem to confirm the tendency of the species to avoid competition between age classes and to explore new environments (Soldatini *et al.* 2005). On the other hand, these gulls are opportunistic feeders, exploiting a wide variety of food (Snow & Perrins 1998). In urban and coastal areas, dumped refuse and fishing discards are highly predictable, daily renewed and locally abundant resources (e.g. Chace & Walsh, 2006), presumably allowing the gulls to minimize time and energies spent foraging.

Aim and Methods

The aim of our study was to assess whether juvenile gulls born in an urban area where anthropogenic food resources are available, accessible and abundant, tend to remain in their natal area after fledging or disperse towards North-European quarters. Since 2001 in the coastal city of Livorno, Italy (43°33'6"N, 10°18'2"E), we have been monitoring an urban population of Yellow-legged Gull (Arcamone & Leone 2001, Arcamone & Franceschi 2006), and from 2009 we started to trap adult breeders and their nestlings in order to band them with coloured rings. A total of 31 chicks were banded in Livorno during the breeding seasons 2009 and 2010. The low number of chicks caught is mainly due to the complexity in capturing gulls in urban environment where most breed on rooftops (tile roofs): the reduced sample depends on the lack of suitable and safe places that ensure the safety both of the researchers and of the gulls, still unable to fly. The chicks were ringed at 15-20 days old, with both metal and engraved colour PVC rings allowing each chick to be individually recognized. Sighting data were actively collected, checking every fifteen days all

year round from July 2009 to June 2011 in all known foraging areas around the city of Livorno, while reports from other ornithologists or birders were also collected.

Results

A total of 32 sightings of 14 individuals were collected, i.e. about 45 % of the ringed chicks. Seven immature gulls were observed as age 3 in late summer or early autumn and then re-sighted five years after their birth (Table 1). We also collected two sightings from abroad: the first was a juvenile ringed on 25 May 2009 thereafter observed on 18 November 2009 at Pasajes, Guipúzcoa, Spain (43°19'20"N, 01°56'01"W) on the Atlantic coast of the Bay of Biscay (age 3; distance 988 km; direction from ringing site: 272,68 °), while the other one ringed on 12 May 2010 has been observed on 12 May 2011 at Zeebrugge, Belgium (51° 20' N, 03° 11'; age 5; distance: 1017,5 km; direction from ringing site: 330,82 °).

Ringing data	Metal ring	Coloured ring	Place	Number of Recoveries		
				Aug-Oct	Nov-Mar	Apr-Jul
20/05/2009	CC 9771	IVAH	Livorno – ITALY	0	2	2
26/05/2009	CC 9782	IVBB	Livorno – ITALY	0	1	2
05/05/2009	CC 9785	IVBF	Livorno – ITALY	0	1	0
07/05/2010	CH 1201	IVCA	Livorno – ITALY	2	1	2
07/05/2010	CH 1202	IVCB	Livorno – ITALY	0	0	1
07/05/2010	CH 1203	IVCL	Livorno – ITALY	0	0	1
28/05/2010	CH 1210	IVCN	Livorno – ITALY	0	3	1

Table 1: Recoveries of Yellow-legged Gulls ringed in Livorno and observed as 2cy (age 5) near the natal colony.

Discussion

Most (88%) of the observations took place at the Porto Mediceo of Livorno, where gulls feed daily on discards arising from fishing vessels activities. Recoveries were made all year round suggesting that some of the juveniles reared in the urban area tended to remain close to their natal area or delayed the departure towards North-European wintering areas. Immature gulls probably find plenty of food available during the winter and thus limit their movements.

Information on the dynamics of urban population of gulls remains scarce and needs more attention, particularly when their management is required. Our data suggest that an available and abundant source of food provided throughout the year, may hold juvenile Yellow-legged gulls in their natal area, or reduce to some extent their dispersal movements. These preliminary results need further investigations and experimental studies involving more marked individuals.

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The breeding status of Slender-billed Gull *Larus genei* in the Valencian Region (E Spain): 20 years of survey and management.

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Summary: Up to 2010, the Slender-billed Gull *Larus genei* has bred at three coastal locations in the Valencian Region (E Spain) since first breeding was recorded in this region in 1991. Changes in colony size at each location (Salinas de Santa Pola, Lagunas de La Mata-Torrevieja and l'Albufera de Valencia) are described as well as threats recorded and management efforts made to preserve the colonies. Despite unstable numbers of pairs at each site, the regional total increased up to 500 breeding pairs after 2006. Conservation issues were: availability of nesting site; competition with the Yellow-legged Gull *L. michahellis*; and exposure to organophosphate pesticides used at colony surroundings.

Key-words. Slender-billed Gull, *Larus genei*, survey, management, Valencian Region, threats.

Introduction

The Slender-billed Gull *Larus genei* is a species associated to coastal salt marshes. It breeds in mixed colonies with other species of gulls, terns and waders, mostly on islands and sandy margins with vegetation. It feeds on fish and invertebrates in shallow waters in coastal lagoons, marine bays, salt pans and fish-farm ponds (Del Hoyo *et al.* 1996). This species shows a high dispersal rate, both natal and reproductive. Distance ring reading data of individuals from the Spanish colonies enabled us to show how the western Mediterranean populations are connected as a metapopulation (Oro 2003).

Here we summarize the fate of the three breeding colonies of Slender-billed Gull that exist in the Valencian Region (Comunitat Valenciana, Mediterranean coast of Spain). Two are located in the wetlands of southern Alicante province (Salinas de Santa Pola and Lagunas de La Mata-Torrevieja). The third colony is located in l'Albufera de Valencia in Valencia province. The species was first observed at Salinas de Santa Pola in the mid-1980s and the first colony subsequently was established in 1991. At Lagunas de La Mata-Torrevieja the species started breeding in 1995 (with individuals coming from Salinas de Santa Pola after colony desertion). At l'Albufera de Valencia the first breeding took place in 1994.