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Common Tern *Sterna hirundo* breeding population: development and nature conservation management results at the Ormož wastewater basins between 1992 and 2002 (NE Slovenia)

Razvoj kolonije navadnih čiger *Sterna hirundo* in rezultati naravovarstvenega upravljanja v bazenih za odpadne vode pri Ormožu v obdobju 1992-2002 (SV Slovenija)

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A colony of Common Terns *Sterna hirundo* and Black-headed Gulls *Larus ridibundus* formed in 1981 in the wastewater basins of the sugar factory in Ormož. From than on, the colony has been monitored regularly by direct counting. The site was flooded in 1994 and, in 1995 and 1996, Common Terns and Black-headed Gulls did not breed. In 1997, the first artificial breeding raft (surface area 12.5 m^2) was placed, followed in 1998 and 2001 by additional rafts (14 m^2 and 96 m^2, respectively). All rafts were placed with the intention of preserving the Common Tern, since this species is highly endangered in Slovenia. As a result, the biggest mixed Common Tern and Black-headed Gull colony in Slovenia has been established on the artificial breeding rafts. In 2002, 64 pairs of Common Tern and 113 pairs of Black-headed Gull bred on rafts, amounting to 45% and 50% respectively of the Slovene breeding population. Black-headed Gulls started to breed in higher numbers on the largest rafts, placed in 2001, and, for that reason, the percentage of Terns breeding on the rafts decreased. In 2000 all the Terns, but in 2001 only 80% of those in the basins were breeding on rafts. It is most probable that the bigger rafts, with special breeding structures for Common Terns, were more attractive for Black-headed Gulls. Obviously they liked the heterogeneous raft surface, because they built their nests on the breeding structures planned to increase the breeding success of Common Terns.

Key words: *Sterna hirundo*, Common Tern, *Larus ridibundus*, Black-headed Gull, breeding, density, artificial rafts, management, sugar factory, Slovenia

Ključne besede: *Sterna hirundo*, navadna čigra, *Larus ridibundus*, rečni galeb, gnezdenje, gostota, umetni splavi, upravljanje, tovarna sladkorja, Slovenija

1. Introduction

The earliest breeding records for the Common Tern *Sterna hirundo* in Slovenia date from 1921 (Reiser 1925). In that year, the species was breeding in the furcation zone of the river Drava. The next reported breeding was in 1977 on a natural gravelly islet on the Drava (Štumberger in: Geister 1995). These were the last Common Terns reported to breed in Slovenia on the species' natural breeding habitat. No further breeding on natural riverbanks or islands was confirmed. The main cause is the large-scale river canalisation and regulation for hydroelectric power stations. The absence of natural river dynamics (annual floods) resulted in dried river channels and disappearance of gravelly habitats (Štumberger 1995). All further colonies were found on artificial, more or less man-made structures – salt pans (Škornik 1983), artificial islets (Janžekovič & Štumberger 1984), gravel pits (Vogrin 1991), concrete objects (Bračko 1999), a sandy islet in an artificial accumulation lake (Šalamun 2001) and in the basins of the sugar factory (Štumberger 1982). At the latter site, a mixed Common Tern and Black-headed Gull *Larus ridibundus* colony was established in 1981, and has

been monitored annually from that time on. After the complete breeding failure in 1993 and 1994, members of DOPPS – BirdLife Slovenia started to implement a Common Tern conservation programme in that area.

In this paper, the population dynamics of breeding Common Terns and Black-headed Gulls in the period between 1992 and 2002, together with the results of Common Tern conservation programme, are presented.

2. Study area and methods

2.1. Study area

The wastewater basins are situated near the Ormož accumulation lake on the river Drava. The river was recognised as an Important Bird Area - IBA (Polak 2000). The whole IBA area covers 8300 ha and was identified as the proposed Special Protected Area - SPA (Božič *in press*). The area also includes basins which are sugar factory's cleaning device for wastewater. Water is cleaned in 6 rectangular sedimentation basins. Two of them (111 × 411 m) are for collecting mud and four (160 × 418 m) for collecting water. They were built in 1980 when the very first campaign for sugar production from sugar beet took place. The total surface area of the water basins' is 0.27 km² and the length of their banks is 6.7 km (E. Škrinjar *pers. comm.*). They are situated in the former flooded area of the Drava. Basins are very important nationally from the ornithological point of view. They are the most important resting areas in Slovenia for migrating shorebirds and the only recently known breeding places for certain waterbird species, such as Black-necked Grebe *Podiceps nigricollis*, Pintail *Anas acuta*, and Common Redshank *Tringa totanus* (Štumberger 2001a & b, *in press*).

2.2. Common Tern conservation programme and description of rafts

The main goal of our conservation programme was to preserve the Common Tern as a breeding species in the basins. For that purpose we decided to make and place the very first artificial breeding raft (raft 1) in Slovenia. Encouraged by the first year's results we placed an additional raft in the basins in the following year (raft 2). Based on observation of the rafts

Table 1: Raft characteristics

Tabela 1: Podatki o splavih

	Raft 1 / splav 1	Raft 2 / splav 2	Rafts 3 / splav 3
Surface area / površina	2.5 m²	14.0 m²	96.0 m²
Surface material/ material na površini	gravel (5 cm layer)/ prod (5 cm sloj)	gravel (5 cm layer)/ prod (5 cm sloj)	gravel (5 cm layer)/ prod (5 cm sloj)
Height of edges (above gravel level)/ višina robov (nad prodom)	7 cm	1998-1999: 7 cm 2000-2002: 20 cm	35 cm
Structures on the surface/ strukture na površini	none / brez	1998-1999: none / brez 2000-2002: 7 "chickshelters"[a]/ 7 kritij za mladičea	5 "chick shelters", old branches and stumps on each raft / na vsakem splavu 5 kritij za mladiče, veje, štori
Duration / trajanje	1997-2000	1998-2002	2001- in function/ še v uporabi
Other / drugo	one 1 m wide plank from the raft to the water/ meter široka deska iz splava v vodo	one 1 m wide plank from the raft to the water / meter široka deska iz splava v vodo	3 rafts 8 × 4 m, firmly connected; without planks to the water / 3 čvrsto povezani splavi; brez desk do vode

Remark: [a]modified after Burness & Morris (1991)
Opomba: [a]prirejeno po Burness & Morris (1991)

Table 2: Positions of Common Tern *Sterna hirundo* nests at the wastewater basins of the Ormož sugar factory

Tabela 2: Mesta gnezdenja navadne čigre *Sterna hirundo* v bazenih za odpadne vode Tovarne sladkorja v Ormožu

Year / leto	Elsewhere / drugje	Raft 1/ splav 1	Raft 2/ splav 2	Rafts 3/ splavi 3	Elsewhere % / drugje %	Rafts % / splavi %
1997	7	5	-	-	58	42
1998	5	13	20	-	13	87
1999	3	19	22	-	7	93
2000	0	30	35	-	0	100
2001	5	-	14	45	8	92
2002	16	-	5	59	20	80

between 1997 and 2000 and on findings about the most appropriate construction to meet the demands of the Common Tern (Becker & Sudmann 1998), we constructed and placed the last, most sophisticated rafts (rafts 3; Table 1).

2.3. Monitoring methods

We used the direct count method for estimating the number of breeding Common Terns and Black-headed Gulls. The counting unit was an apparently occupied nest-site, defined as those birds sitting tight and apparently incubating eggs or brooding chicks (Bibby & Burgess 1993). Counts were made with a telescope from different positions, so that the whole colony could be counted. A minimum of 4 counts were carried out each breeding season. We considered the highest counted number of breeding birds.

In 1999, counts were done more thoroughly, so we could count fledged young, too. From 1997-1998 and from 2000-2002 we could not accurately count fledged terns.

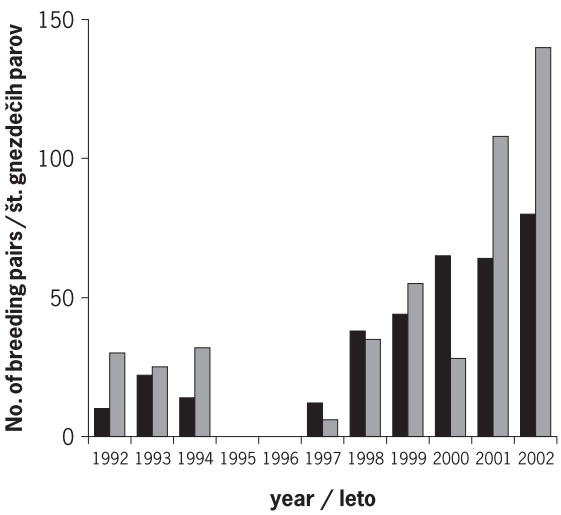

Figure 1: Population development of the Common Tern *Sterna hirundo* (black) and Black-headed Gull *Larus ridibundus* (grey) breeding colony at the basins of the Ormož sugar factory

Slika 1: Razvoj populacije navadne čigre *Sterna hirundo* (črno) in rečnega galeba *Larus ridibundus* (sivo) v bazenih Tovarne sladkorja v Ormožu

3. Results

In 1992, Common Terns and Black-headed Gulls were breeding in a mixed colony within stands of aquatic vegetation *Carex* sp. in the basins of the sugar factory. In 1994, due to the high water level, the colony was flooded. Consequently, in the same year, Common Terns attempted to lay their replacement clutches on a gravel road by the basins, but without success. Only one pair laid an egg, but the young did not hatch. The high water level was the reason for an absence of breeding in 1995 and 1996. The increase in population after 1997 (Figure 1) was the result of the artificial breeding rafts placed for Common Terns.

In 1997, when the first raft was placed, the majority of Common Terns were breeding on accumulated material that had appeared that year on the water surface (branches, pieces of wood, plants, etc., deposited by water). In the following years, the percentage of Common Terns breeding on rafts increased dramatically but started to decrease again after 2001, when three new rafts were placed (Table 2).

Black-headed Gulls did not breed on artificial rafts until 1999. Since then the percentage

Table 3: Positions of Black-headed Gull *Larus ridibundus* nests at the wastewater basins of the Ormož sugar factory

Tabela 3: Mesta gnezdenja rečnega galeba *Larus ridibundus* v bazenih za odpadne vode Tovarne sladkorja v Ormožu

Year / leto	Elsewhere / drugje	Raft 1/ splav 1	Raft 2/ splav 2	Rafts 3/ splavi 3	Elsewhere % / drugje %	Rafts % / splavi %
1997	6	0	-	-	100	0
1998	35	0	0	-	100	0
1999	49	3	3	-	89	11
2000	22	3	3	-	79	21
2001	4	-	4	100	4	96
2002	27	-	3	110	19	81

breeding on rafts has increased, most drastically in 2001 when they almost completely occupied the three new rafts (Table 3).

We have data on the breeding success of the Common Tern on rafts only for 1999. From 11 and 16 fledged Common Terns counted on rafts 1 and 2, respectively, in 1999, we calculated breeding success as 0.58 fledgling / pair for raft 1 and 0.72 fledgling / pair for raft 2.

The highest joint breeding density of Common Terns and Black-headed Gulls (2.71 nests / m^2) was observed on raft 2 in the year 2000 (Figure 2).

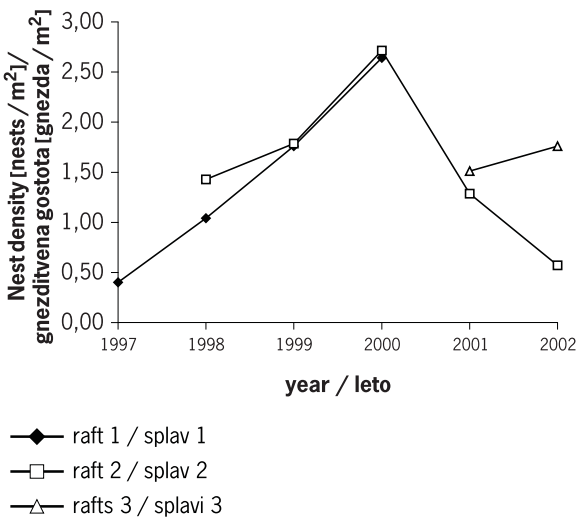

Figure 2: Joint densities of nests of Common Tern *Sterna hirundo*, and Black-headed Gull *Larus ridibundus*, on rafts at the wastewater basins of the Ormož sugar factory

Slika 2: Skupna gnezditvena gostota navadne čigre *Sterna hirundo* in rečnega galeba *Larus ridibundus* na gnezditvenih splavih v bazenih za odpadne vode Tovarne sladkorja v Ormožu

4. Discussion

This Common Tern and Black-headed Gull colony is the very first on artificial breeding rafts in Slovenia. From a nature conservation point of view the colony is very important for both species, as it is larger than before its collapse in 1994. According to the number of breeding pairs it is the biggest mixed Common Tern and Black-headed Gull colony in Slovenia and the fourth known Common Tern breeding site after Sečovlje salt pans (Makovec *et al.* 1998), Ptuj accumulation lake (Geister 1995) and Gajševsko lake (Šalamun 2001). 45% of the Slovene Common Tern population breeds in these basins. The basins are the second known breeding place of Black-headed Gull in Slovenia, after the Ptuj accumulation lake. In 2002, 50% of the total population of Black-headed Gull bred on rafts. Thus, by placing rafts, we have contributed positively to the conservation of two highly endangered species that are on the Red list of breeding birds in Slovenia.

Management of Common Tern breeding sites and placing artificial rafts are effective methods for conserving the Common Tern population in areas of middle Europe where their natural breeding sites have been destroyed by river canalisation and regulation (e.g. Boschert & Dronneau 1998, Raab 1998, Stark 1998, Zintl 1998).

The immediate occupation of rafts by Common Terns in 1997 can be explained as a sign of the absence of appropriate natural breeding sites. After the colony collapsed in 1994, the Common Terns remained in the basins, probably because of their nest site fidelity (Cramp 1994, Wendeln & Becker 1998), however they did not breed because of the absence of breeding structures, which were flooded. Breeding rafts and water deposits, both of which appeared in 1997, offered appropriate breeding sites, and Common Terns

occupied both. The number breeding on deposits gradually decreased and in 2000 all the Terns were breeding on rafts. The most probable reason for their population increase was immigration from other areas, because breeding success was too small to account for it. Actual breeding success was established only for 1999, when the values 0.58 and 0.72 fledged young / pair were low. Only the latter is close to the value at which a population is self-sustainable (Wendeln & Becker 1998). Breeding success is an important population parameter and is indispensable for evaluating the efficiency of placing rafts. In 1997-1998 and after 1999 we established breeding success indirectly, as it correlates negatively with breeding density (Sudmann 1998). According to this relation, we found that breeding success was highest in 1997, low in 1998 and lowest in 2000. It is typical of the Common Tern that, in cases of high breeding densities, negative intraspecific interactions like throwing young into the water increase and breeding success decreases (Sudmann 1998). Nest density at the basins was comparable to that on artificial rafts abroad (between 0.28 and 2.13 nests / m^2 on the Lower Rhine; Sudmann 1998). Until 2000, no special structures (e.g. chick shelters) for increasing breeding success were placed on rafts. Such structures can decrease predation of young (Burness & Morris 1991) and heat shock, and provide shelter from the rain.

After placement of the three rafts in 2001, the trend in selecting Common Tern breeding sites changed. They again started to breed on natural structures in the basins because Black-headed Gulls massively occupied the rafts. Black-headed Gulls start to breed earlier (Cramp 1994), so they can occupy the majority of places on rafts before the arrival of Terns from migration. Terns bred elsewhere in the basins, most probably due to the competition with Black-headed Gulls for nest space on rafts. Black-headed Gulls started to breed on rafts in 1999, and until 2001 they were breeding there in smaller numbers (maximum six pairs). Most of them were breeding on water deposits and on basin edges overgrown with vegetation. They prefer a heterogeneous breeding place with higher vegetation. The height of the vegetation is the factor which most characterizes the difference in breeding niche of the two species (Fasola & Canova 1992). It is very likely that addition of special breeding structures for Common Terns on the new rafts made them more attractive for Gulls. They even built some of their nests on the branches. Very probably it was the larger size of the rafts placed in 2001 that stimulated Gulls to occupy them massively, because on smaller rafts their numbers were much lower.

Breeding success of Common Terns in relation to interspecific competition should be researched, to establish whether it is high enough for the Terns to maintain a stable population or not. In the latter case, additional measures should be undertaken to improve their breeding conditions (e.g. smaller rafts with breeding structures or an artificial island with simulated natural breeding conditions).

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5. Povzetek

Leta 1981 so navadne čigre *Sterna hirundo* in rečni galebi *Larus ridibundus* oblikovali novo kolonijo v bazenih za odpadne vode Tovarne sladkorja v Ormožu. Število gnezdečih rečnih galebov in navadnih čiger redno spremljamo z metodo večkratnega štetja s teleskopom. Leta 1994 je zaradi dviga vodne gladine v bazenih kolonijo preplavilo. V letih 1995 in 1996 navadne čigre in rečni galebi v bazenih niso gnezdili. Leta 1997 je bil v bazenih postavljen prvi gnezditveni splav površine 12,5 m^2, leta 1998 drugi s površino 14 m^2 in leta 2001 trije med seboj povezani enaki splavi s skupno površino 96 m^2. Postavili smo jih z namenom, da bi se oblikovala nova kolonija navadne čigre in da bi se ta ptica ohranila kot gnezdilka na tem območju. Na gnezditvenih splavih je tako nastala največja mešana kolonija navadnih čiger in rečnih galebov v Sloveniji. Leta 2002 je na splavih gnezdilo 64 parov navadnih čiger in 113 parov rečnih galebov. To je 45% slovenske populacije navadnih čiger in 50% rečnih galebov. Rečni galebi so začeli množično gnezditi na splavih šele leta 2001, ko smo namestili tri največje

splave. Odstotek gnezdečih čiger na splavih se je zmanjšal: leta 2002 jih je 20% gnezdilo na naplavinah in blatnih polojih, leta 2000 pa so vse gnezdile na splavih. Menim, da so rečni galebi množično zasedli nove splave zaradi njihove velikosti in heterogene površine. Na splave smo namestili večje število gnezditvenih struktur (strešnike, veje, štore - za kritje mladičem pred dežjem, vročino in plenilci) za navadno čigro. Na teh strukturah so gnezdili rečni galebi.

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