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Esther Sebastián-González, José Antonio Sánchez-Zapata, Francisco Botella

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ORIGINAL PAPER

Agricultural ponds as alternative habitat for waterbirds: spatial and temporal patterns of abundance and management strategies

Esther Sebastián-González · José Antonio Sánchez-Zapata · Francisco Botella

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Abstract The progressive lost of natural wetlands as a consequence of human activities has lead to the use of new habitats by the species linked to water presence. In Southeast Spain, thousands of irrigation ponds have been lately constructed to store water for agriculture and are used by waterbirds as an alternative habitat. For this study, breeding and wintering waterbirds were counted in a subset of irrigation ponds between 2002 and 2007. Breeding communities were more abundant than wintering communities, but they presented a similar richness and diversity. The ponds were selected by waterbirds according to their characteristics, and breeding communities were more selective than wintering communities. Our results enhance the importance of pond size (area), connectivity (distance to the nearest wetland) and habitat quality (resource offer and construction material) in the pond selection process. The presence and design of these impoundments could be playing a crucial role for some waterbirds species. Therefore, the long-term information provided here can be useful for establishing management strategies for these artificial wetlands.

Keywords Artificial ecosystems · Birds · Conservation · Habitat · Irrigation · Wetland

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E. Sebastián-González
Estación Biológica de Doñana-CSIC,
Américo Vespucio s/n,
41092 Sevilla, Spain

E. Sebastián-González (✉) · J. A. Sánchez-Zapata · F. Botella
Área de Ecología, Departamento de Biología Aplicada,
Universidad Miguel Hernández,
Cra. Beniel Km 3.2,
03312 Orihuela, Alicante, Spain
e-mail: esebastian@umh.es

Introduction

Wetlands are vital habitats for many waterbird communities, but they are under heavy pressure with the intensification of human activities and environmental changes (Turner et al. 2000; Froneman et al. 2001). Almost half the world's wetlands have disappeared in the last century due to agricultural and urban development (Shine and Klemm 1999). Therefore, waterbirds may benefit from using alternative places to feed and breed, even if these spaces are man-made. These new aquatic systems were originally designed and managed for human benefit and only secondarily acquired a role in biodiversity conservation (Maeda 2001; Múrias et al. 2002; Elphick and Oring 2003; Ma et al. 2004; Sánchez-Zapata et al. 2005).

Many authors have already studied the relative importance of artificial wetlands, and most have found that they can provide suitable habitats for waterbirds (Tourenq et al. 2001; McKinstry and Anderson 2002; Paracuellos and Telleria 2004; Santoul et al. 2004; Okes et al. 2008, Rendon et al. 2008). Salt marshes, aquaculture fish ponds, mine impoundments, gravel pits, rice fields or irrigation ponds are able to provide alternative or substitute habitats for waterbirds communities as well as for amphibians (Knutson et al. 2004; Julian et al. 2006) plants or invertebrates (Nicolet et al. 2004; Taft and Haig 2005; Abellán et al. 2006).

The south-eastern part of Spain is an important area for wintering and breeding waterbirds (Martí and Del Moral 2003, 2004), which has important wetlands with different protection statuses given their international importance for waterbirds conservation (http://ramsar.org/sitelist.doc). They are important stop-over places for migrating birds on their way from and to Africa because of their strategic location, and they are also important breeding sites for some endangered species.

A matrix of fields used for intensive agriculture and house developments surrounds these wetlands. Thousands of private irrigation ponds have been constructed in this area over the last three decades to store water for agriculture. Ponds can provide high biodiversity benefits for biota in agricultural landscapes using current agri-environment resources if well managed (Davies et al. 2009). In a previous study, we have already assessed the use of these artificial wetlands by waterbirds during the breeding season (Sánchez-Zapata et al. 2005), and we know that the abundance and richness of waterbirds at irrigation ponds are directly related to the characteristics of the pond. Nevertheless, the nature of the effects may vary from one species assemblage (guild) to another (Wiens 1989).

The description of the structure and functioning of bird communities is useful in terms of ecological theory (DeSante 1990) and conservation practice (Kremen 1992; Chettri et al. 2001). Conserving bird diversity requires a comprehensive understanding of bird–environment year-round relationships (Newton 1998) and a management of not only breeding but also wintering habitats, especially for migratory birds (e.g. Sherry and Holmes 1996; Rappole et al. 2003). Consequently, a complete knowledge of the processes occurring in winter, as well as the annual and seasonal variations, and the distribution patterns are necessary to develop management policies for these agricultural facilities.

The objectives of this study are to:

1. Describe the waterbirds community using the ponds in both the wintering and breeding seasons and to analyse the differences between both seasons.
2. Reveal the pond characteristics required in both the breeding and wintering seasons for the different waterbird guilds.
3. Develop suggestions for the management of these agricultural impoundments in order to enhance waterbirds conservation.

Methods

Study area

The study was conducted in the Vega Baja Valley in Southeast Spain. It covers an area of 95,840 ha that borders the Mediterranean Sea on the east. It has a Mediterranean semiarid climate with warm mean annual temperatures (18°C). The rainfall is scarce (mean annual, 300 mm), stormy and concentrated in spring and autumn. The landscape is dominated by irrigated crops such as citrus, fruit trees and vegetables. There are also some extensive crops such as almonds (*Prunus amygdala*) or olive trees (*Olea europaea*), palm trees (*Phoenix dactylifera*), housing developments and remaining areas of natural Mediterranean shrubs (*Pistacea lentiscus*, *Rosmarinus officinalis*, *Thymus* spp) and pine trees (*Pinus halepensis* and *Pinus pinea*). Topographic relief is flat, with small hills close to the sea (Sierra de Escalona, 300 m asl), and small rocky mountains in the vicinity of the Segura River (Sierra de Orihuela, 600 m asl) and in the north of the study area (Sierra de Crevillente, 800 m asl). In the 1980s, an inter-river water transfer was built to bring water for irrigation purposes to such an arid area. Since then, the region has become one of the most intensively used agricultural areas in Europe. Moreover, 2,627 ponds have been constructed to store the water received, and the area has turned into a mosaic of crop fields and artificial wetlands (Fig. 1). There is a general increase in the number of houses to the detriment of extensive agriculture and to the Mediterranean shrubs remaining (Sánchez-Zapata et al. 2005).

Apart from the ponds, there are also some natural and semi-natural wetlands. Some of them (Pantano de El Hondo, Lagunas de la Mata y Torrevieja, Salinas de San Pedro and Salinas de Santa Pola) enjoy regional environmental protection (as Natural Parks or Protected Places), as well as the international status of SPAs and RAMSAR sites because of their internationally acknowledged importance for waterbirds.

Waterbird censuses and guilds

Waterbirds were counted between May and June for the breeding season from 2002 to 2007, while wintering birds were censused in the months of January and February between 2003 and 2007. An average of 263 ponds was visited each season, with numbers ranging between 89 and 329 ponds. Each pond was visited twice a year (one visit for the breeding census and the other for the wintering census) with a single visit per season. All the waterbirds in the pond were counted using binoculars and scopes. The poor vegetation cover of the ponds and their small size (0.01–6.61 ha) reduced the census error (Gutiérrez and Figuerola 1997).

Waterbirds were also divided into groups depending on their feeding characteristics in order to simplify the ordination analyses. We included those species taking their food from the ponds with a similar procedure in the same guild. Seven groups were finally formed: herons (herons and egrets), cormorants, waders, dabbling ducks, diving ducks, gulls (and terns) and rallids. The Stone Curlew *Burhinus oedicnemus* was excluded from all groups and was not included in the analyses because it did not fit in any guild, and its presence at the ponds was purely incidental.

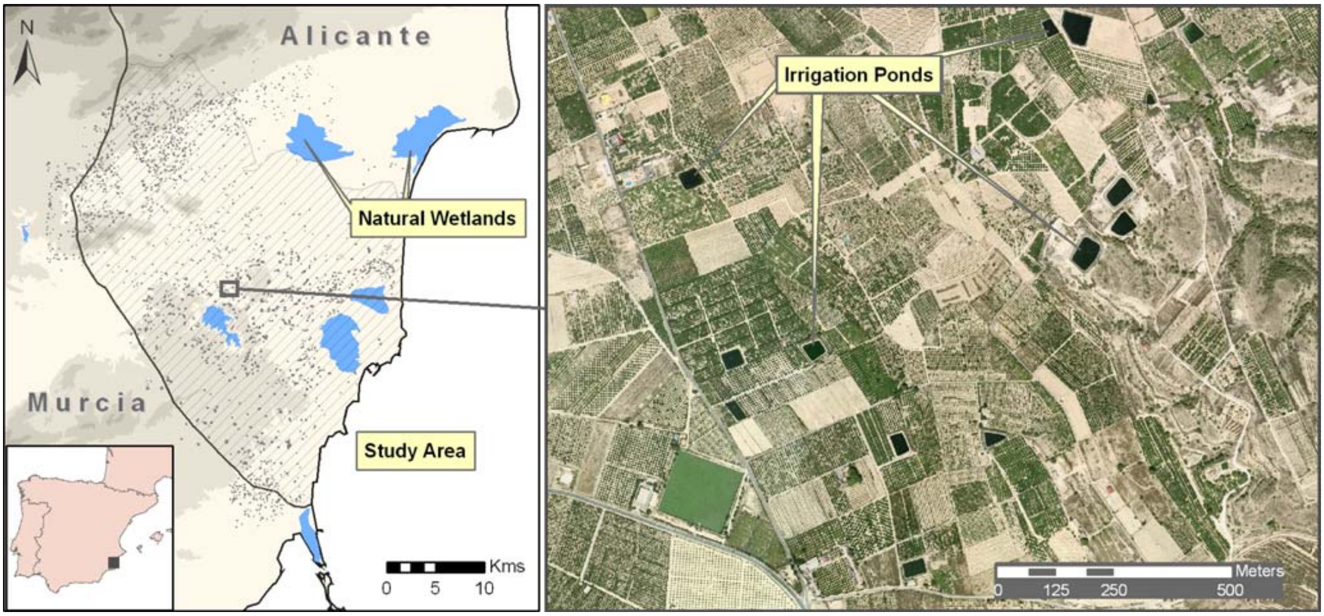

Fig. 1 Study area. The Vega Baja Valley covers several natural wetlands and about 2,700 irrigation ponds. The aerial photograph shows a detail of the landscape, including irrigation ponds and agricultural fields

Pond characteristics

Each pond was characterised to study the features preferred by waterbirds (Table 1). We specified the vegetation in the pond (presence or absence), and we included shore vegetation, submerged vegetation, unicellular algae and reed. Ponds were also classified by their construction material: One kind was built using low-density polyethylene (LDP) and was then covered with sand and gravel to prevent from external aggressions; the other kind was constructed using high-density polyethylene (HDP) like PVC or other materials without the cover. As an average, the 46% of the surveyed ponds were constructed with LDP (ranging from 40.1% to 49.5%).

The studied irrigation ponds were mainly surrounded by citrus trees; some of them were close to extensive fields, fruit trees and vegetables, and a few ponds were constructed in forested areas close to pine trees and Mediterranean shrubs. The ponds depth varied depending on the pond size and the shore slope, ranging approximately between 2 and 15 m.

Table 1 Pond characteristics

	Mean	SD
Area (ha)	0.599	0.012
DTW (m)	9,149.28	100.02
Submerged vegetation	0.24	0.01
Shore vegetation	0.24	0.01
Reed	0.56	0.10

DTW distance to Wetland

We used digitalised aerial photographs and a geographic information system (GRASS 5.0) to calculate the size of the ponds and the distance to the closest wetland. Ponds varied in size from 0.01 to 6.61 ha, even though most of them were smaller than 1 ha, with only 36 ponds over this size.

Statistical analysis

Differences in abundance, diversity and richness between years were tested using non-parametric statistics with the SPSS 13.0. software (SPSS Inc. 1997). Diversity was measured by means of the Shannon–Wiener Index (Begon et al. 1988).

To study the relations among guilds and the external variables, correspondence analyses (CA) were performed. The CANOCO for Windows 4.1 programme was used for these analyses. This program enables partial analyses, where the influence of particular variables (termed covariables) is eliminated before the influence of the variables of interest (termed environmental variables) is tested. CA is a descriptive/exploratory technique designed to analyse multiway tables containing some measure of correspondence between the rows and columns (Greenacre 1984; Legendre and Legendre 1998). CA attribute scores to both species guilds and environmental variables so that the correlation between environmental variables scores and species scores is maximal, given the best ‘correspondence’ between species and variables (Prodon 1992). ReDundancy Analyses (RDA) were selected from the different ordination

Table 2 Abundance, richness and diversity in the breeding and in the wintering season

		2002	2003	2004	2005	2006	2007
Wintering season	Abundance	–	2.60	2.00	2.42	2.37	3.74
	Richness	–	24	22	26	25	20
	Diversity	–	2.29	2.25	2.38	2.19	2.33
Breeding	Abundance	4.40	3.94	2.83	3.32	3.49	4.12
	Richness	23	31	25	25	25	23
	Diversity	2.38	2.34	2.22	2.38	2.29	2.13

Abundance was assessed as the average number of birds per pond. Richness was calculated as the number of species found per census and diversity was obtained from the Shannon–Wiener index

procedures. RDA ordinate guilds using axes that are constrained to be linear combinations of the considered external variables, in such a way that the relationship between the guilds and these variables, can be clearly seen. Significance was tested by the distribution-free Monte Carlo test (1,000 permutations), in which the distribution of the test statistics under the null hypothesis is generated by random permutations of cases in the environmental data (Ter Braak and Smilauer 1998).

Results

Waterbirds community

A total of 9,343 waterbirds (6,284 in the breeding season and 3,059 in the wintering season) belonging to up to 45 different species were counted in the 11 censuses performed. Of the 45 species, six were only found in winter, while nine could only be seen in the breeding season (Appendices 1 and 2). A total of 37 different species were found in the six breeding censuses. From these species, 16 appeared in all the censuses, while seven could only be seen in one of the years. A total of 33 different species were found in the wintering season, 14 of which were found in all the censuses, while nine only appeared in one census. The seven reproductive species (Little Grebe *Tachybaptus rufficollis*, Black-winged Stilt *Himantopus himantopus*, Little-ringed Plover *Charadrius dubius*, Moorhen *Gallinula chloropus*, Mallard *Anas platyrhynchos* and Common Shelduck *Tadorna tadorna*) accounted for 78.2% of the total abundance in the breeding season. Moreover, only two species (Little Grebe and Mallard) comprised 46.6% of the total amount of birds found in winter.

Table 3 Wintering environmental variables

	P	F
Area	0.002	40.89
Material	0.002	9.40
Reed	0.012	4.97

Ranking in importance by their conditional effects in RDA obtained by forward selection procedure by means of Monte Carlo permutation test

Annual and seasonal differences

In the breeding season, we found no significant differences in abundance between census years, but remained close to significance (Kruskal–Wallis test, H=10,638, P=0.059). In the wintering season, abundance in the first four censuses was similar with no significant differences (Kruskal–Wallis test, H=1.091, P=0.779), while it increased in the census of 2007 (Kruskal–Wallis test, H=14.923 P=0.005).

The average number of birds per pond found in summer was almost double that in the wintering season (4.17 vs 2.56, Table 2). Richness and diversity were similar for breeding and wintering communities (Mann–Whitney U test both P>0.4; Table 2).

Pond preferences

In order to identify the characteristics of the ponds that make them more appropriate for each waterbirds group, we performed a RDA for both breeding and wintering

Table 4 Breeding environmental variables

	P	F
Material	0.002	55.74
Area	0.002	38.19
Submerged vegetation	0.002	14.32
DTW	0.002	9.57
Reed	0.002	7.83
Shore vegetation	0.028	2.81

Ranking in importance by their conditional effects in RDA obtained by forward selection procedure by means of Monte Carlo permutation test

DTW distance to the nearest wetland

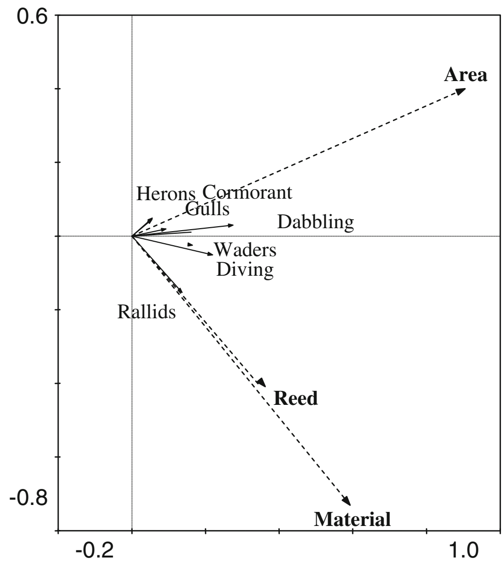

Fig. 2 RDA ordination biplot of guilds and environmental variables in the wintering season based on guild data. Species and environmental variables are represented by *arrows* that indicate the direction in which the variables are increasing. *Dashed lines* represent pond variables, and *solid lines* represent waterbird guilds

communities. The Monte Carlo permutation test provided strong evidence of a correlation between waterbird guilds and the external variables (Tables 3 and 4). In the wintering season, submerged vegetation (F=1.89, P=0.110), distance to wetland (F=0.67, P=0.414), algae (F=1.48, P=0.170) and shore vegetation (F=1.07, P=0.366) were excluded, while only one variable (algae, F=2.07, P=0.078) was not included in the ordination in the breeding season. Moreover, waterbirds were more abundant in LDP ponds than in HDP ponds (breeding season 1.39 birds/pond in HDP and 6.01 in LDP; wintering season 1.24 birds/pond in HDP and 3.97 in LDP).

The ordination plots (Figs. 2 and 3) illustrate that all breeding waterbirds benefited from LDP ponds as wintering waterbirds did. Rallids preferred ponds with shore, reed and submerged vegetation in summer and LDP ponds with reed in winter, while diving ducks went for LDP ponds with vegetation. Gulls preferred big ponds, while dabbling ducks and waders were found more often in large LDP ponds. Herons and cormorants showed little habitat preference. As distance to the nearest wetland decreased, the abundance of all breeding birds increased. Total observed variance of the first canonical axis was 87.3% in the breeding season and 88.8% in the wintering season.

In general, for every year and for both seasons, the number of waterbird species using irrigation ponds was low, but the abundance of some of these species was high. Furthermore, ponds were selected according to their biological and physical characteristics, and wintering communities were less exigent than breeding ones.

Discussion

Irrigation ponds at the study area were used by waterbirds to spend the winter and/or to breed. As with other man-made wetlands (Tourenq et al. 2001; Maeda 2001; Múrias et al. 2002; Elphick and Oring 2003; Ma et al. 2004; Paracuellos and Telleria 2004; Santoul et al. 2004), these ponds were exploited all year long by several waterbird species and provided them with refuge, food and/or breeding sites.

The use of these ponds made by waterbirds varied depending on the season. Breeding average abundances doubled wintering ones. This contrasts with the results in other artificial wetlands, e.g. fish-farm pond in South Spain (Rodríguez-Pérez and Green 2006), where waterbird abundance was higher in the wintering season. The seasonal variations at the irrigation ponds waterbird community may be associated with migration processes, which, to some extent, made the community different in both study seasons, with some species exclusive from one of the periods and with differences in the most abundant species (Berthold 1993). In general, artificial wetlands hold less abundant populations than natural wetlands (e.g. Tourenq et al. 2001; Ma et al. 2004), but these man-made wetlands may be important in some situations and for certain species (Froneman et al. 2001; Elphick and Oring 2003). For example, irrigation ponds hold larger populations of Black-winged Stilt, Little Grebe and Common Shelduck than the natural wetlands at the area (Martí and Del Moral 2004). Moreover, both diversity and richness were similar in the breeding and wintering seasons. This seems to be a consequence of a higher species richness in the wintering season registered at the natural wetlands of the area (Martí and Del Moral 2003, 2004) and, conversely, to a lower evenness at the ponds.

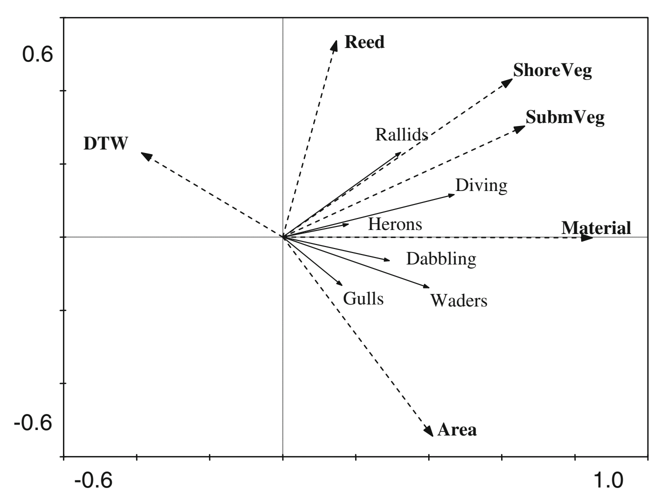

Fig. 3 RDA ordination biplot of guilds and environmental variables in the breeding season based on guild data. Species and environmental variables are represented by *arrows* that indicate the direction in which the variables are increasing. *DTW* distance to the nearest wetland. *Dashed lines* represent pond variables, and *solid lines* represent waterbird guilds

Waterbird populations in irrigation ponds displayed a general annual stability which contrasted with some more marked variations of the waterbird populations at natural wetlands (Martí and Del Moral 2003, 2004). This scenario differs from other artificial wetlands where annual variations in waterbirds abundance were more patent (Shimada et al. 2000; Yallop et al. 2004; Romano et al. 2005).

Our results showed that the presence of waterbirds was influenced by pond characteristics, but these requirements were different for each waterbird guild and season. Construction material was especially important for rallids and diving birds. This does not seem to be directly related to the materials used in the pond construction, but to pond characteristics linked to the construction material: LDP ponds have a more natural appearance, have softer slopes and present vegetation with a higher frequency than HDP ones (Sánchez-Zapata et al. 2005); moreover, LDP ponds are richer and more abundant in macroinvertebrates (Abellán et al. 2006) and macrophytes than HDP and therefore provide waterbirds with more resources.

Distance to the nearest wetland negatively affected abundance and richness of breeding but not of wintering communities. The significance of this variable may be caused by the presence of terns and gulls because, although these species breed in the natural wetlands of the study area, some of them use irrigation ponds as well as the sea to forage (authors unpublished). This isolation measure disappeared in winter because most of these species migrate. This situation differs from the results of other studies where distance to the nearest wetland was more important in winter due to an increase in the waterbirds movements between patches (Paracuellos and Telleria 2004). Besides, the importance of this isolation measure has already been demonstrated in bird studies (e.g. Manu et al. 2007), but its effect has not always been found (Guadagnin and Maltchik 2007). On the other hand, the smooth effect of distance to the nearest wetland in summer for some guilds and its complete absence in the wintering ordination, with the general stability of the community using the ponds over the years, can lead to the conclusion that some species use these ponds independently of natural wetlands.

The size of the pond was directly related to the presence of gulls, terns, waders and dabbling ducks in summer, and gulls, herons and cormorants in winter. Several studies had already confirmed the importance of this feature for bird abundance and richness (Hubbell 2001; Santoul et al. 2004; Paracuellos and Telleria 2004; Guadagnin et al. 2005; Guadagnin and Maltchik 2007; Fattorini 2007). Waterbird communities in large ponds hold higher individual numbers. Moreover, the importance of this variable is especially valuable for dabbling ducks (McKinstry and Anderson 2002).

The presence of vegetation provides waterbirds with feeding provisions and has an essential effect on the habitat selection process (Cody 1985). Vegetation was significant mainly in the breeding period, which coincides with other studies (Paracuellos and Telleria 2004) because the nutritional requirements were higher as a consequence of chicks' needs and because they were less mobile. The role of the submerged vegetation during the breeding season was more important for rallids and diving ducks because it offered them a place to forage, protection from predators and a place to build their nest (McKinstry and Anderson 2002).

Many bird species vary their habitat selection in winter, if compared to the breeding season, and tend to be more wide ranging and less specific in their selection (e.g. Pino et al. 2000; Yahner 2000). Our results agree with this pattern and waterbird breeding communities in irrigation ponds seemed to be more selective and demanding than wintering ones. Ordination axis included more variables and guilds showed clearer preferences for pond characteristic as a consequence of the higher resource requirements during the breeding season.

Conservation implications

The abundance of some species at irrigation ponds seems to be large in comparison to the population in the natural wetlands. Therefore, irrigation ponds should be included in the official waterbird censuses, which are conducted every year in order to obtain more precise knowledge of the real population in the study area (Martí and del Moral 2003, 2004). Moreover, the importance of ponds, like other artificial wetlands (Maeda 2001; Tourenq et al. 2001; Múrias et al. 2002; McKinstry and Anderson 2002; Elphick and Oring 2003; Paracuellos and Telleria 2004; Ma et al. 2004; Santoul et al. 2004; Okes et al. 2008, Rendon et al. 2008), increases as a result of the degradation of natural ones. In our case, the value of ponds for waterbirds conservation is higher in the breeding season, as a consequence of the characteristics of the climate in the zone. In summer, the study area suffers from long dry periods which drastically decrease or even dries completely the water reserves at natural wetlands (Green et al. 2005). Subsequently, waterbirds may depend upon alternative habitats. Irrigation ponds maintain their water all year round because they receive it from inter-basin transfers, and they can provide waterbirds with substitute resources. This could be assessed in 2006 when a second breeding census was performed after the El Hondo Natural Park (the wetland that fluctuates the most) completely dried of, and we found that the mean abundance of waterbirds at ponds almost doubled in the second census than in the pre-drought one, with an average of 6.78 birds per pond.

The development of agri-environment schemes under Regulation (EEC) 2078/92 provides the farmers with new tools to conceal their agricultural practices with the conservation of the environment (Taylor and Morecroft 2009). Ponds constructed for irrigation are under economic subsidies. Therefore, it might be useful to provide some guidelines about the characteristics that ponds have to follow in the construction process to enhance biodiversity conservation. As demonstrated herein and in previous studies (Sánchez-Zapata et al. 2005, Abellán et al. 2006), it is possible to discriminate between construction material, vegetation presence, size and place for the location of agricultural impoundments in order to increase the value of these ponds for the different guilds. As pond location and size are determined by social and hydrological factors and are difficult to manage, construction material and vegetation presence become the main factors to be regulated.

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Appendix 1

Table 5 Wintering censuses

Family	Species Number of censused ponds	Common name	2003 300	2004 287	2005 274	2006 301	2007 89
Anatidae	*Tadorna tadorna*	Common Shelduck	1	12	9	14	11
	Tadorna ferruginea	Ruddy Shelduck	0	0	1	0	0
	Anas clypeata	Northern Shoveler	10	0	29	4	0
	Anas platyrhynchos	Mallard	106	105	123	249	54
	Aythya fuligula	Tufted Duck	1	0	0	0	0
	Aythya ferina	Common Pochard	0	0	0	2	0
	Oxyura leucocephala	White-headed Duck	0	0	3	0	0
	Netta rufina	Red-crested Pochard	0	0	1	0	10
	Aythya nyroca	Ferruginous Duck	0	1	0	0	0
	Anser sp.	Domestic Goose	7	2	0	1	1
	Anas sp.	Domestic Duck	13	25	15	30	5
	Marmaronetta angustirostris	Marbled Teal	0	0	0	1	0
Ardeidae	*Bubulcus ibis*	Cattle Egret	3	8	24	2	0
	Egretta garzetta	Little Egret	15	14	41	2	3
	Nycticorax nycticorax	Night Heron	0	0	0	0	1
	Ardea cinerea	Grey Heron	18	17	21	15	6
Burhinidae	*Burhinus oedicnemus*	Stone Curlew	0	24	1	3	0
Charadriidae	*Charadrius dubius*	Little-ringed Plover	8	2	1	1	3
	Charadrius hiaticula	Ringed Plover	0	0	1	2	0
Laridae	*Larus cachinnans*	Yellow-legged Gull	47	8	11	7	0
	Larus ridibundus	Black-headed Gull	21	45	17	35	0
	Larus audouinii	Audouin's Gull	2	0	0	0	0
Phalacrocoracidae	*Phalacrocorax carbo*	Great Cormorant	49	22	96	7	3
Podicipedidae	*Tachybaptus ruficollis*	Little Grebe	265	163	142	135	87
	Podiceps nigricollis	Black-necked Grebe	0	1	16	22	6
Rallidae	*Gallinula chloropus*	Moorhen	51	29	20	43	10
	Fulica atra	Common Coot	43	15	31	33	48
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt	26	18	13	30	39
Scolopacidae	*Tringa nebularia*	Greenshank	8	12	4	16	11
	Tringa totanus	Common Redshank	3	0	0	0	0
	Actitis hypoleucos	Common Sandpiper	40	33	32	35	21
	Tringa ochropus	Green Sandpiper	38	17	13	23	13
	Gallinago gallinago	Common Snipe	4	0	1	0	1
		Total	779	573	666	712	333

Appendix 2

Table 6 Breeding census

Family	Species Number of censused ponds	Common name	2002 222	2003 228	2004 310	2005 309	2006 329	2007 257
Anatidae	*Tadorna tadorna*	Common Shelduck	24	34	52	57	70	79
	Anas platyrhynchos	Mallard	27	94	53	106	146	92
	Aythya ferina	Common Pochard	0	0	3	9	9	0
	Netta rufina	Red-crested Pochard	0	37	0	15	0	0
	Oxyura leucocephala	White-headed Duck	0	0	0	0	0	2
	Aythya nyroca	Ferruginous Duck	0	2	0	0	3	0
	Anas strepera	Gadwall	2	0	0	7	0	0
	Ansar sp.	Domestic Goose	1	0	1	4	5	0
	Marmaronetta angustirostris	Marbled Teal	0	2	0	0	0	0
	Anas sp.	Domestic Duck	15	28	33	32	19	35
Ardeidae	*Bubulcus ibis*	Cattle Egret	123	3	27	43	7	29
	Egretta garzetta	Little Egret	5	5	6	5	7	14
	Ardea purpurea	Purple Heron	0	2	0	0	0	1
	Ardeola ralloides	Squacco Heron	2	5	7	9	4	4
	Nycticorax nycticorax	Night Heron	5	12	6	0	25	2
	Ardea cinerea	Grey Heron	5	7	7	2	7	6
Burhinidae	*Burhinus oedicnemus*	Stone Curlew	0	3	4	0	2	0
Charadriidae	*Charadrius dubius*	Little-ringed Plover	96	71	55	34	63	67
	Charadrius hiaticula	Ringed Plover	0	1	0	0	0	0
Laridae	*Larus cachinnans*	Yellow-legged Gull	4	6	79	17	11	6
	Larus ridibundus	Black-headed Gull	18	2	9	31	68	12
Sternidae	*Sterna hirundo*	Common Tern	53	6	1	2	1	0
	Sterna albifrons	Little Tern	45	7	5	11	4	3
	Chlidonias hybridus	Whiskered Tern	20	21	7	54	42	1
	Chlidonias níger	Black Tern	0	1	0	0	0	0
	Gelochelidon nilotica	Gull-billed Tern	0	8	7	0	16	0
Podicipedidae	*Tachybaptus ruficollis*	Little Grebe	199	169	194	178	169	236
	Podiceps cristatus	Great-crested Grebe	0	0	1	1	0	0
	Podiceps nigricollis	Black-necked Grebe	0	9	0	3	1	0
Rallidae	*Gallinula chloropus*	Moorhen	46	46	38	40	35	58
	Fulica atra	Common Coot	32	16	13	53	52	36
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt	241	297	268	303	381	372
Scolopacidae	*Tringa erythropus*	Spotted Redshank	0	1	0	0	0	0
	Tringa nebularia	Greenshank	0	0	0	0	0	1
	Calidris minuta	Little Stint	0	3	0	0	0	0
	Actitis hypoleucos	Common Sandpiper	3	7	2	12	0	1
	Tringa ochropus	Green Sandpiper	16	0	0	0	0	2
		Total	982	905	878	1,028	1,147	1,059

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