Short communications

Waterbird breeding on salinas in Ria Formosa, southern Portugal

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Salinas (saltworks) are particularly important for the estuarine waterbirds that breed in Mediterranean countries, where nesting habitats are often scarce. Here we analyze the use of habitats by waterbirds breeding in a salinas complex on the Ria Formosa in southern Portugal. The results should assist in determining the value of salinas for breeding waterbirds and in drawing up appropriate conservation prescriptions. The species recorded were Black-winged Stilt *Himantopus himantopus*, Pied Avocet *Recurvirostra avosetta*, Kentish Plover *Charadrius alexandrinus*, Little Tern *Sterna albifrons*, Mallard *Anas platyrhynchos* and Little Grebe *Tachybaptus ruficollis*. Our study suggests that each species chooses to use different ponds depending on water level and salinity. Knowledge of such patterns is useful in determining good conservation management.

Salinas are man-made supratidal habitats that may provide suitable habitats for waterbirds to breed and forage (Britton & Johnson 1987, Velasquez & Hockey 1992, Erwin *et al.* 1994). Although they are generally located in estuarine areas, salinas are not influenced by tidal rhythms and the water levels change slowly (Velasquez 1992), making them regular and predictable habitats over time (Masero *et al.* 2000). These features mean that salinas are particularly important for estuarine waterbirds breeding in Mediterranean countries, where alternative breeding habitats are scarce. Despite their value for wildlife, the number of salinas has declined around the Mediterranean in recent decades due to the abandonment of salt production. Moreover there has been a change from traditional to industrial salt extraction methods, which affects their value as habitat for waterbirds. Together, these factors have resulted in a general loss of breeding habitat for estuarine waterbirds and have led to calls for the protection and favourable management of those areas that still provide adequate conditions.

In Portugal, some large salinas remain in the estuaries of the rivers Tagus, Sado and Guadiana, and in Ria de Aveiro and Ria Formosa. As in other Mediterranean countries, salinas have declined in Portugal (Rufino & Neves 1992), and have totally disappeared in some small estuaries such as that of the river Mira. The value of Portuguese salinas for waterbirds has been often demonstrated, both as wintering and breeding habitats (Rufino *et al.* 1984, Bijlsma *et al.* 1985, Batty 1992, Neves & Rufino 1994). However, information on the factors that affect the suitability of these areas as breeding habitats remains scarce. As a consequence, knowledge on how they can best be managed for waterbirds is inadequate. These issues are addressed in the present study, in which we analyse the use of habitats by breeding waterbirds on a salinas complex in southern Portugal.

The study was conducted on the salinas of the Tavira estuary (37°02'N, 7°38'W) in the Ria Formosa wetland, Algarve, southern Portugal. The study area comprises 132 ha where each salina is made up of three sets of pans (for storage, evaporation and crystallization) which are connected through a series of sluices. They differ mainly in their salinity (40‰, 150‰ and 250‰ respectively); water depth (50 cm, 20 cm and 5 cm) and vegetation (dense, moderate and sparse) (Rufino & Neves 1992). This area is subject to increasing human disturbance due to tourism, including the building of resort facilities near the breeding areas.

The waterbirds breeding in the salinas were surveyed twice a week between 30 March and 5 August 1999. The area was divided into nine sectors corresponding to different salinas. Each sector included all of the three different types of saltpan and each was visited by the same observer. The location of all waterbirds that were apparently breeding (i.e. birds with nests, birds using distraction display, etc.) was recorded on maps and the number of individuals in each sector was estimated.

Six waterbird species were found breeding in the salinas of Tavira in 1999, though only four – Black-winged Stilt, Pied Avocet, Kentish Plover and Little Tern – occurred in appreciable numbers (Table 1). These are the same four species that are the most commonly found breeding in Portuguese salinas generally (Neves & Rufino 1994). All six species bred in both the storage and evaporation pans, with the exception of Mallard and Little Grebe which were only found in the storage pans. No waterbirds were found breeding in the crystallization pans, possibly a consequence of high levels of salinity (and therefore low availability of food), predation risk and disturbance by men working in these pans during summer. All species appeared to prefer larger and more isolated salinas of 15–25 ha instead of smaller ones of 5–8 ha (authors' unpubl. data). Probably this arises because of the birds' need for large, undisturbed, open areas, facilitating less competition for territory and better visibility of approaching predators.

Black-winged Stilts were significantly more abundant in

Table 1. Numbers of individual breeding waterbirds (i.e. both sexes combined) using evaporation and storage pans in the Vale Carangueijo-Tavira saltpans, Ria Formosa, southern Portugal between 30 March and 5 August 1999. No breeding waterbirds were observed on crystallization pans (which are shallow (~5cm deep), have high salinity (~250‰) and sparse vegetation). χ^2 tests show whether, for each species, the numbers using the two habitats are significantly different from equality (d.f. = 1 with Yates correction in each case).

Habitat characteristics	**Evaporation pans**	**Storage pans**			
Salinity	~150 ‰	~40 ‰			
Water depth	~20 cm	~50 cm			
Vegetation	moderate	dense			
Species	**Count**	**Count**	**Total**	**χ^2**	**p**
Black-winged Stilt *Himantopus himantopus*	18	52	70	15.56	<0.01
Pied Avocet *Recurvirostra avosetta*	17	30	47	3.06	ns
Kentish Plover *Charadrius alexandrinus*	24	18	42	0.88	ns
Little Tern *Sterna albifrons*	12	7	19	0.84	ns
Little Grebe *Tachybaptus ruficollis*	0	5	5		
Mallard *Anas platyrhynchos*	0	2	2		
Totals	**71**	**114**	**185**		

storage ponds than in evaporation ponds and there was a similar though not quite significant trend among Pied Avocets (Table 1). Both species nest on the dykes between the pans and their apparent preference for storage pans probably relates to the denser vegetation which helps camouflage their nests (Rufino *et al.* 1984).

Salinas are the most important breeding habitat for Black-winged Stilts in Portugal and support about 70% of the national population (Neves & Rufino 1994). In our study area, they comprised 40% of all breeding waterbirds, another indication of the value of the habitat for stilts.

In contrast to the stilts and avocets, Kentish Plovers and Little Terns occurred more frequently in evaporation ponds, but the differences were not significant (Table 1). Possibly, however, a dataset for a larger area would show that these preferences are significant. If so, the reason could be that their nests are built on semi-open areas (Kentish Plover) or are only partially surrounded by vegetation (Little Tern) (Cramp & Simmons 1983). We also found that these species tend to breed close to one another (authors' unpubl. data). Possibly the reason is that Little Tern eggs are relatively easy for predators to detect (Valle & Scarton 1999). Therefore nesting close to Little Terns could be beneficial to Kentish Plovers if the attention of predators is drawn to Little Tern nests and away from their own.

Although we only found small numbers of breeding Little Grebes and Mallards, it would seem likely that these species have a preference for storage pans because of their deeper water levels and more dense vegetation. Little Grebes usually construct floating nests in quiet areas (Cramp & Simmons 1977), so, with plenty of emergent vegetation and low levels of human disturbance, storage pans would be the most suitable habitat.

Today conservation efforts, must apply the principles of sustainable development in order to have a good chance of success. Since water levels influence the availability of food and safe nesting sites, agreement needs to be established with the salt-producers in order to manage water levels to balance the interests of salt producers as well as birds. This would improve breeding conditions at the salinas and increase breeding success.

Salinas are artificial wetlands and their biological richness disappears quickly in the absence of adequate water management. Particularly when they are located along a heavily developed coastline, as in many parts of southern Portugal, they often become the subject of land speculation, and may be filled and disappear (Sadoul *et al.*1998).

In this note, we have drawn attention to the valuable role salinas play as breeding habitat for several waterbird species. They deserve careful conservation and further research.

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