ORNIS SVECICA 9:127–132, 1999

Breeding birds of Rače ponds in NE Slovenia and their trends during 13 years

MILAN VOGRIN

Abstract

The breeding bird assemblage of the Rače fishpond complex in north-eastern Slovenia is described. There are three ponds (4.5 ha to 20 ha) which are managed for semi-intensive fish-farming. During 13 years (1986–1998), I estimated the number of breeding bird pairs on the bases of found nests and/or observed females with fledglings. Six species of non-Passeriformes, i.e. *Tachybaptus ruficollis, Podiceps cristatus, Anas platyrhynchos, Aythya fuligula, Fulica atra* and *Gallinula chloropus,* nested regularly. The total number of breeding pairs (excluding "possible" breeders) varied between 12 in 1994 and 45 in 1998. During the period only two species declined, i.e. *Anas platyrhynchos* and *Aythya fuligula*. The numbers of two species pairs were positively correlated, i.e. *Podiceps cristatus* vs. *Tachybaptus ruficollis,* and *Fulica atra* vs. *Gallinula chloropus*. The densities among ponds were positively correlated in only one species pair, i.e. *Podiceps cristatus* and *Gallinula chloropus*. Although the total density was highest in the smallest pond, the difference among ponds was not significant.

Milan Vogrin, Hotinjska c. 108, SI-2312 Orehova vas, Slovenia

Present address
Zg. Hajdina 83c, SI-2288 Hajdina, Slovenia
E-mail: milan.vogrin@guest.arnes.si

Received 4 April 1999, Accepted 1 July 1999, Editor: S. Svensson

Introduction

It is already well known that fishponds provide a suitable habitat for many waterbird species and that they are the most important breeding sites in some regions for some species (e.g. Musil et al. 1992, Bukacinska et al. 1996). Moreover, the presence of fishponds in some parts of Europe is one of the most important reasons for the richness and diversity of birds. In many areas fishponds play an important role as a substitute for natural habitats for many waterbirds.

The breeding bird assemblages of fishponds has been investigated in a number of recent studies, mostly in Central Europe (e.g. Hudec 1975, Cempulik 1985, Kot 1986, Musil et al. 1992, Musil & Šalek 1994, Pavelka et al. 1995, Trnka 1995 and references therein). But little quantitative information is available from southern Europe. The assemblages of birds breeding in the fishponds in Slovenia are poorly known, the only study being the one by Vogrin (1996).

In 1986, I began a comprehensive survey of the breeding birds occurring in the Rački ribniki (hereafter Rače ponds). My aims were to follow the population trends over the years, and to analyse the relationships among the breeding species.

Study area

The study was made at the Rače ponds in the Landscape Park Rački ribniki – Požeg, north-eastern Slovenia (approximately 46°27'N, 15°41'E). The Rače ponds (fishpond complex) consist of three ponds (covering from 4.5 ha to 20 ha) which are managed for semi-intensive fish-farming. This is the largest and oldest fishpond complex in Slovenia. The fish ponds were regularly emptied in early spring or in autumn for a few weeks for fish harvest. The belt of vegetation (mainly in the biggest pond), up to 30 m wide, is composed mainly of *Typha angustifolia* and runs mostly along the northern shore. The other dominant plant species are *Nym-*

phoides peltata in the largest pond, *Polygonum amphibium* in the middle pond and *Trapa natans* in the smallest pond. According to my own estimate, the average depth in the ponds is about 1.1 m. The ponds are eutrophic. In the northern part of the largest pond there is also an island (about 35 x 5 m), covered mainly with *Alnus glutinosa*, *Urtica* spp. and *Robus* spp. The culturing of carp has always been carried out there, and has lately been done with supplementary feeding and manuring. The surrounding landscape consists mainly of mixed forests and meadows with hedges.

Methods

This study presents the results for the 1986–1998 period, except for 1989 when only data for grebes were gathered. The number of pairs of *Podiceps cristatus*, *Tachybaptus ruficollis*, *Aythya fuligula*, *Fulica atra* and *Gallinula chloropus* were estimated only on the basis of found nests, and that of all other species on the basis of nests and/or observed females with fledglings. Only nest with eggs, egg shells or young were included in the count (see also e.g. Goc 1986). All nests, survived and robbed, were included.

Searching for nests was carried out two to five times in the breeding season (May–July), see also Vogrin (1999). Attempts were made to find all nests by making a systematic search of the vegetation. Additional censuses were carried out at least twenty times during each breeding season. Only non-Passeriformes were used for this study.

When comparing densities between ponds only densities of the four most common species (*Podiceps cristatus*, *Tachybaptus ruficollis*, *Fulica atra* and *Gallinula chloropus*) were used. The reasons for this is that other species did not breed in all ponds (*Aythya fuligula*), their densities were very low, or/and the number of pairs of certain species (e.g. *Anas platyrhynchos*) was not possible to determine for each pond separately.

Since the frequency distribution of several parameters did not appear to be normally distributed, I used non-parametric tests (Chi-square and Kruskal-Wallis 1-Way Anova tests) and Spearman correlation coefficient. A p-value < 0.05 was considered significant. All statistical tests were performed using a SPPS/PC 6.0 package and according to Sokal & Rohlf (1995).

Results

Six species of non-Passeriformes nested regularly at the Rače ponds. They were *Tachybaptus ruficollis*, *Podiceps cristatus*, *Anas platyrhynchos*, *Aythya fuligula*, *Fulica atra* and *Gallinula chloropus*. Two additional species, i.e. *Porzana parva* and *Charadrius dubius*, nested occasionally. The number of breeding pairs (without "possible" breeders) varied between 12 in 1994 and 45 in 1998 (Figure 1). The average densities of the four commonest species in all ponds together are given in Table 1.

Declines were observed in the number of *Anas platyrhynchos* (r_S = -0.63, P < 0.05, n = 11) and *Aythya fuligula* (r_S = -0.75, P < 0.005, n = 13); Figure 2. At the start of the study, *Aythya fuligula* was one of the most numerous breeding species. At that time, up to twelve nests were found. No other species showed any significant trend during the study.

The pooled data for all ponds show a positive relationship between the number of *Podiceps cristatus* and *Tachybaptus ruficollis* pairs (r_S = 0.72, P < 0.05, n = 12; Figure 3). I also calculated the relationships for the four most common breeders for each pond separately. In the largest pond I found two positive relationships, namely between *Podiceps cristatus* and *Tachybaptus ruficollis* (r_S = 0.61, P < 0.05, n = 10), and between *Fulica atra* and *Gallinula chloropus* (r_S = 0.86, P < 0.01, n = 11). In the smallest pond a positive relationship existed between *Podiceps cristatus* and *Gallinula chloropus* (r_S = 0.62, P < 0.05, n = 12). For the middle pond no significant relationships were found.

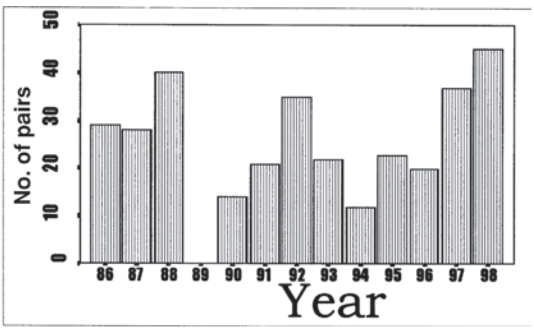

Figure 1. Numbers of pairs of breeding species at the Rače ponds between 1986–1998 (data for 1989 missing).
Antal häckande par vid Rače fiskdammar åren 1986–1998 (data för 1989 saknas)

Table 1. Densities (pairs/10 ha) of the four most common birds at the Rače ponds between 1986–1998 (pooled data for all three ponds).

Tätheten (par/10 ha) för de fyra vanligaste arterna i Rače fiskdammar åren 1986–1998 (summerade siffror för alla tre dammarna)

Year *År*	*Podiceps cristatus*	*Tachybaptus ruficollis*	*Fulica atra*	*Gallinula chloropus*
1986	2.1	2.4	1.5	0.9
1987	3.3	1.5	1.2	0.6
1988	2.7	2.7	1.5	0.6
1989	–	–	–	–
1990	1.2	0.9	0.3	0.3
1991	1.5	1.5	0.9	0.6
1992	1.2	3.9	2.1	1.5
1993	1.8	2.7	0.6	0.6
1994	0.9	0.9	0.9	0.6
1995	1.5	2.4	0.9	0.6
1996	1.8	2.1	0.6	0.9
1997	4.5	4.5	0.6	0.6
1998	4.8	5.8	0.9	1.2
Average	2.3	2.6	1.0	0.8

The densities of *Podiceps cristatus* (Kruskal-Wallis test, Chi-square = 15.69, df = 2, $P < 0.001$, n = 36) and *Gallinula chloropus* (Kruskal-Wallis test, Chi-square = 6.11, df = 2, $P < 0.05$, n = 36) was significantly correlated between ponds, whereas the densities of *Tachybaptus ruficollis* (Kruskal-Wallis test, Chi-square = 3.77, df = 2) and *Fulica atra* (Kruskal-Wallis test, Chi-square = 3.72, df = 2) did not differ significantly between the ponds (in both cases: $P > 0.05$, n = 36).

In the pooled data, the bird densities were highest in the smallest pond; however, the differences among ponds were not significant (Kruskal-Wallis test = 5.3, df = 2, $P > 0.05$, n = 144).

Discussion

It is interesting to compare whether species numbers shift independently of one other, in parallel, or compensatorily. According to Mac Arthur (1972), changes in the number of individuals is determined mostly by inter-specific interactions within the community. One would then anticipate numerous negative correlations among species, principally among the ecologically most similar congeners (Lack 1971). If numbers change in a totally independent manner, no significant correlations should appear, except in a few cases, due to chance (Newton 1998).

In my cases no negative correlations were found. There are two nearly congeneric pairs of species in my data set (*Podiceps cristatus* and *Tachybaptus ruficollis*, and *Fulica atra* and *Gallinula chloropus*), co-occurring in the same pond and with feeding and breeding habits that more or less overlap (e.g. Cramp & Simmons 1977, Cramp & Simmons 1980, Glutz Von Blotzheim et al. 1987), but none of them was negatively correlated. Instead, the changes were mostly independent, or, in the cases of *Podiceps cristatus* vs. *Tachybaptus ruficollis*, and *Fulica atra* vs. *Gallinula chloropus*, even strongly positively correlated. This suggests that these species responded in a similar way to a common environmental factor (Newton 1998). On the other hand, *Podiceps cristatus* and *Gallinula chloropus* are so different morphologically and ecologically that the positive correlation between them probably was due to chance.

The reason for the decline of *Aythya fuligula* has already been discussed (Vogrin 1997). The main reason was high fish stocks and overgrowth of island. The reason for decline of *Anas platyrhynchos* is unknown. Decreasing numbers of these and other species were noted also in many other ponds in Central Europe (see e.g. Musil et al. 1992, Pavelka et al. 1992, Musil et al. 1995). Musil et al. (1992) explained this decline of ducks by a gradual growth of shrubs and trees on islets which formerly had been

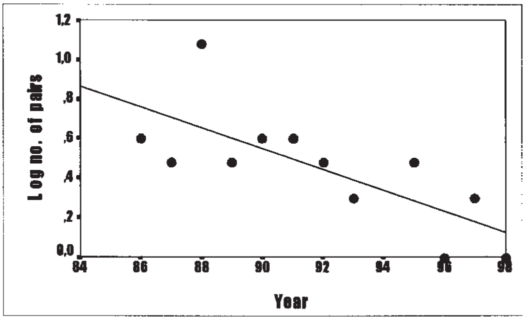

Figure 2. The relationship between number of pairs (log) of *Aythya fuligula* and year.
Sambandet mellan antalet par (log) av Aythya fuligula *och år.*

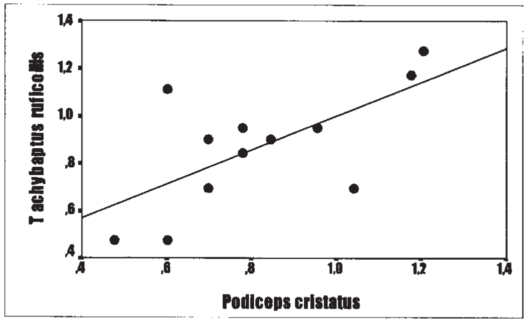

Figure 3. The relationship between number of pairs (log) of *Podiceps cristatus* and *Tachybaptus ruficollis*. Pooled data for all ponds during the study.
Sambandet mellan antalet par (log) av Podiceps cristatus *och* Tachybabtus ruficollis. *Sammanslagna data för alla dammar under studien.*

optimal breeding habitats for ducks. Nevertheless, the declines could also be due to high fish stocks in the ponds (see e.g. Pykal & Janda 1994, Pykal 1995), and to shortage of food (e.g. Gardarsson & Einarsson 1994). Dense fish stock causes high feeding pressure on available food (e.g. large zooplankton, benthos, littoral fauna), hence lack of feeding sources for waterfowl. Moreover, manuring with excrement of domestic animals which is added to the water for the purpose of producing bigger fish affects the chemical balance of the water. In order to reduce undesirable plant species more chemicals (e.g. lime) were used.

The number of breeding species in the Rače fishponds (possible breeders are not taken into account) is low compared to that of other ponds and water bodies in Central Europe. In the lake Ilgi (NE Poland) and in the ponds near Puste Ulany (Slovakia), which are comparable in size to the Rače fishponds, up to 16 (Mackowicz & Krajewski 1993) and 13 (Trnka 1995) species, respectively, were breeding. I suggest that human impact (e.g. supplementary feeding of fishes by fishermen from boats, intimidating the fish eating birds, e.g. *Phalacrocorax carbo* and *Ardea cinerea*, and emptying of the ponds in spring), and lack of suitable vegetation, e.g. *Phragmites australis*, are responsible for the scarcity of breeding species in my area.

Podiceps cristatus preferred the largest pond (see also Vogrin 1989), where it reached the highest density. The reason is probably the rich and dense emergent vegetation in that pond, the most important factor (beside food) for nest site selection (e.g. Salonen & Penttinen 1988). In contrast to *Podiceps cristatus*, *Gallinula chloropus* reached the highest density in the smallest pond. This finding is in agreement with the result of e.g. Cempulik (1993). My results seem to show that *Podiceps cristatus* and *Gallinula chloropus* are specialists whereas *Tachybaptus ruficollis* and *Fulica atra* are more flexible when selecting their breeding sites.

In the course of the present study some rare species not yet reported from this region bred. One was *Porzana parva*, which is an extremely rare breeding species in Slovenia (Geister 1995). It bred in 1998 at the Rače pond complex, and this is the only known recent nesting site in north-eastern Slovenia. All other possible breeders, i.e. *Podiceps nigricollis*, *Anas querquedula*, *A. clypeata*, *A. crecca* and *Aythya ferina*, are also rare breeders in Slovenia (Geister 1995).

Acknowledgements

All field work on which this report is based was carried out by myself with assistance of my wife Nuša and my brother Marjan, to whom I am particularly grateful. All work was conducted without financial support. Additional literature was kindly provided by Bard Gunner Stokke (Jakobsli, Norway).

References

Bukacinska, M., Bukacinski, D., Cygan, P. J., Dobrowolski, A. K. & Kaczmarek, W. 1996. The importance of fishponds to waterfowl in Poland. *Acta Hydrobiol.* 37 (Supplement 1): 57–73.

Cempulik, P. 1985. Waterfowl breeding on the Wielikat fish-

ponds (Upper Silesia, Poland). *Acta ornithologica* 21: 115–134. (In Polish with English summary).
Cempulik, P. 1993. Breeding ecology of the Moorhen *Gallinula chloropus* in Upper Silesia (Poland). *Acta ornithologica* 28: 75–89.
Cramp, S. & Simmons, K. E. L. (eds.) 1977. *The Birds of the Western Palearctic. Handbook of the Birds of Europe, the Middle East and North Africa.* Vol. 1. Oxford University Press, New York.
Cramp, S. & Simmons, K. E. L. (eds.) 1980. *The Birds of the Western Palearctic. Handbook of the Birds of Europe, the Middle East and North Africa.* Vol. 2. Oxford University Press, New York.
Gardarsson, A. & Einarsson, A. 1994. Responses of breeding duck populations to changes in food supply. *Hydrobiologia* 279/280: 15–27.
Geister, I. 1995. *Ornithological Atlas of Slovenia*. DZS, Ljubljana. (In Slovene with English summary).
Glutz von Blotzheim, U. N., Bauer, K. M. & Bezzel, E. 1987. *Handbuch der Vögel Mitteleuropas*. Band 1, Gaviformes – Phoenicopteriformes. Frankfurt am Main.
Goc, M. 1986. Colonial versus territorial breeding of the great crested grebe *Podiceps cristatus* on Lake Druzno. *Acta ornithologica* 22: 95–145.
Hill, D. A. 1984. Factors affecting nest success in the Mallard and Tufted Duck. *Ornis Scandinavica* 15: 115–122.
Hudec, K. 1975. Density and breeding of birds in the reed swamps of southern Moravian ponds. *Acta Scientiarum Naturalum Academiae Scientiarum Bohemoslovace* 9: 3–40.
Kot, H. 1986. Breeding birds and spring migration on fishponds near Siedlce, eastern Poland. *Acta ornithologica* 22: 159–182. (In Polish with English summary).
Lack, D. 1971. *Ecological isolation in birds*. Blackwell, Oxford.
Mac Arthur, R. H. 1972. *Geographical ecology: patterns in the distribution of species*. Harper Row, New York.
Mackowicz, M. R. & Krajewski, P. 1993. Breeding birds of the Lake Ilgi Reserve (NE Poland) and changes in their composition in 1970–1988. *Acta zoologica cracoviensia* 36: 291–312.
Musil, P. 1995. Changes in numbers of water and wetland birds on fishponds in the Trebon basin in 1988–1995. *Sbornik Vyznamna ptači uzemi v Česke republice*: 25–33. Praha. (In Czech with English summary).
Musil, P. & Šalek, M. 1994. Changes in abundance of waterbirds in south Behemia during the last decade: a summary review. In: Aubrecht G., Dick G., Prentice C. (eds.). *Monitoring of Ecological Change in Wetlands of Middle Europe*: 55–60. Proc. International Workshop, Linz, Austria, 1993. Stapfia, 31, Linz, Austria and IWRB Publication No. 30, Slimbridge, UK.
Musil, P., Štastny, K. & Bejček V. 1993. Abundance of particular water and wetland bird species on fishponds in the Trebon basin and changes over the last decade. *Sbornik Vyznamna ptači uzemi v Česke a Slovenske republice*. Trebon, 1992: 35–46. (In Czech with English summary).
Newton, I. 1998. *Population limitation in birds*. Academic Press.
Pavelka, K., Kašinsky, J. & Foral M. 1993. Influence of agriculture and fishery on the avifauna in the Poodri protected landscape area. *Sbornik Vyznamna ptači uzemi v Česke a Slovenske republice*. Trebon, 1992: 86–90. (In Czech with English summary).
Pavelka, K., Foral, M. & Koštal, J. 1995. Conservation and monitoring activities of the IBA Poodri patron group in 1992–1994. *Sbornik Vyznamna ptači uzemi v Česke republice*: 45–54. Praha. (In Czech with English summary).
Pykal, J. 1995. Recommendations for management of fishpond IBAs. *Sbornik Vyznamna ptači uzemi v Česke republice*: 80–84. Praha. (In Czech with English summary).
Pykal, J. & Janda, J. 1994. Relation between waterfowl numbers on South Bohemian fishponds and fishpond management. *Sylvia* 30: 3–11. (In Czech with English summary).
Salonen, V. & Penttinen, A. 1988. Factors affecting nest predation in the Great Crested Grebe: field observations, experiments and their statistical analysis. *Ornis Fennica* 65: 13–20.
Sokal, R. R. & Rohlf, F. J. 1995. *Biometry. The principles and practice of statistics in biological research.* H. Freeman and Company. New York.
Trnka, A. 1995. Nesting community of the birds on ponds near Puste Ulany (Podunajska niûina Lowland, Slovakia). *Zbor. Slov. nar. Muz., Prir. Vedy* 16: 87–92. (In Slovak with English summary).
Vogrin, M. 1989. Colony breeding of the Great Crested Grebe *Podiceps cristatus* on ponds at Rače. *Acrocephalus* 10: 51–56. (In Slovene with English summary).
Vogrin, M. 1996. Birds of Vrbje pond in the Lower Savinja valley, and a look at its conservationist complexity. *Acrocephalus* 17: 7–24. (In Slovene with English summary).
Vogrin, M. 1997. Breeding Tufted Duck in the Dravsko polje, north-east Slovenia. *Duck Specialist Group Bulletin* 1: 10–12. IUCN, Wetlands International.
Vogrin, M. 1999. Comparison between two different methods for estimating numbers of pairs of the breeding Little Grebe *Tachybaptus ruficollis*, Coomon Coot *Fulica atra*, and Coomon Moorhen *Gallinula chloropus*. *Acrocephalus* 20: 45–49. (In Slovene with English summary).

Sammanfattning

Häckande fåglar och deras trender i Race fiskdammar i nordöstra Slovenien under 13 år.

Det är välkänt att dammar för fiskodling utgör viktiga biotoper för vissa vattenfåglar i många områden. I sjöfattiga delar av Europa är fiskdammar en viktig orsak till artrikedomen eftersom de där är ett substitut för naturliga våtmarker. Kännedom om fågelfaunan i fiskdammar i Slovenien är dålig, och jag har därför inventerat ett litet komplex av fiskdammar inom ”landskapsparken” Race ribniki i nordöstra Slovenien under en trettonårsperiod (1986–1998, utom 1989). Det rör sig om tre dammar som har en areal mellan 4,5 och 20 ha. De sköts för halvintensiv fiskodling och är det äldsta och största dammkomplexet i Slovenien. Dammarna töms under våren och hösten för skörd av fisken. Dammarna har en del vegetation, främst längs den största dammens norra strand, mestadels kaveldun. Därtill finns sjögull i den största dammen, vattenpilört i den mellersta och sjönöt i den minsta. Vattendjupet i dammarna är ungefär en meter. I den största dammen finns en mindre ö med träd och buskar. Fiskarna matas och dammarna gödslas varför de är eutrofa.

Antalet häckande par uppskattades genom enbart boräkning för skäggdopping, smådopping, vigg, sothöna och rörhöna, alla övriga arter genom boräkning och antal honor med ungar. Boräkning skedde genom två till fem detaljerade genomsökningar av vegetationen under maj–juli. Övrig inventering bestod i minst tjugo besök varje säsong. Endast våtmarksarter exklusive tättingar inventerades.

Sex arter häckade regelbundet: smådopping, skäggdopping, gräsand, vigg, sothöna och rörhöna. Mindre sumphöna och mindre strandpipare häckade tillfälligt. Antalet par varierade mellan 12 och 45 (Figur 1). Endast två arter visade signifikant nedgång, nämligen gräsand och särskilt vigg (Figur 2). Den genomsnittliga tätheten för alla arter visas i Tabell 1. Mellan vissa arter fanns samvariation, nämligen mellan smådopping och skäggdopping och mellan sothöna och rörhöna i den största dammen samt mellan skäggdopping och rörhöna i den minsta dammen. Mellan dammarna fanns korrelation för tätheten för skäggdopping och rörhöna men inte för smådopping och sothöna.

Analysen visade att det inte fanns några negativa samband som kunde tyda på konkurrens. Istället var sambanden positiva eller saknades, vilket närmast tyder på att det var gemensamma omvärldsfaktorer som styrde antalet fåglar. Beträffande nedgången för vigg så berodde den på ökande fiskbestånd och uppväxande vegetation på ön, medan orsaken till nedgången för gräsanden är okänd. Man har observerat liknande nedgångar hos flera arter i andra fiskdammar i Centraleuropa och orsakerna anses kunna vara flera: födokonkurrens från täta fiskbestånd, igenväxning av stränderna, gödsling för att få större fiskar med ändrad vattenkemi som följd samt kemisk bekämpning av oönskad vegetation. Racedammarna är fågelfattigare än många andra vattenområden i Centraleuropa. Detta beror sannolikt delvis på lokala omständigheter, såsom kraftiga störningar, tömningen av dammarna på våren och avsaknad av lämplig vegetation, särskilt bladvass.

Under inventeringarna hade jag också tillfälle att notera ett antal sällsynta fåglar i dammarna, t.ex. den ovan nämnda häckningen av mindre sumphöna, som är extremt sällsynt i regionen. Andra rariteter, som möjligen men ej bevisligen häckade, var svarthalsad dopping, årta, skedand, kricka och brunand.