Foraging habitat selection by gull–billed tern (*Gelochelidon nilotica*) in Central Spain (Castilla–La Mancha)

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Abstract
*Foraging habitat selection by gull–billed tern (*Gelochelidon nilotica*) in Central Spain (Castilla–La Mancha).* The gull–billed tern breeds in temporary lakes in Castilla–La Mancha in Central Spain but depends on surrounding land habitats to feed its chicks. It is therefore vital to know the type of environments it selects to capture prey to feed nestlings. The aim of this study was to evaluate the use of habitats for hunting by adult gull–billed tern. Of 66 lakes monitored between 1996 and 2016, we found the gull–billed tern used 12 for breeding. Each lake was used during this period for 1–14 breeding seasons. We selected circular areas around the three wetlands where the species bred in 2013 and 2014. Within these circles, we sampled a total of 60 random points and recorded 125 gull–billed tern contacts (including between 1 and 39 birds). We estimated the same environmental variables at contact and random points, including land use and the distance to the nearest wetland, the nearest colony and to several types of anthropic uses (paved roads, houses, and cities). To evaluate habitat selection we calculated the Manly selection index for soil use variables, and fitted linear mixed models to evaluate differences in the distance variables. Land uses selected for foraging by the gull–billed tern were mainly cereal crops, whereas vineyards were avoided. The birds foraged on average up to 2 km from the colonies and tended to avoid proximity of towns and paved roads, suggesting that the species is sensitive to human disturbance. Vineyards are the main land use in this region and the intensity is increasing. Our results suggest vineyards should be limited in areas around these wetlands so that gull–billed terns may forage in their preferred sites.

Key words: Breeding colony, Agricultural landscape, Intensive vineyards, Foraging, Habitat selection, Temporary lake

Resumen
*Selección del hábitat alimentario de la pagaza piconegra (*Gelochelidon nilotica*) en el centro de España (Castilla–La Mancha).* La pagaza piconegra se reproduce en lagos temporales de Castilla–La Mancha, pero depende de los hábitats terrestres de los alrededores para alimentar a los pollos. Por consiguiente, es fundamental conocer el tipo de ambientes que selecciona para capturar presas con las que alimentarlos. La finalidad de este estudio fue evaluar la utilización que los adultos de la pagaza piconegra hacen de los hábitats para la caza. De los 66 lagos estudiados entre 1996 y 2016, constatamos que la pagaza se reproducía en 12. Durante este período, cada lago se utilizó para 1–14 temporadas de cría. Seleccionamos las zonas circulares alrededor de los tres humedales en los que la especie crio en 2013 y 2014. Dentro de estos círculos, muestreamos 60 puntos aleatorios y registramos 125 contactos con pagazas piconegras (incluidas entre 1 y 39 aves). Estimamos las mismas variables ambientales en los puntos de contacto y los aleatorios, con inclusión del uso de la tierra y la distancia al humedal más cercano, a la colonia más cercana y a varios tipos de usos antrópicos (carreteras asfaltadas, viviendas y ciudades). Para evaluar la selección del hábitat, calculamos el índice de selección de Manly para las variables de uso del suelo y utilizamos modelos lineales mixtos para evaluar las diferencias entre las variables de distancia. El principal uso de la tierra que la pagaza piconegra seleccionó para la alimentación fue el cultivo de cereales, mientras que evitó los viñedos. De media, las aves se alejaban para alimentarse hasta 2 km de las colonias y tendían a evitar la proximidad de ciudades y carreteras asfaltadas, lo que sugiere que la especie es sensible a las perturbaciones antrópicas. Los viñedos constituyen el

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principal uso de la tierra en esta región y su extensión está aumentando. Nuestros resultados sugieren que los viñedos se deberían limitar en zonas cercanas a estos humedales, para que la pagaza piconegra pueda alimentarse en sus lugares preferidos.

Palabras clave: Colonia de reproducción, Paisaje agrícola, Viñedos intensivos, Alimentación, Selección de hábitat, Lago temporal

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Introduction

Habitat selection is closely linked to the need to extract resources necessary to complete life cycles. It is therefore necessary that wildlife managers are aware of a species' preferred habitats (Caughley, 1994). Habitat selection is the innate or learned behavioral response that allows a bird to choose among the various environmental components, habitats or structures in a location that will influence survival or adaptation (Block and Brennan, 1993). The selection of breeding places seems to be a major factor in the breeding strategy of gulls and terns (Vargas et al., 1978; Goutner, 1991; Sánchez et al., 1991; Erwin et al., 1998), since many potential breeding sites are highly unstable and unpredictable habitats. Despite this, many individuals often use the same locality for years or decades, occupying the same places in consecutive breeding seasons, while in some years, colonies move to new breeding sites (Sánchez et al., 2004; Corbacho et al., 2009).

The gull–billed tern, *Gelochelidon nilotica*, has a worldwide distribution range, but its breeding colonies show a patched spatial distribution (Del Hoyo et al., 1996). In Spain, the gull–billed tern breeds in the Delta del Ebro, in a few temporary lakes in Central Spain, in the south of Andalusia, and in a few sites in Extremadura and Castilla–León (Martí and Del Moral, 2003). Breeding colonies tend to be located on beaches, wetlands and sedimentary islands but they are also found in man–modified habitats (Moller, 1981; Cramps, 1985; Palacios and Mellink, 2007). The gull–billed tern breeds in monospecific or mixed colonies, with other waterbirds (Vargas et al., 1978; Sánchez et al., 2004; Molina et al., 2009; Barati et al., 2012). They forage at distances ranging from 2 km to 20 km (Fasola and Bogliani, 1990) of breeding places.

The population of gull–billed tern in Central Spain appears to be increasing (Corbacho et al., 2009), but there is some also evidence of a reversing trend (Del Hoyo et al., 1996). The agricultural intensification that is occurring in Central Spain (Ruiz–Pulpón, 2013, 2015) could be related to a decrease in appropriate feeding habitats for the Gull–billed tern, since the lakes with breeding colonies are surrounded by agriculture fields, mainly vineyards and cereal crops (Ruiz–Pulpón, 2013, 2015). Changes in the landscape affect some bird species, especially those that breed in regions with intensive agriculture (Chamberlain et al., 2000), because these fields are prone to changes linked to crops considered more profitable.

To provide information that may help to preserve breeding colonies and their breeding success (Litvaitis, 2000; Molina et al., 2009, 2010), in this study we aimed to determine which habitats surrounding wetlands were preferentially used for hunting by the gull–billed tern and which habitats were avoided

Study area

The study area is located in the Reserva de La Biosfera Mancha Húmeda (hereafter RBMH), a wetland–rich area in Central Spain that stretches over almost 7.551 ha (GIA, 2015) with 117 humid zones. Most Castilla–La Mancha lakes are temporary and salty, and face drought periods which may dry them for years (Cirujano and Medina, 2002; Cirujano and Cobelas, 2011). We monitored 66 wetlands in this region. In some cases, this monitoring began in 1996, but it began ten years ago in most cases (fig. 1). These wetlands are located in a large agricultural region whose main crops are vineyards and cereals. Fields with tree species, such as olive trees (*Olea europaea)*, are scarce. Only 12 of the 66 wetlands had breeding colonies of gull–billed tern in one or more years (fig. 2). We recorded the number of couples that bred from 2007 to 2016 in all the wetlands. Of the wetlands used in 2013–2014, we selected four to study habitat selection in the following two breeding seasons. One of these wetlands (Camino de Villafranca) was not occupied in the following years, reducing the number of wetlands studied to three: Manjavacas (39° 24' 54'' N, 2° 51' 59'' W), Mermejuela (39° 32' 22'' N, 3° 8' 18'' W) and Longar (39° 42' 10'' N, 3° 19' 31'' W).

Data collection

We used a 7–km radius circle, centered in each study lake, to record habitat use and availability. In other habitats, gull–billed terns may search for food farther than this distance (Molina and Marschalek, 2003), but in our study area, a larger radius would encompass parts of nearby towns. Data collection was carried out in spring and summer, from April to June, in 2015 in Longar and in 2015 and 2016 in the other two lakes. Overall, we covered 27 itineraries, totalling 2,248.46 km (mean = 83.30 km, SD = 48.1). We used a GIS (Geographic Information System) to delimit the itineraries in such a way that they were distributed across the entire surface of the circle. Itineraries were visited by car as many times as needed to reach a minimum of 30 foraging observations per circle of each lake. Contacts with gull–billed terns looking for food, identified through their hunting flight, were positioned by GPS (Garmin ETREX30). The hunting flight is characterized by the bird flying slowly, with head down and frequent dipping movements towards land, corresponding to attempts to catching prey (Cramp, 1985; Molina and Marschalek, 2003; Molina et al., 2009). Contacts with birds in direct displacement flight, when they did not seem to be inspecting territory, were not considered in the analyses.

At every contact point (hereafter CP), the following variables were obtained: the number of birds searching for food and the type of environment (land use type) in which they fed. We used GIS to estimate distance from the individual bird or flock to: i) the nearest breeding colony; ii) to nearest paved road; iii) to nearest urban place (towns and villages); iv) to nearest wetland (used or not for breeding); and v) to the nearest isolated building (including abandoned buildings, inhabited houses or shelters for cattle) (table 1).

To evaluate habitat availability, we selected 20 random points (hereafter RP) within the 7–km

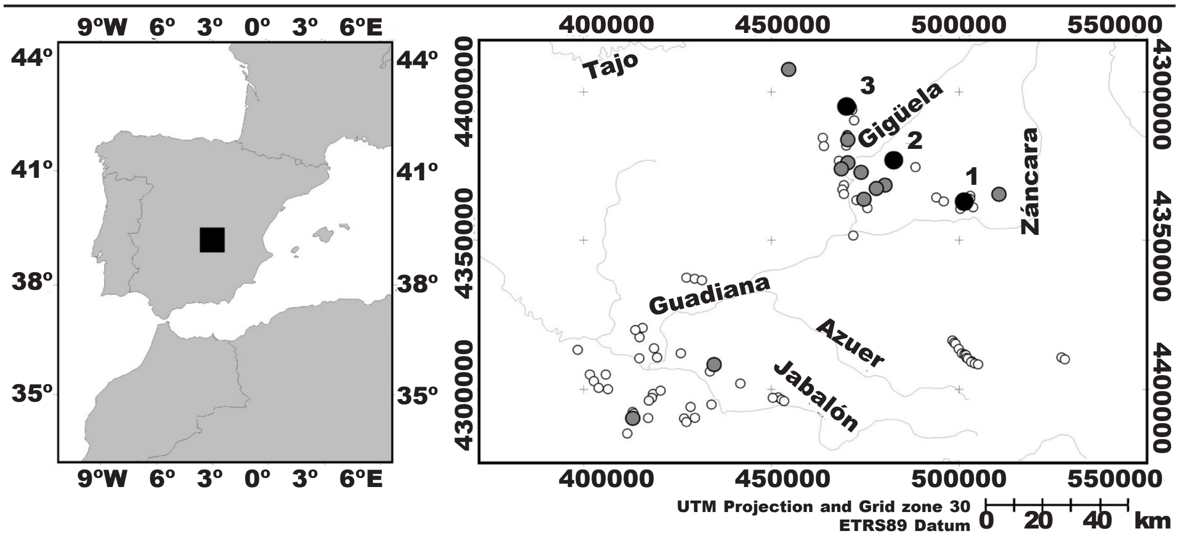

Fig. 1. Left, map of Spain with black square marking the study area. Right, map of Castilla–La Mancha wetlands showing the three sites (1, Manjavacas; 2, Mermejuela; 3, Longar) where habitat selection was studied: ● breeding colonies (studied lakes); ● breeding colonies (previous studied years); ○ lake without breeding colonies.

Fig. 1. Izquierda: mapa de España con la zona de estudio indicada con un cuadro negro. Derecha: mapa de los humedales de Castilla–La Mancha en el que se muestran los tres lugares (1, Manjavacas; 2, Mermejuela; 3, Longar) en los que se estudió la selección de hábitat: ● colonias de cría (lagos estudiados); ● colonias de cría (años estudiados previamente); ○ lago sin colonias de cría.

radius circle centered in each of the three wetlands studied. For this purpose, we randomly selected 20 random points, distributed along the length of the itinerary previously defined with GIS around each lake, using the random numbers function in Excel. At each of these points, this function was also used to randomly select the left or right side of the itinerary and a random perpendicular distance between 0 and 80 m from the point. Thus random points were situated within a 160 m wide band centered in the itineraries. This band was selected because gull–billed terns were detected from the itineraries within it, and in this way random points were selected within the area where terns were detectable. In RP, we estimated the same variables as in CP. Given that Manjavacas and Mermejuela were monitored in 2015 and 2016, the same RP were visited in the second year to check if type of land use had changed, but in all cases it remained the same.

Land use types considered (table 1) comprised two types of vineyards (traditional goblet vineyards and vertical trellis vineyards, in which canes are secured to trellis wires running the length of the row of vines), grain fields in different stages, and fallows (uncultivated fields resting between harvesting seasons). The wetland edge category includes areas with low vegetation surrounding lakes that may be flooded after high rainfalls.

Data analysis

Manly's Index (Manly et al., 2004) was used to evaluate the selection of land use types. This index computes the relation between available environments and those used by the species, as in equation 1:

$$Wj = \frac{uj}{aj} \qquad \text{(Eq. 1)}$$

where *uj* is the proportion of use of habitat in category *j* and *aj* is the availability of habitat *j*. These indices were calculated using package adehabitat HS (Calenge, 2006) in R (R development Core Team, 2016).

We used linear mixed models to evaluate whether distance variables differed between RP and CP. In these models, each distance variable was included as a dependent variable and the type of point (coded RP as 0 and CP as 1) as a fixed factor. Lake was included as a random factor. We used the lme function in the R nlme package (Pinheiro et al., 2017) to fit these models.

Results

The gull–billed tern bred in 12 of the 66 temporary wetlands monitored (fig. 1). Colonies used each lake from 1 to 8 times (fig. 2). Some colonies occupied the

Wetlands	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Pajares												25									
Salicor												108	240								
Camino de Villafranca	29	176							195			120	70	200	140	170	4	106			
Mermejuela													3	3	3		12		23	43	20
Longar							200	473		238						3	221		258	183	820
Manjavacas	215	72	239	137				48				145	66		6	200	322 120	53	220	167	23
Huevero															6						
Inesperada			12		50										2		6			35	
Cucharas															2	2		10			
Peñahueca					350	325	350	190													
Quero												20	3		3						
Larga de Villacañas						26	20														

Not breeding Breeding No registry Attempt to breed

Fig. 2. Monitoring data of the 12 wetlands used as breeding colonies by gull–billed tern.

Fig. 2. Datos de seguimiento de los 12 humedales empleados como colonias de reproducción por la pagaza piconegra.

Table 1. Description of habitat variables (land uses and minimum distances to potentially relevant territory features) used in this study.

Tabla 1. Descripción de las variables del hábitat (usos de la tierra y distancias mínimas a características del territorio potencialmente relevantes) empleadas en este estudio.

Substrate	Code	Description
Land use		
Cereal production	CE	Crops of oats or wheat
Fallows	FA	Unploughed cereal fields harvested at least one year ago and with dense herbaceous cover
Wetland	W	Naturally flooded areas
Wetland edge	WE	Herbaceous plants and bushes around wetlands
Ploughed fields	P	Ploughed fields, mostly without vegetation
Traditional vineyards	TV	Non–irrigated vineyards grown in a traditional way (goblet)
Intensive vineyard	IV	Irrigated vineyards grown on metal trellises
Trees	TR	Stands of *Pinus* ssp, *Prunus dulcis* or *Olea europaea*
Distance (km)		
Distance to breeding colony	Distcolony	Distance to closest breeding colony
Distance to wetland	Distwetland	Distance to closest wetland (used or not for breeding)
Distance to paved roads	Distroad	Distance to closest roads
Distance to urban places	Disttowns	Distance to closest town or village
Distance to houses	Disthouse	Distance to closest abandoned building, inhabited house or shelter for cattle

Table 2. Percentage of random (RP) and contact (CP) points where each habitat type was present in the 7–km radius circle and distances to variables (mean ± SD). Number of contact points in parentheses. Number of random points is 20 in each lake. Selection index shown is the Manly index (Wj), its standard error (SE) and significance level (p). Land uses W and WE were not considered to calculate selection indexes as no random points were selected in therein. Table 1 shows the codes of variables.

Variable	Manjavacas		Mermejuela	
Land use	CP (45)	RP (20)	CP (45)	RP (20)
CE	60	10	31.11	20
FA	11.11	20	26.67	20
W	–	–	4.44	–
WE	13.33	–	–	–
P	8.89	5	35.56	–
TV	6.67	40	2.22	50
IV	–	15	–	5
TR	–	10	–	5
Distance				
Distcolony	2.73 ± 1.52	3.21 ± 1.19	1.36 ± 1.35	4.10 ± 1.26
Distwetland	1.77 ± 1.43	2.09 ± 1.01	1.36 ± 1.35	3.56 ± 1.12
Distroad	1.16 ± 0.89	1.60 ± 1.23	2.51 ± 1.00	1.35 ± 1.17
Disttowns	6.65 ± 1.49	6.57 ± 1.38	6.23 ± 2.76	4.60 ± 3.16
Disthouse	0.45 ± 0.35	0.56 ± 0.55	0.98 ± 0.93	0.47 ± 0.53

same wetland in consecutive years. In some cases, colonies appeared to have moved to other wetlands in the same breeding season owing to flooding of nesting sites. For instance, in 2007, the gull–billed terns abandoned the Camino de Villafranca colony because heavy rains in May flooded the sedimentary island where the colony was settled. In parallel, in the Salicor wetland, this rainfall turned some areas that were previously connected with surrounding fields into islands. A gull–billed tern colony settled on these islands soon after the abandonment of the breeding colony at Camino de Villafranca. This suggests a movement of the gull–billed tern colony of Camino de Villafranca toward Salicor Lake. In 2010, heavy May rains flooded the sedimentary islands at Manjavacas, causing the desertion of its colony. A colony then settled in Huevero Lake, likely including the individuals that left Manjavacas.

Foraging habitat

A total of 136 contacts with gull–billed terns were recorded; 11 of these were located outside the 7 km radius and are not considered here. The size of gull–billed tern flocks searching for food ranged from 1 to 39 individuals (mean = 3.4; SD = 4.5; N = 125). The largest flock observed was following a tractor in a grain field. Distances between the contacts and the nearest colony ranged from 0.03 to 6.24 km (mean = 1.98; SD = 1.50; N = 125).

The gull–billed tern showed a positive selection towards cereal fields (p = 0.032), clearly avoiding traditional vineyards (p = 0.000) (table 2). Ploughed fields presented the highest selection index, but it was not significant. Fallows were used according to their availability. No use of intensive vineyards or areas with trees was detected. These habitat preferences were similar in the three studied sites (table 2).

The analysis of distance variables showed that gull–billed tern seeks food closer to the colony than expected according to random points ($p < 0.0001$), at 2 km on average. On the contrary, they were found farther than expected from paved roads ($p < 0.0001$) and towns (p = 0.0195), even if these were near colonies (fig. 3). The variable distance from solitary houses scattered in the fields had no effect (p = 0.8482) (table 2, fig. 3).

Discussion

Habitat selection

We observed that cereal crops were the preferred habitat for hunting in the agricultural landscapes studied, and this pattern was similar between the

Tabla 2. Porcentaje de puntos aleatorios (RP) y de contacto (CP) en los que cada tipo de hábitat estaba presente en un radio de 7 km y las distancias a las variables (media ± DE). Número de puntos de contacto entre paréntesis. El número de puntos aleatorios es de 20 en cada lago. Se muestran el índice de selección de Manly (Wj), su error estándar (SE) y el grado de significación (p). Los usos de la tierra W y WE no se tuvieron en cuenta para calcular los índices de selección porque no contenían puntos aleatorios. En la tabla 1 se muestran los códigos de las variables.

Longar		Total		Selection index		
CP (35)	RP (20)	CP	RP	*Wj*	SE	*p*
42.86	15	44.80	15	3.24	1.04	0.032
20	35	19.20	25	0.83	0.24	0.492
2.86	–	2.40	0	–	–	–
2.86	–	5.60	0	–	–	–
31.43	15	24.80	6.67	4.04	2.04	0.138
–	–	3.20	30	0.11	0.06	0.000
–	15	–	10	0	–	–
–	25	–	13.33	0	–	–
				F	df	P
1.81 ± 1.25	3.41 ± 1.06	1.98 ± 1.50	3.57 ± 1.22	53.38	1.181	< 0.0001
1.63 ± 1.28	2.86 ± 1.35	1.59 ± 1.36	2.84 ± 1.29	35.41	1.181	< 0.0001
2.50 ± 1.60	0.94 ± 0.69	2.02 ± 1.33	1.30 ± 1.08	15.13	1.181	< 0.0001
4.40 ± 2.82	3.52 ± 1.79	5.87 ± 2.56	4.90 ± 2.55	5.55	1.181	0.0195
0.92 ± 0.61	1.41 ± 1.47	0.77 ± 0.71	0.82 ± 1.04	0.03	1.181	0.8482

study colonies. Clearly, gull–billed terns avoided both vineyards types present in the study area, since we only found a slight percentage of contacts in traditional vineyard and we did not detect any use of intensive vineyards. Avoidance of vineyards could be explained by several factors. On the one hand, cereal fields are less intensive crops than vineyards, and it is likely that availability of prey is higher in the former. Differences in composition of the arthropod community may also be important, since gull–billed terns prey mainly on large ground–dwelling insects (beetles and grasshoppers, Britto et al., in prep.) while canopy–dwelling arthropods are more abundant in vineyards (Nash et al., 2010). In addition, vertical habitat structure may have an important effect on habitat selection by this species. Gull–billed terns capture prey in flight and do not pursue them on foot (Molina et al., 2009), so searching for food over open areas, such as cereal crops or plowed fields, may facilitate prey capture, while woody vegetation (such as trees and vineyards) would make it more difficult. The dense vegetation cover of vineyards in spring may limit prey visibility and, in intensive vineyards, the vertical metal posts on which branches are fixed to wires running the length of the row of vines may limit birds' flight.

Our results show that gull–billed terns forage mainly in specific land use types (cereal crops, ploughed fields and fallows accounted for 89 % of contacts) in areas surrounding the colonies, so chicks depend on preys captured by the parents n these zones (Vargas et al., 1978; Fasola et al., 1989; Díes et al., 2005; Aourir et al., 2013). On average, in our studied colonies, parents fly about 2 km to look for their prey and rarely more than 6 km from the colony. In an Italian coastal lagoon, Fasola and Bogliani (1990) found that the gull–billed tern was one of the species, together with the Little Tern, whose density decreased faster with distance from the nesting wetland, although in this area average distance (9.3 km) was higher than in La Mancha. In California, individuals foraged at least 8–9 km from the nesting colony (Molina and Marschalek, 2003). The longer distance covered for hunting in the studies of Fasola and Bogliani (1990) and Molina and Marschalek (2003) could be explained because these colonies lived in coastal habitats where they catch larger prey that are more profitable energetically (crustaceans, fishes and lizards). In our study area, the main preys are insects and these smaller preys could set a shorter limit to the hunting distance.

The changes in land use within the belt around the breeding site may have a strong effect on colony success. In particular, according to our results, agricultural changes favoring intensive vineyards could have the worst effect. If intensive vineyards were extended to surround the breeding wetlands, the cost of displacement of adults to seek food could increase

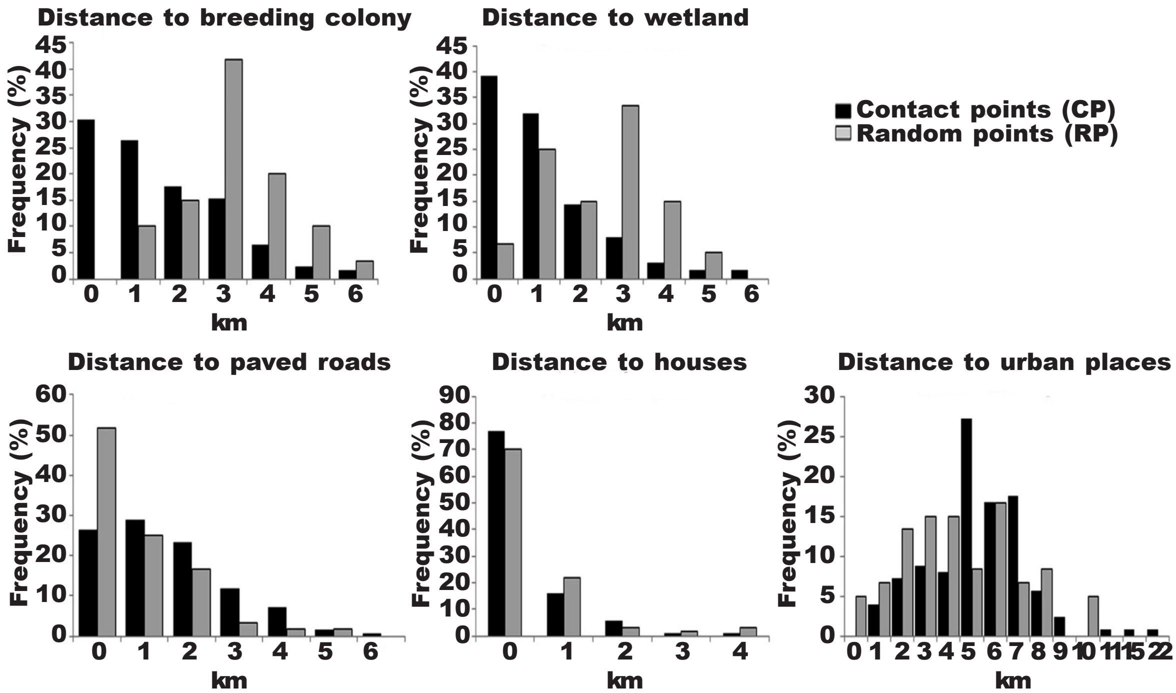

Fig. 3. Frequency distribution (%) of the distance variables (km) analyzed in this study.

Fig. 3. Distribución de la frecuencia (%) de las variables de distancia (km) analizadas en este estudio.

to the point of not being energetically profitable and lakes at the study area could become unsuitable for breeding. Intensive vineyards are widespread in the RBMH, and they are extending in detriment of other crop types, including traditional vineyards (Ruiz–Pulpón, 2013, 2015). Other bird species are also reported to avoid vineyards (García et al., 2006; Benítez–López et al., 2017) and we agree with these authors that the establishment of intensive vineyards should be prohibited in areas that are most appropriate for endangered birds.

The gull–billed tern does not seem to choose a feeding habitat independently of its surroundings. In the agricultural landscapes where human interference is constantly present, we found a significant effect of several landscape features. The species avoids feeding close to towns, villages and paved roads; however, it is not affected by isolated farm houses. The lack of effect of the proximity of farm houses can be explained by the fact that they are scattered and human presence is sporadic. In a meta–analysis of infrastructural effects, Benítez–López et al. (2010) detected a negative effect of roads and other infrastructures on bird abundance that extended up to 1 km. Our results agree with this result because we found fewer contacts than expected within 1 km from roads. The effects of roads on wildlife are multiple (Trombulak and Frissell, 2000), but given the mobility of gull–billed terns and the relative low traffic on most of these roads, we hypothesize that in our study, a likely effect is the reduction in prey availability through changes in conditions near roads. The same could be true for the distance from towns, where the percentage of contacts is lower than the percentage of random points within the first four kilometers. Although in some cases fallows and cereal fields reach the edges of towns, they are usually surrounded by land use types that are not so attractive for this species. Distance variables were not analyzed in other studies of gull–billed terns, so we do not know if the effect of these man–made structures is similar in other landscapes.

In our study area, where rainfall and water level at lakes varies from year to year, it is not uncommon that gull–billed tern colonies are forced to abandon a wetland and establish a new breeding colony in another lake within the same breeding season. These changes seem to be associated to adverse weather conditions. Spring abundant rainfalls may change the availability of suitable islands for nesting by flooding sedimentary islands harboring a gull–billed tern colony. In other lakes, the same rains may induce the formation of new sedimentary islands by isolating pieces of land from the shore. Besides our study, other authors have also reported nesting site changes within the same breeding season (Costa, 1986; Sánchez et al., 2004). Therefore, the possibility arises of an interaction between the environmental factors affecting nesting place selection inside the lake and habitat selection in their surroundings. Further research is needed to assess whether, in these dry

Mediterranean landscapes, the lack of appropriate habitats for feeding around the lakes would limit the chances to move colonies between lakes when rainfalls alter wetlands suitability for breeding.

Conservation implications

This study offers new information about gull–billed tern ecology that may help in the design of regional and local level conservation management strategies. Habitat selection analysis allowed us to identify factors that determine habitat preferences for hunting and the potential influence of human disturbance on this species. At a landscape scale, our results call for limitations in agricultural intensification around potential nesting places. Vineyards should be limited or avoided in areas surrounding these wetlands. Given the importance of rotation of cereal crops and fallow lands as hunting areas, these uses should be maintained and incentivized in lands surrounding wetlands in this region. In addition, the lakes where breeding colonies regularly settle must be protected. The awareness of farmers and people is extremely important for the implementation of conservation strategies of this species that should involve the implementation of specific agri–environment schemes.

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