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Seasonal changes in the number of the Grey Heron *Ardea cinerea* occurring on Kolut fishponds in northern Serbia

Säsongsförändringar av antalet gråhägrar Ardea cinerea *vid Kolut fiskdammar i norra Serbien*

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Abstract

The number of Grey Herons *Ardea cinerea* occurring at different times of the year on Kolut fishponds in northern Serbia was monitored between 1998 and 2003. With data pooled over the years, the number of birds occurring in the the non-breeding period, August to April, varied significantly between months. The number of overwintering herons was low and then increased significantly to reach a spring peak in March. In April the number decreased before breeding, probably because migrating individuals left the area. In autumn there was an even higher peak in November compared to the spring peak. Significantly more herons occurred in autumn (August to December) than in spring (January to April). There was no significant difference between the spring months in the number of herons while there was significantly more herons occurring in November than in the other autumn months. The number of Grey Herons correlated with the number of Great White Egrets *Egretta alba*, meaning that also the number of Great White Egrets increased when the number of herons did so.

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Introduction

In Europe, the Grey Heron is a migratory, partially migratory and dispersive species. Autumn migration lasts from early September to late October. In the northern and eastern parts of Europe the cold winters make the habitat unsuitable for herons, and large parts of the populations in such areas are migratory (Pineau 2000). Many birds spend the winter in the Mediterranean region and the Middle East, while others migrate to Northern Africa. Spring migration starts in February (Cramp & Simmons 1983).

After Little Bittern *Ixobrychus minutus*, the Grey Heron is the second most common breeding heron in Serbia, where 2100–2400 pairs were estimated to breed yearly between 1990 and 2003 (Puzović et al. 2003). Outside the breeding season this species occurs in a variety of habitats throughout the country (Puzović 1999). The stopover sites during migration include floodplains (e.g. Iršai 1997, Kanjo 1997), sodium lakes and temporarily wet saline meadows (e.g. Lukač & Ternovac 1990, Dević 2000), and euthropic natural lakes (Hulo & Gergelj 2001). Nevertheless, fishponds appear to be the most important type of stopover site, with numerous flocks of herons present at many locations outside the breeding season (Šoti & Dimitrijević 1974, Lukač et al. 1995). According to ringing studies, birds passing through, or wintering in Serbia originate from breeding colonies situated in northern, north-eastern (Novčić & Ivović 2000) and central Europe (Kroneisl-Rucner 1960).

Even though the Grey Heron is such a numerous species in Serbia, its occurrence and variation in numbers on particular localities in the country has not been discussed at all. The aim of this work is to describe Grey Heron occurrence at different times of the year on a small fishfarm near Kolut in Serbia, and to discuss this in relation to the phases of fish production in this man-made wetland.

Study area and methods

The Kolut fishponds are situated on the edge of the village Kolut in the province of Vojvodina situated in north-western Serbia (UTM CR48, 45° 53'N 18° 57'E). The region has a Danubian type of continental climate with the highest mean temperature in July (20,9°C) and the lowest mean

temperature in January (–0,9°C). The month with the highest mean precipitation is June (78 mm), the one with the lowest is February (33 mm) and the yearly average is 569 mm (Tomić 1996). The dominant fish species that is reared in the ponds is Carp *Cyprinus carpio*, but also small numbers of other species such as Grass Carp *Ctenopharyngodon idella*, Silver Carp *Hypophtalamychtis molitrix*, Bighead Carp *H. nobilis*, Wels Catfish *Silurus glanis*, Zander *Stizostedion lucioperca*, and Pike *Esox lucius* occur (Ržančanin et al. 1982). During the study period, 175 ha of ponds was in usage within the farm. Fish production takes place in 8 large ponds, while 10 smaller ones serve as wintering storage of fish (Barkjaktarov 2004). Ponds receive water from the nearby river Plazović. The fish is fed from boats, and after the winter, feeding starts in April. The production technique includes enhancement of the benthos production by addition of fertilizers, as well as water calcification throughout the year. Provisioning of food to the fish continues until late September, after which the larger ponds are emptied and the fish harvested. The emptying procedure lasts until late October and harvesting continues until mid December. The large ponds are not refilled again until late February and the ratio between empty and full ponds during the winter is approximately 50%–50%.

The banks and the small islets in the ponds are mainly covered by Reed *Phragmites communis* and Reedmace *Typha* spp. During the vegetation growth season, underwater vegetation covers most of the pond bottoms and this vegetation emerges over the surface only in some patches. Near the ponds the vegetation is dominated by Blackthorn *Prunus nigra*, White Willow *Salix alba*, White Poplar *Populus alba*, Goat Willow *S. caprea* and Grey Willow *S. cinerea*. The fishponds are surrounded by agricultural fields, marshy depressions of the river Plazović and the village Kolut.

I visited the fishponds 129 times between 13 February 1998 and 18 November 2003. During every excursion I surveyed the entire surface of the ponds from the embankments situated between the ponds. I made my observations from points from which all parts of the ponds were visible. I registered all individuals that I observed in or above the study area. When flocks were very large counting could be difficult, and I then assessed the number of Grey Herons using the "block method" (for an explanation see Simić & Tucakov 2003).

In the statistical analyses I used the Chi-square test, the Kruskal-Wallis one-way ANOVA test, the Spearman correlation test, and the Mann Whitney U-test in the statistical package SPSS 8.0. I did not analyse possible differences in the numbers of herons between particular years. In order to increase the resolution in the figure and the analyses I divided each month into three ten day periods ("decades") and assigned my observations to these. The first decade would then be the 1st to the 10th of the month, the second decade the 11th–20th and the third decade the 21st–31st day. I used the average number in every decade when I made the figures. Strictly, data are not independent between months since the same individuals may occur several months. However, such dependence is not a problem here since it can only decrease my chance to find significant differences. Grey Herons breed near the ponds, for example in a nearby colony near Bezdan (Puzović et al. 1999), but its occurrence during the breeding period (May, June and July) is excluded from the analyses in this article.

Results

I recorded Grey Herons during 122 (94.6%) of the visits to the ponds. It was the second most common bird species in the study period, after the Mallard *Anas platyrhynchos*. The number of individuals occurring on the ponds outside the breeding season (August to April) is given in Table 1. During this period the number of Grey Herons differed significantly between months (Kruskal-Wallis test, Chi-square = 34.1, df = 8, $P < 0.001$) as well as between spring (January to April) and

Table 1. Number of Grey Heron occurring on Kolut fishponds in Northen Serbia during migration and winter.
Antalet gråhägrar vid Kolut's fiskdammsanläggning utanför häckningstid.

Month *Månad*	No. of individuals (Mean ± SD) *Antal individer*	Maximum no. of individuals *Max antal individer*
January	12.2 ± 10.7	25
February	45.3 ± 40.1	110
March	58.8 ± 51.3	160
April	39.4 ± 27.6	70
August	28.2 ± 21.5	60
September	29.0 ± 20.7	65
October	136 ± 20.7	385
November	252 ± 112	650
December	182 ± 134	350
Total		85.2 ± 83.5

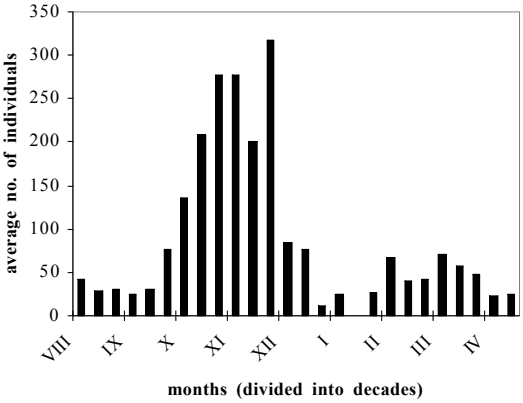

Figure 1. Average number of Grey Herons *Ardea cinerea* per ten-day period over the non-breeding season at the Kolut fishponds between 1998 and 2003.
Genomsnittligt antal hägrar vid Kolutdammarna per tiodagarsperiod utanför häckningstid under åren 1998–2003.

autumn (August to December) (Mann-Whitney U-test = 703.0, $P < 0.005$). Looking at the spring separately, the number of individuals did not differ significantly between months (Kruskal Wallis test, Chi-square = 4.2, df = 3, $P > 0.05$). In the autumn, on the other hand, the number of Grey Herons differed significantly between months (Kruskal Wallis test, Chi-square = 20.6, df = 4, $P > 0.001$).

In winter, from the third decade in December throughout January the highest record ever was 25 individuals on 20 January 2001. Spring migration begins immediately after the ice starts melting, as water fills the emptied ponds. Migration occurs throughout February and the number of individuals reaches a peak in early March (Figure 1). The maximum number of individuals recorded in spring was 160 individuals observed 28 March 2001. Spring migration ends in early April, after which only local breeders and individuals from a nearby breeding colony near Bezdan occur at the ponds. In early August up to 67 individuals has been recorded while more intensive autumn gathering starts in early October. The autumn peak occurs in late November with a maximum of 650 individuals recorded on 18 November 2000. High numbers still occur throughout much of December.

During the fish-rearing season, between April and September, Grey Herons forage on the edges of the ponds in emergent vegetation or in shallow water close to the banks. However, as emptying of the ponds progresses with the ongoing fish harvesting, birds use shallow water patches all over the ponds for foraging, especially the dikes and depressions that have been constructed to facilitate harvesting. The same foraging areas are regularly used also by large numbers of Great White Egrets *Egretta alba*, whose numbers were compared with the numbers of Grey Herons (Table 2).

Discussion

The increase in numbers in early August indicates post breeding aggregations. Grey Herons regularly occur on fishponds in northern Serbia (Purger 1989, Šoti & Šite 1983, Lukač et al. 1995), which holds true for my study area, as well. Grey Herons mainly eat small fish (Cramp 1998) and will thus benefit from the easily accessible food on fishponds throughout much of the year (Boldreghini et al. 1995). To some extent the species can be considered to be an indicator of the euthropic status of these waterbodies (Vikstrøm 2003). Furthermore, it has been suggested that the recent increase of the population in Vojvodina and Serbia could depend on the improved feeding conditions provided by the construction of carp fishponds during the last 40 years (Puzović et al. 1999).

Outside the breeding season Grey Herons are primarily considered to be solitary foragers that aggregate in flocks only for resting or migration (Cramp & Simmons 1983). Still, they aggregate in large numbers on all surveyed fishpond establishments in province of Vojvodina, with yearly maxima recorded in the autumn. Despite the fact that the Kolut fishponds are relatively small compared to other fishponds in Vojvodina (Bugarčić 1999), it boasts the highest yearly maxima of Grey Herons recorded in any surveyed establishments of this type (Lukač et al. 1995, Dević 1995). This suggests that the Kolut ponds are an important stopover and foraging site for this species.

Both during the breeding (Fasola & Barbieri 1978) and non-breeding seasons (Fasola & Ruiz 1996) herons aggregate on wetland sites where they can find good availability of food. At fishponds, the numbers of Grey Herons outside the breeding season is frequently positively correlated with the size of the fish farm (Lukač et al. 1995, Dević 1995, Šetina 1996, Vogrin & Vogrin 1999, Tadić pers. com). There are several possible reasons for this, for example larger fishfarms normally offer larger and more diversified foraging areas (pers. obs.). Also, larger fish farms have more ponds, which means that the emptying and fish harvesting processes last longer. At the same

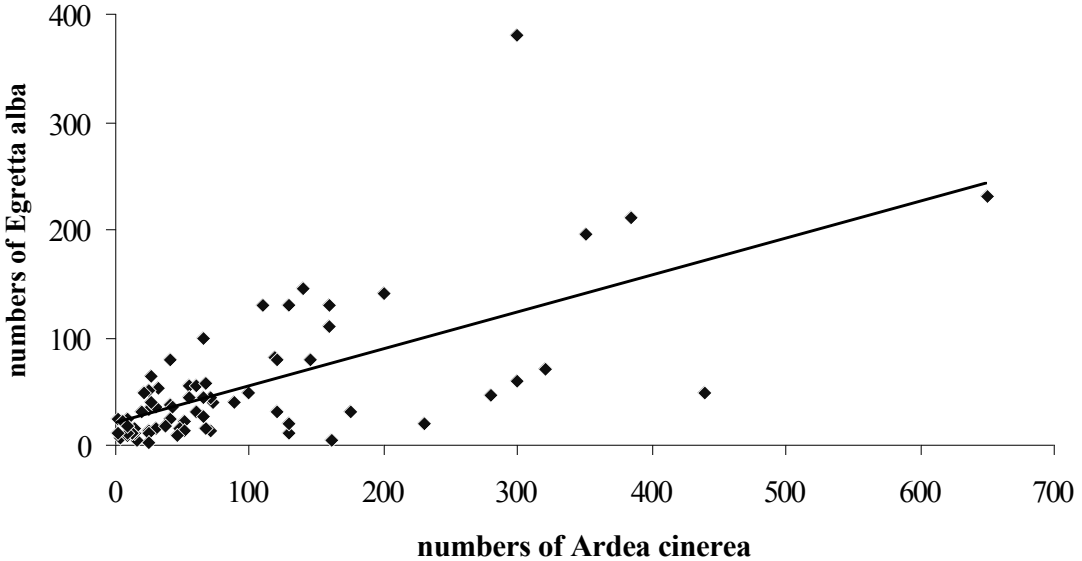

Figure 2. The relationship between the number of Grey Herons *Ardea cinerea* and Great White Egrets *Egretta alba* at the Kolut fishponds.
Förhållandet mellan antalet gråhägrar och antalet äggretthägrar vid Koluts fiskdammar.

time larger establishments may increase the birds' safety; flocks may rest in places that are less accessible for humans at the same time as the possibility to spot possible predators may be good (own data, Brooke & Birkhead 1991). Finally, fishponds situated along migration routes may attract bigger flocks. Since Kolut fish farm is relatively small this suggests that it must offer superb foraging possibilities to outweigh these benefits offered at larger fishponds.

For Grey Herons the food supply on Kolut fishponds peaks during the fish harvesting in late autumn. At this time fish and other aquatic animals will be concentrated in the depressions on the bottom of the ponds, prior to fish netting (own data). That must be one of the reasons for the high number of Grey Herons occurring from early October and onwards (Figure 1, see statistical analyses). An additional reason is that this period partly coincides with the autumn migration. Thus the number of Grey Herons reaches its autumn peaks in November (Figure 1) when many ponds are shallow or almost empty and their foraging value is highest. Thus the high number of birds in November probably depends on the combined effect of migration and suitable food conditions. The prolonged stay of high numbers of herons in December suggests the overwintering sites may be available in the vicinity.

In late December the ponds ususally freezes completely. The number of individuals then suddenly drops and remains low throughout January and early February (Figure 1). During that period, the role of the fishponds as a food source for piscivore birds is small since they are either frozen or empty (Bukacinska et al. 1996, Radović 1996). Besides the inaccessability due to the ice cover, the supply of food for herons may now be low since the ponds have been heavily exploited during November and December, not only by Grey Herons but also by other fish-eating birds, the most numerous of them being the Great White Egret (see Results, Figure 2).

A similar autumn peak in November is recorded in the wetlands of western Banat in northern Serbia (Šoti & Dimitrijević 1974), as well as in the Pesnica valley in north-eastern Slovenia, where the August peak is more pronounced than in my study area (Gregori 1989). In Hungary, north of my study area, however, autumn migration peaks in late September and early October (Molnar 1998). On fishponds the timing of autumn concentrations of herons will not only depend on climate and geography, but also on the timing of fish har-

vesting. Especially semi-emptied ponds will offer plenty of accessible food (Kovács 1984, Gergelj & Šoti 1990, Lukač et al. 1995, Vogrin & Vogrin 1995, 1996, Molnar 1998, Vogrin & Vogrin 1999). In contrast to the conditions in Slovenia (Vogrin 1996), there were no pond emptying in spring in my study area. This is one reasons for the smaller number of Grey Herons present during spring months in comparison to the autumn (see statistics, Figure 1).

In all studied years, Grey Heron numbers were low in January since feeding opportunities were poor. All individuals that were observed during that month foraged in channels located between the ponds. These channels were the only unfrozen water patches in the area in January and early February. In winter, Grey Herons will seek suitable foraging niches on unfrozen and bigger waterbodies (Novčić 2000, Gergelj, pers. comm.) or forage on arable land (Vogrin 1999a).

A similar correlation between the number of Great White Egrets and Grey Herons that I found (Figure 2) has been reported by Vogrin (1999b) for NE Slovenia. This suggests that competion for food between these species is not severe when they aggregate at fish ponds. This correlation supports my conclusion that the Kolut fishponds is an important foraging site for herons outside the breeding season.

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Sammanfattning

Mellan åren 1998 och 2003 har jag studerat och räknat antalet hägrar *Aredea cinerea* utanför häckningssäsongen i en fiskodlingsanläggning vid Kolut i norra Serbien. Då jag var intresserad av variationen över året och anläggningens betydelse som rastlokal har jag slagit samman observationerna från de olika åren.

Antalet hägrar uppvisade två toppar, en på våren och en på hösten. Vårtoppen kom i början av mars (Figur 1), men antalet hägrar var då inte signifikant större än under övriga vårmånader. Under hösten, däremot, var antalet signifikant större än under övriga höstmånader. Om vår och höst jämförs var antalet signifikant större under hösten (Tabell 1, Figur 1). Detta beror troligen på att dammarna töms under senare delen av hösten när fiskarna i dammarna ”skördas”.

Trots att Kolutanläggningen är relativt liten jämfört med andra liknande anläggningar i denna del av Europa är antalet rastande och furagerande hägrar untanför häckningstiden större än i någon annan sådan anläggning. Detta tyder på att Kolutdammarna är viktiga för flyttande och furagernade hägrar.

Ägretthäger *Egretta alba* furagerar också i dammarna och antalet sådana samvarierar med antalet gråhägrar (Figur 2).