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POPULATIONS SIZE, TRENDS AND CONSERVATION PROBLEMS OF SEABIRDS BREEDING IN THE LAGOON OF VENICE

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Introduction

The Italian coastline of the Northern Adriatic Sea is formed of a stretch of lagoons and deltas centering on Venice and extending from Trieste to Ravenna, a distance of about 250 km. With its 550 km^2 the Lagoon of Venice is the largest coastal lagoon in Italy, and includes around 4000 ha of saltmarshes. Despite the widely recognized importance of the Lagoon, until the beginning of the 1980's very few works, mostly with anecdotic or general information, have been published about the breeding birds. The first comprehensive data on seabirds were collected in 1982-1984, in the framework of the Italian "Laridae Project" (Fasola 1986).
In 1989 we started a yearly monitoring program which aimed at (1) following the populations trend over the years and (2) proposing measures for breeding sites conservation and management. Some aspects of the breeding biology has been also studied (Scarton et al. 1994) but other relevant aspects such as breeding success and survival rates could not be investigated, due to the lack of funding.
The aim of this note is to summarize of all the available data (from published and unpublished material) about the seabirds populations during the 1983-1995 years, along with a synthesis of the major conservation problems.

Study area

The Lagoon of Venice is a coastal lagoon between the mouths of the rivers Brenta and Piave ($45^o11'$-$45^o34'$N, $12^o18'$-$12^o38'$E), along the Adriatic Sea in north-eastern Italy (figure 1). It has a surface of some 550 km^2; the Lagoon is bordered by two sandy barrier islands, heavily urbanized, and it exchanges water with the sea through three entrance channels. The tidal range is approximately one meter. There is an extensive, central water body (about 400 km^2) with bottoms that are partly covered with algae and seagrass; tidal mudflats, bare and exposed at low tide, and hundreds of muddy islets covered with halophilous vegetation (mainly Limonium serotinum, Salicornia sp.pl., Halimione portulacoides and Spartina maritima). These islets are

flooded at high tide, since they are between +20 and +40 cm above sea level; the size of these islets ranges from 0.1 to a ten of hectares. There also two large reclaimed islands (built in the central Lagoon at the end of the 1960's, with an area of 750 ha and 410 ha) and twelve dredged islands, which have been made since the end of the 1980's, between 5 and 30 ha in size. The remaining area of the Lagoon (150 km^2) include small water bodies with low salinities, which are used for fish farming and hunting (these fish farms host only irregularly colonies of seabirds, which were not included in the figures presented below), the town of Venice and the surrounding islands. Only a very small part of the Lagoon is protected.

Materials & methods

Systematic censuses of the whole central water body were carried on in 1984 and in 1989-1995; partial counts, covering most of the area, were made in 1982-83 and 1985-88. Data for the years 1982-84 have been published in Fasola (1986), and more recent counts in Scarton et al. (1994 and 1995). We visited all the colonies of Black-headed Gull Larus ridibundus, Common Tern Sterna hirundo, Sandwich Tern Sterna sandvicensis and Little Tern Sterna albifrons. For Yellow-legged Gulls Larus cachinnans less detailed information are available; we censused all the small colonies, whereas for the two largest colonies we refer to censuses or estimates made by other local ornithologists. To calculate the yearly totals, we assumed the L.cachinnans population in 1984 and 1996 was of the same size of 1983 and 1995. For further details about the surveys methodologies, see Scarton et al. (1994).
Apart from L. cachinnans, the figures presented here refer to the highest number of nests (= no. of pairs) that were found during each breeding season. The Average Growth Rate (AGR) was calculated for each population over the 1989-95 years, whereas the existence of significant trends over the 1984-1995 years were evaluated with a non parametric test (Spearman coefficient of correlation).

Results

Figure 1 shows the results of the censuses made in the Lagoon of Venice over the period considered; only years with complete coverage are presented. Four species bred in the years 1983-1994, while in 1995 a new species, the Sandwich Tern, colonized the Lagoon. The total number of breeding seabirds may be estimated (the uncertainty due only to the Yellow-legged Gull) at about 2400 pairs in 1984, 2200 pairs in 1989 and 5000 pairs in 1995.
This recent marked increase is mostly due to Yellow-legged Gulls, which accounted for about the 34% of total in 1984, the 45% in 1989 and 54% in 1995. The other gulls and terns populations ranged between 1191 (1989) and 2303 (1995) pairs, with a mean of 1445; if we exclude the last year, yearly fluctuations were much more reduced, being about $\pm$ 20%. A short description for each species is given below.

Black-headed Gull
The first nests were found in 1984 but, due to the lack of observations in prior years, we can not exclude the species was already present. In a text of the last century (Contarini 1847) the species is considered breeding, whereas in the 1930's it was not included among the breeding

seabirds (Ninni 1938).
From 1989 to 1992 the species raised its effectives (AGR= +17.5%), then decreased in the following two years (AGR: -44.7%) and again went up in 1995 (+106%). It is not clear what caused these fluctuations. Nevertheless from 1984 the population is stable, with a non significant decrease (r_s=-0.21, p>0.05). There were two to six colonies each year, located only in saltmarshes, mostly associated with terns. The reproductive success can be heavily affected by weather conditions, that can cause the flooding of the sites with consequent over washing of nests and eggs.

Yellow-legged Gull
Both in the last century and at the beginning of this the species was commonly breeding in the fish farms (Ninni 1880 and Ninni 1938). In 1983 this species was censused with very small groups in several fish farms and, with two large colonies, in both the artificial islands. Since 1989 dredging of new canals inside these islands has changed their morphology, providing new space (such as non flooded areas or embankments) suitable for the two colonies. These have been estimate to amount to 1000 pairs in 1989 and 2500 pairs in 1994 (Tiloca pers. comm.); this would lead to an estimate AGR of +21.1%. The species has rapidly occupied some of the dredged islands recently built in the southern Lagoon, while, on the contrary, it has never bred on saltmarshes, where the other gulls and terns make their nests. Over the 1983-1995 years, the Yellow-legged Gulls has to be considered as increasing.

Sandwich Tern
It was never reported breeding in the Lagoon, while the occurrence of summering birds near the entrance channels is known since long time (Ninni 1938). In 1995 we discovered on a saltmarsh a colony of 202 nests, located within the biggest colony of gulls and terns found in that year. The Sandwich Terns nests were clumped in a small area (about 62 m^2), with low vegetal cover; eggs had been laid between the 10th and the 15th of May (Scarton et al. 1995). The mean clutch size was 1.67 (s.d. = 0.47, n = 200); 113 chicks were ringed between the end of June and the beginning of July (G.Cherubini pers. comm.). The Lagoon of Venice is the second Italian breeding site (the first being the traditional one of Valli di Comacchio, 93 km south of Venice) and one of the very few in the whole Mediterranean (Ferrer and Martinez-Vilalta 1993). In 1995 the breeding population of Valli di Comacchio decreased of some hundreds pairs (P.Brichetti and U.Foschi pers. comm.); it is likely that these birds had colonized the Lagoon. Nevertheless, the settlement in the Lagoon of local summering birds could also be possible.

Common Tern
This species was reported nesting both at the end ot the last century (Ninni 1882) and at the beginning of this one (Ninni 1938). From 1989 to 1991 the population increased, with an AGR of +20.2%; subsequently, there were year-to-year fluctuations. The AGR for the 1989-1995 period is +8.9%. Over a longer period (1984-1995) the species has to be considered stable, since the apparent increase is not significant (r_s=0.35, p>0.05).
There were 6 to 17 colonies active each year, located exclusively on saltmarshes; some of these colonies are extremely stable. One site in the northern Lagoon has been occupied at least since 1981 and so it was for all the following census years. Breeding in fish farms is

occasional, whereas colonies were never found in sandy barrier islands. Most of the colonies are mixed with other gulls and terns; in a study area of the southern Lagoon, a significant positive relationship between numbers of breeding Redshanks Tringa totanus and those of Common Terns has been documented over a period of eight years (Valle and Scarton 1995). Nests are made mostly on wrecked material (84%, n=1394) and, with a much lesser percentage (12%), on shells' heaps (Borella et al. 1993). The apparent reproductive success of Common Terns during years with unusual high tides and summer storms (such as 1994 and 1995) is very low.

Little Tern

This species was reported breeding in the last century (Anon. 1832) and in the 1930's (Ninni 1938); both these authors do not mention the nesting on saltmarshes, but only in sandy beaches. From 1989 to 1993 the species decreased, with an almost linear trend (AGR: -37%) and only 40 pairs left in 1993. Subsequently, the breeders increased spectacularly, with 393 pairs in 1994 and 611 in 1995. In the same two years the once flourishing population breeding in the Po Delta sandy barrier islands (60 km south of Venice) has almost disappeared (M.Benà and R.Rusticali pers. comm.).

It is likely that at least a part of these breeders had moved to the saltmarshes of the Venetian Lagoon. Here, over the period 1984-1995 the species is stable (the apparent increase being non significant: r_s=0.04, p>0.05). In the Lagoon the species nests in a sandy barrier island (with just a colony, protected by an environmentalist group, and probably occupied without interruptions during the last twenty years; Scarton et al. 1995) and in saltmarshes, where the colonies are much more ephemeral. The apparent reproductive success of saltmarsh colonies in the last two years was almost zero, due to weather conditions; in 1995 the largest colony (481 nests) was completely destroyed by waves, rain and hail. It is possible that even in the Lagoon, as supposed for other seabirds in north American coastal wetlands (Erwin et al. 1981), the Little Terns had to move towards less suitable habitat, such as saltmarshes, due to the excessive man pressure on sandy beaches.

Discussion

The observations made over a period of almost 15 years allow us to draw some conclusions regarding the Lagoon of Venice and its seabirds, despite the still incomplete knowledge of several aspects of their breeding biology. The total abundance of gulls and terns is comparable with other large Mediterranean coastal wetlands (data from Fasola et al. 1993), such as the Ebro and the Po deltas. Unlikely, the number of species is much lower, since all the major sites considered host from seven (Evros Delta) to twelve species (Ebro Delta). The reason can be due to the lack, in the Lagoon of Venice, of some specific biotopes (such as saltpans), while sandy beaches are almost completely urbanized. Moreover, most of the Lagoon is heavily affected by hunting, tourism, and fishing, and only the remotest spots (in the southern basin) are less disturbed.

Nevertheless, S.sandvicensis has colonized the Lagoon in the last year and, for this species and for S.albifrons, it is likely that this site has served as a refuge for birds coming from nearby northern Adriatic wetlands. This allows us to expect the settlement of another species currently present in the Lagoon but non nesting, such as the Mediterranean Gull Larus melanocephalus.

Overall, the Lagoon of Venice is a breeding site of national relevance for Common Tern, Little Tern and Black-headed Gull; moreover, it is one of the very few sites for Sandwich Tern in the whole Mediterranean.

Most of seabirds colonies were located on saltmarshes. These biotopes were still widespread at the beginning of the century, whereas seventy years later there were only 4,000 ha left (Favaro 1992). They are currently disappearing due to a number of causes, both natural (sediments compaction) and linked with human activities (erosion due to vessel passages and globally increased turbulent motion, uncontrolled bait digging and peat extraction). On going studies suggest also the forecasted increase in the sea level rise will affect heavily these marshes, leading to the disappearance of many of them (Day et al. 1995). Despite the obvious importance of these saltmarshes, for both seabirds and waders (Valle et al. in press), they are only formally protected and any kind of management is given. Due to the limited number of breeding sites active each year, it would not be too difficult to control and protect each of them; in case of funds scarcity, priority in conservation should be placed on large colonies, particularly those with several years of activity. Unfortunately, local Authorities and scientific Institutions are not aware of the intrinsic value of these sites, nor they intend to undertake seabirds censuses or more in-deep studies.

The only species clearly increasing is the Yellow-legged Gull. It has recently colonized the barrier islands of the close Po Delta (Scarton and Valle in press) and a recent work of Benussi and Brichetti (1994) estimates at 40,000-50,000 pairs the population breeding along the northern Adriatic coasts. In the Lagoon of Venice we did not yet observe negative effects upon the other seabirds, such as colonies displacement or intensive predation on chicks and eggs (while carcasses of Black-winged Stilts Himanthopus himanthopus and Redshanks chicks has been observed several times around the gulls nests; G.Tiloca pers. comm.) Nevertheless the settlement and rapid growth of colonies of this species in the recently created dredged islands is a cause of concerns. Some of these islands turned out to be a suitable breeding habitat for several waders (Black-winged Stilt, Redshank, Kentish Plover Caradrius alexandrinus) and ducks (Mallard Anas platyrhynchos, Shelduck Tadorna tadorna) but, due their relative height above sea level and the sparse vegetative cover, they also meet the requirements for Yellow-legged Gulls colonies. Since these islands are scattered over the Lagoon and built close to or adjacent natural saltmarshes, we are worried about the effects in the near future on the traditional breeding sites of the other gulls and terns.

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Summary

In 1984 and 1989-1995 detailed censuses of the seabirds breeding population were carried out in the lagoon of Venice. The results show as three species (L.ridibundus. S.hirundo, S.albifrons) are stable, even if year-to-year fluctuations were recorded. The mean size, from 1984 to 1995, of each of these populations was 105, 1041 and 272 pairs. S.sandvicensis colonized the Lagoon in 1995, with 202 pairs; L.cachinnans (1523 pairs) is rapidly increasing in the last years, due to new suitable areas provided by man activities. Most of the colonies are located on saltmarshes, unprotected and heavily threatened by natural and man induced processes.

References

Anonimous. 1832. Osservazioni intorno all'Ornitologia Toscana del dott. P. Savi. Biblioteca ital., 57: 76-83.

S.Borella, F.Scarton & R.Valle. 1993. Distribuzione e consistenza delle colonie di Sterna comune (Sterna hirundo) in laguna di Venezia. Atti I Conv. Faun. Ven., Montebelluna Aprile 1993: 89-92.

E.Benussi, P.Brichetti. 1994. Distribution and population-size of colonies of Yellow-legged Gull breeding in North-eastern Adriatic sea. Avocetta, 18: 107-113.

N.Contarini. 1847. Notizie sulla fauna terrestre. In: Venezia e le sue lagune. Antonelli Ed., Venezia.

J.W.Day, D.Are, A.Rismondo, F.Scarton & G.Cecconi. 1995. Relative sea level rise and Venice lagoon wetlands. Proceedings of the MEDCOAST 95 Conference. Tarragona, 24-27 October 1995: 793-807.

R.M. Erwin, J. Galli & J. Burger. 1981. Colony site dynamics and habitat use in Atlantic coast seabirds. Auk, 98: 550-561.

M.Fasola (ed.). 1986. Distribuzione e popolazione dei Laridi e Sternidi nidificanti in Italia. Suppl.Ric.Biol.Selv., Vol. XI.

M.Fasola, V.Goutner & J.G.Walmsley. 1993. Comparative breeding biology of the gulls and terns in the four main deltas of the northern Mediterranean. In J.S.Aguilar, X.Monbailliu & A.M. Paterson (eds.). Proceedings of the 2nd MEDMARAVIS Conference. Calvià, 21-26 March 1989: 111-124.

V.Favaro. 1992. Evoluzione morfologica e trasformazioni ambientali dalla conterminazione lagunare al nostro secolo. In: Conterminazione lagunare: storia, ingegneria, politica e diritto nella laguna di Venezia. Atti del convegno di studio nel bicentenario della conterminazione lagunare. Venice, 14-16 March, 1991.

X.Ferrer & A.Martinez-Vilalta. 1993. Estatus y distribucion de la poblacion reproductora del Charran patinegro (Sterna sandvicensis) en el Mediterraneo. In J.S.Aguilar, X.Monbailliu & A.M. Paterson (eds.). Proceedings of the 2nd MEDMARAVIS Conference. Calvià, 21-26 March 1989: 107-110.

A.P. Ninni.1880. Materiali per una fauna veneta. Aves. Atti Reg. Ist. ven. Sc. Lett. Art. 5, 6: 173-208.

A.P. Ninni.1882. Materiali per una fauna veneta. Aves. Atti Reg. Ist. ven. Sc. Lett. Art. 5, 8: 1449-1474.

E. Ninni. 1938. Gli uccelli delle lagune venete. Atti XXVI Riun. Società Italiana per il Progresso delle Scienze 5, 1: 132-163.

F.Scarton, S.Borella & R.Valle. 1995. Nuovo sito di nidificazione di Beccapesci (Sterna sandvicensis) in Italia. Avocetta, 19: 157.

F.Scarton & R.Valle. in press. Colony and nest site selection of Yellow-legged gulls (Larus cachinnans michaellis) on barrier islands of the Po Delta (NE Italy). Vogelwelt.

F.Scarton, R.Valle & S.Borella. 1994. Some comparative aspects of the breeding biology of Black-headed Gull, Common Tern and Little Tern in the Lagoon of Venice. Avocetta, 18: 119-124.

F.Scarton, R.Valle and S.Borella. 1995. Il Fraticello (Sterna albifrons) nidificante in laguna di Venezia: anni 1989-1993. Lavori Soc. ven Sc. Nat., 20: 81-88.

R.Valle & F.Scarton. 1995. La Pettegola nidificante nella laguna di Venezia: le ragioni di una scelta coloniale. Avocetta, 19: 36.

R.Valle, F.Scarton, R.Tinarelli, M.Grussu, P.Utmar & S.Borella. in press. Censimento nazionale della Pettegola (Tringa totanus). Proceedings of the 7th Italian Congress of Ornithology. Urbino, 23-26 September 1993.