

Effect of urbanization and feeding intensity on the distribution of wintering Mallards *Anas platyrhynchos* in NE Poland

*Effekt av urbanisering och matning på förekomsten av övervintrande gräsänder *Anas platyrhynchos* i nordöstra Polen*

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Abstract

Urban areas are alternative wintering sites for species with ability to exploit the new conditions that cities offer, such as food, shelter and reduced predation. During four winters (November–February), we recorded the number of Mallards along 108 km of rivers within an urbanization gradient from city centre to rural in north-east Poland. In the urban area, but not in the suburban and rural areas, there was an increase of numbers through winter with highest numbers in February, the coldest month. However, we found no correlation between numbers and ice cover. The only correlation was with feeding intensity by humans, and we suggest that intensity of feeding and the location of the feeding sites is the main factor determining number of wintering Mallards. This was sup-

ported by recoveries of ringed birds. Mallards ringed at good feeding sites in the city centre were recovered at the same sites whereas birds ringed in the periphery of the city tended to move to the centre in subsequent winters.

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Received 20 April 2010, Accepted 15 June 2010, Editor: S. Svensson

Introduction

Adaptation to urban ecological niches requires changes in the behaviour and ecology of species primarily occupying non-urban (rural and wild) areas. For example, urban populations of Blackbird *Turdus merula*, Mallard *Anas platyrhynchos*, Coot *Fulica atra*, Mute Swan *Cygnus olor*, and Rook *Corvus frugilegus* in Central Europe usually spend winters in their urban breeding areas, while rural populations of these species migrate over long distances to their wintering sites (review in Luniak 2004). Reduction of seasonal migrations is a consequence of better wintering conditions within cities, particularly related to the milder urban microclimate, providing snow-free spaces and ice-free waters (Avilova 2008, Brauze & Kurkowski 2008).

The urban populations of these species are usually characterized by a year-round high population density, mainly due to lower predation pressure and rich anthropogenic food resources (leftovers, feeding by people). Such opportunities are attractive to many bird and mammal species, leading to

changes in their feeding behaviour (Guillemain et al. 2002, Charalambidou et al. 2005, Jones & Reynolds 2008). In the Mallard, anthropogenic food resources contribute to a substantial (sometimes the main) diet component, particularly during winters (Polańska & Meissner 2008). The distribution of feeding sites as well as the feeding intensity are important factors affecting abundance and density of Mallards during winter periods (Jones & Reynolds 2008). In the breeding season it is the availability of suitable nesting sites, dispersed within the matrix of built-up areas, that determines the density of urban populations (Huhtalo & Järvinen 1977).

The Mallard seems to be a species that has adapted particularly well to urban conditions across Europe (Cramp & Simmons 1977, Engel et al. 1988, Luniak 2006). In Poland it is reported as the most numerous over-wintering species (e.g. Brewka 1993, Mazurek & Polakowski 2002, Piotrowska 2003, Tomiałoć & Stawarczyk 2003, Zieleniak 2007, Ławicki et al. 2008), which can be observed in urban areas (Hebda 2001, Biaduń 2005, Luniak 2006). However, we are not aware of any study of

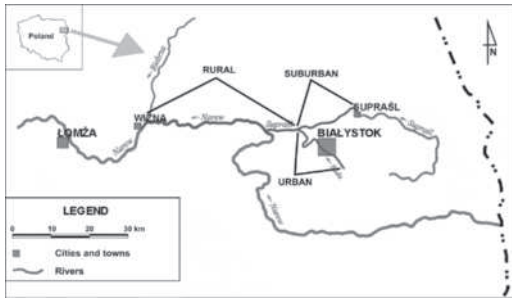


Figure 1. Study area. *Undersökningsområde.*

its distribution in urban and suburban areas under varied winter conditions, including the aspect of feeding intensity. In this paper we investigate the influence of different weather conditions, presence of ice cover and varying food supply on the distribution of wintering Mallards in urban, suburban and rural environments.

Material and methods

This study was carried out in North Podlasie (NE Poland), which is the coldest region in Poland outside the mountains, and therefore provides a good opportunity to study over-wintering bird communities. The data was collected during four winter seasons (2005/2006–2008/2009), in the frame of the regional Wintering Birds Survey headed by The Polish Society for Birds Protection and the Biology Students Scientific Circle at the Institute of Biology, University of Białystok. Observations were collected along rivers, along 108 km altogether (Figure 1). Each part of the rivers was assigned to one of three categories regarding the urbanization gradient of the surrounding area: (1) urban – Białystok City with the Biała River, (2) suburban – the Supraśl River from Supraśl Town to Fasty Village, and (3) rural – the Supraśl River from Fasty Village to the Narew River and the Narew River from Złotoria Village to Wizna Town. Surveys lasting 2–4 days were done in the middle of each month (from November through February).

Simultaneously, we captured and marked Mallards at 27 ringing sites within the urban area in order to investigate the level of attachment of individual birds to feeding sites between two subsequent winter seasons (Figure 2). At each ringing site, the area of ice cover on the river was recorded,

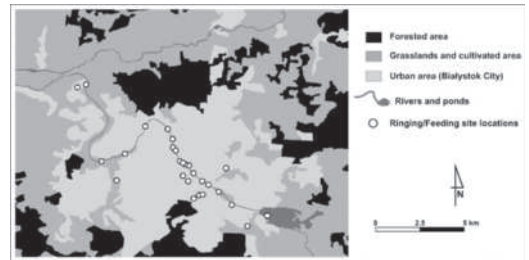


Figure 2. Locations of ringing and feeding sites in the Białystok City.

Lokalisering av platser för ringmärkning och matning i Białystok (små cirklar). Svart är skog, mörkgrått jordbruksmark och ljusgrått tätort.

as well as the feeding intensity, expressed as the number of people feeding birds per one hour. A total of 225 Mallards was ringed. They were trapped using a loop-trap made of a fishing line of 0.33 mm diameter, placed on the ground across the ducks' usual route to the water and with bait in the loop. The observer then pulled the line that tightened on the bird's leg. This method is successfully applied in Poland for capturing ducks (*Anas* sp.), geese (*Anser* sp. and *Branta* sp.), gulls (*Larus* sp.) and other birds (M. Polakowski – own unpublished data), and performed by an experienced person this method is equally safe for birds as other capturing techniques.

Statistical tests were performed using Kruskal-Wallis non-parametric analysis of variance and Friedman test in SPSS 12.0 PL for Windows.

Results and discussion

The number of wintering Mallards differed between the habitat categories (Figure 3). Most Mallards wintered in the urban area (Białystok City). The smallest numbers were found in the suburban area, whereas rather high numbers were recorded in the rural area (Narew River).

Mallard abundance did not differ significantly between winters in any of the three considered areas when data from all months were pooled (Figure 3). However, we observed significant increase in the number of individuals in the urban area from November to February ($\rho = 0.679$, $p < 0.01$), whereas numbers remained similar throughout the winter in suburban and rural areas. The increase of the number of individuals during the winter in the urban area was probably caused by relatively little ice on rivers within the city, compared to suburbs

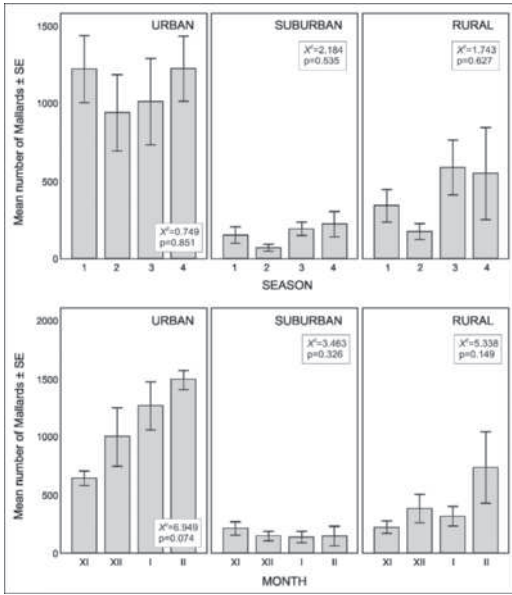


Figure 3. Comparison of mean numbers of wintering Mallards between different winter seasons (upper) and months (lower) under various urbanisation gradients.

Medeltal övervintrande gräsänder olika vintrar (överst) och månader (nederst) i biotoper med olika grad av urbanisering.

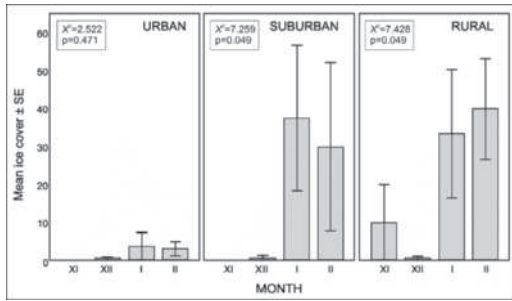


Figure 4. Mean ice cover (percent) in different months in the three habitats with different level of urbanisation.

Istäckning (procent) olika månader inom de tre områdena med olika urbanisering.

and rural area (Figure 4). However, no significant effect of ice cover could be found when this was tested.

There were no significant differences in the mean feeding intensity between months ($\chi^2 = 0.018$, $df = 3$, $p = 0.895$). We found that Mallard abundance was positively correlated with feeding intensity (p

$= 0.534$, $p < 0.01$). Sites with highest feeding intensity (from 4.0 to 5.0 persons per hour), were mostly found in the city centre, while low feeding intensity sites (from 0.5 to 1.5 persons per hour) were located in the peripheral area of the city. We assumed that no feeding occurred in the suburban and rural areas, since we did not observe such activities during field surveys.

Twenty-four ringed Mallards were recaptured in a subsequent winter. Fourteen of them were both ringed and recovered in the city centre. Eight birds that had been ringed in the periphery of the city were recovered at feeding sites in the centre. The remaining two recoveries were made in the city periphery. Individuals ringed at low feeding intensity sites (regardless whether it was the city centre or the periphery) were recovered at sites where feeding intensity was higher than at the ringing site (Figure 5).

The facts that we could find no significant effect of ice cover, the tendency of recovered birds to move from poorer to better feeding sites, and the strong increase of birds in the urban area (they gathered in the city centre where the feeding intensity was highest as the winter became colder) suggest that the main factor affecting wintering Mallard abundance was the location of feeding sites and feeding intensity.

We also observed that during the coldest months (bigger ice cover in sub-urban and rural areas than in the city centre) a high number of Mallards moved into the urban area, reaching the maximum number ever recorded during this study. This suggests that birds from outside the study area were also winter-

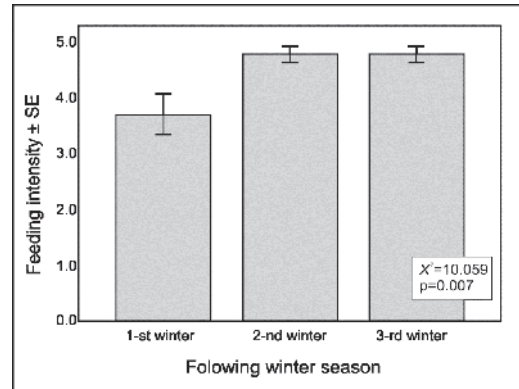


Figure 5. Mallard feeding site choice in following winter seasons.

Val av födosöksområde vinter efter märkning.

ing in the city. This observation can be explained by the migration of birds that usually winter in artificial lakes and ponds around the city. When these lakes had frozen, birds moved into the city which was the closest alternative wintering site.

Our results suggest that both the density and the distribution of wintering Mallards in urban areas are determined mainly by the intensity of feeding and the location of feeding sites. We found that Mallards ringed at good feeding sites in the city centre were recovered at the same sites in subsequent seasons, while birds ringed in the peripheral area tended to move to the centre during the following winters. Moreover, our results show an interesting foraging behaviour of Mallards, where individuals were able to localise good feeding sites from one winter season to another.

Acknowledgements

We want to thank numerous people from The Polish Society for Birds Protection and the Biology Students Scientific Circle at the Institute of Biology, University of Białystok for their assistance in the field work.

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Sammanfattning

De fåglar som anpassat sig till tätorternas annorlunda ekologiska nischer har ofta andra vanor än sina artfränder på landsbygden eller ute i den vilda naturen. Exempelvis övervintrar fåglar som häckar i tätorter i högre grad än de som lever på landsbygden, vilka kan flytta långa sträckor. Arter som i hög grad anpassat sig till urbana miljöer är bl.a. koltrast, sothöna, knölsvan och råka. De har funnit gynnsamma betingelser för övervintring och har ofta tätare bestånd året runt i städerna än uti i naturen. Beroende på art kan orsaken vara gynnsammare mikroklimat, lägre predation eller ett rikare utbud av föda. Gräsanden är en annan art som särskilt väl anpassat sig till urbana förhållanden vintertid på många håll i Europa. Exakt vad som bestämmer antalet övervintrande gräsänder är dock mindre väl känt, och särskilt vilken betydelse som människans utfodring har.

Vi studerade de övervintrande gräsänderna i nor-

ra Podlasie i nordöstra Polen, den kallaste delen av landet nedom bergen. Data insamlades under 2–4 dagar i mitten av varje månad från november till februari under fyra vintrar (2005/2006–2008/2009). Räkningarna utfördes längs 108 kilometer flodsträckor, som delades upp i tre grader av urbanisering utifrån omgivningarna: urban (city), suburban och rural (landsbygd). Antalet gräsänder räknades i alla tre miljöerna. I den urbana delen registrerade vi också matningen i form av antal personer som matade per timme på olika ställen. Vi fångade och märkte gräsänder på olika platser i den urbana delen, både i centrum och i periferin. Vi registrerade också isläget vid varje tillfälle och på varje plats. Totalt märktes 225 gräsänder.

Antalet övervintrande gräsänder skilde sig mellan de tre biotoperna (Figur 3). De högsta antalen fanns i Białostok centrum och de lägsta på platser i de suburban miljöerna. Däremot fanns ganska många där floder rann genom landsbygd. Det var ingen skillnad i antal mellan vintrarna när man slog ihop alla månader. Däremot noterade vi en signifikant ökning under vinterns lopp i stadsmiljön med högst antal i februari, den kallaste månaden. Möjligen kunde detta bero på mindre is på floden i cen-

trum, men vi fann dock ingen statistiskt signifikant effekt av isläget.

Vi registrerade inga skillnader i matningsintensitet mellan olika månader. Men gräsändernas antal var signifikant korrelerat till människornas matningsintensitet, och denna var högst just i centrum men lägre mot periferi i den urbana miljön. Vi tror att det inte förekom någon matning i den suburban och rurala miljön, något som vi dock inte studerade.

Märkningarna resulterade i 24 återfångster ett senare år. Fjorton fåglar både märktes och återfångades på samma platser i centrum. Åtta fåglar som märkts i periferin återfångades i centrum. De återstående två fåglarna återfångades i periferin. Oberoende av var de märkts återfångades fåglarna på platser där det var högre matningsintensitet än där de märkts (Figur 5).

Det faktum att vi inte fann något signifikant samband med istäckningen, tendensen att fåglarna flytta från sämre till bättre matplatser och den kraftiga ökningen av gräsänder i centrum under den kallaste månaden tolkar vi som att huvudfaktorn som bestämmer antal och plats för övervintring var människornas matning.