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Factors affecting apparent survival and resighting probability of wintering mallards *Anas platyrhynchos*: A case study from a small town in north-eastern Poland

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Survival of adults is a key demographic parameter affecting avian population dynamics. In urban areas, *e.g.*, city parks, birds stay in winter in large numbers where they have access to a multitude of food sources due to human activities, which is one of the key factors that attract birds into the cities. Our study estimates apparent survival of mallard ducks *Anas platyrhynchos* between non-breeding seasons in a small town in the coldest region in north-eastern Poland between 2005 and 2017. We found lower survival estimates for females (juveniles: 0.54; adults: 0.59) than males (juveniles: 0.76; adults: 0.72) and probabilities of resighting individuals in the next non-breeding season were higher if the bird was resighted in the study area during the prior breeding period. Thus, we conclude that sedentary mallards from the local urban population have relatively high survival, which may be explained by lower pressure from raptors, lack of hunting and higher winter temperatures in the urban site. Additionally, winter temperature was negatively related to resighting probability in the next non-breeding season. Resighting probability was time-dependent with a bimodal pattern with maximal estimates of 0.48 in 2007/2008 and 0.98 in 2013/2014, 0.98 in 2014/2015, 1.00 in 2015/2016. These results are most likely related to volunteers' activity that increased due to organized official competition with special awards during those seasons. Considering the fact that the type of ring (metal or plastic coloured) significantly influenced the probabilities of resighting of individuals, it is recommended that apparent survival studies on birds be conducted using colour rings. Moreover, we encourage to collect more capture-mark-recapture data to enable accurate estimations of duck survival, which not the least is a prerequisite for successful management and conservation efforts.

1. Introduction

Survival of adults is a key demographic parameter affecting avian population dynamics (Sæther & Bakke 2000, Flint *et al.* 2006, Tack *et al.* 2017). For waterbirds that spend winter in temperate climate zones, risks and challenges are associated with increased mortality due to harsh weather and limited access to food resources (Fredrickson 1969, Suter & van Eerden 1992). However, in urban areas, where birds stay in winter in large numbers, they have access to a multitude of food sources due to human activities, which is one of the key factors that attract birds into cities (Avilova & Eremkin 2001, Galbraith *et al.* 2015, Coogan *et al.* 2018). These cities are characterized by higher average winter temperatures resulting in more snow-free spaces and ice-free waters, and low avian predation pressure when comparing to rural areas (Luniak 2004). Additionally, urban areas provide refuges for waterbirds, *e.g.*, ducks Anatidae, because birds spending winter in these places are not exposed to hunting pressure (Figley & VanDruff 1982). Although higher survival in populations from urban areas has been found in different bird species (*e.g.*, Hõrak & Lebreton 1998, Anderies *et al.* 2007, Varner *et al.* 2014), some factors may negatively affect survival of birds staying in the cities. Domestic predators, such as cats *Felis catus* or dogs *Canis lupus* familiaris, are often abundant in urban environments, which can have profound effects on birds (Loss *et al.* 2013). Large glass surfaces and vehicle traffic can cause collision mortality (Hager *et al.* 2008). Moreover, staying in urban environments may have negative impacts on waterbirds due to facilitated pathogen transmission when they are congregating in winter in large numbers and high densities (Wobeser & Kost 1992, Meissner *et al.* 2015a, Murray *et al.* 2016, Kleyheeg *et al.* 2017). Dependency on anthropogenic foods may contribute to health risks such as nutritional imbalance, which may lead to metabolic disorders (Kreeger & Waiser 1984, Zsivanovits *et al.* 2006) or affect subsequent reproduction (Plummer *et al.* 2013, Ruffino *et al.* 2014). Studies conducted on duck survival so far have provided inconclusive results (*e.g.*, Soutiere 1989, Giudice 2003, Gunnarsson *et al.* 2008, Söderquist *et al.* 2021), potentially because those were based on birds of different encounter histories (resightings or dead recoveries), age (pulli, juveniles or adults) and origin (wild or raised in captivity). To our knowledge only one study compared apparent survival of a duck species, *i.e.*, mottled duck Anas fulvigula in urban and non-urban areas using capture-mark-recapture analyses (*e.g.*, Cormack-Jolly-Seber models) (Varner *et al.* 2014), which is the best way to achieve reliable estimates of survival rates (Clobert *et al.* 1987, Lukas *et al.* 2004). Other estimates of annual survival rates of urban dabbling duck species (*i.e.*, Heusmann 1981) were calculated using other methods and we believe resulted in underestimations (for a similar discussion, see also Gunnarsson *et al.* 2008).

The mallard *Anas platyrhynchos* is the most abundant and widely distributed dabbling duck species which shows a strong tendency for synurbization and is well adapted to urban environments (Figley & VanDruff 1982, Engel *et al.* 1988). Furthermore, this species is found in very large numbers during winter in many cities of the Northern Hemisphere (*e.g.*, Heusmann & Burrell 1984, Schonert 1991, Meissner *et al.* 2015b, Avilova 2016, Berliner Ornithologische Arbeitgemeinschaft 2019). The species include migratory populations (Figley & VanDruff 1982, Engel *et al.* 1988), but many mallards breeding in urbanized areas are sedentary (Heusmann 1981, Figley & Van Druff 1982, Heusmann & Burrell 1984, Luniak 2004, Zárybnický & Klvaňa 2008). In contrast to urban mallards the apparent survival of ducks in wild populations has previously been described (*e.g.*, Bergan & Smith 1993, Lake *et al.* 2006, Lancaster 2013, McDougall & Amundson 2017). They have also adapted to close association with humans and permit people to approach to very short distances to feed these birds bread or scraps of food, thus reducing their escape distance in urbanized areas (Figley & VanDruff 1982, Avilova & Eremkin 2001, Luniak 2004). Studies on urban populations of dabbling ducks provide an excellent opportunity to assess and estimate apparent survival, because these species reveal strong wintering site fidelity (Heusmann 1981, Guillemain *et al.* 2008). This makes re-sightings of ringed ducks much easier to obtain without catching them, compared to when data are gathered in waterbodies outside urban areas where ducks normally are more dispersed.

This study was designed to estimate apparent survival rates of mallards between non-breeding seasons in one small town in the coldest region in north-eastern Poland and identify factors affecting resighting probabilities in the next non-breeding season. Based on earlier studies, we expected that adult mallards would have higher survival estimates than juveniles, as older ducks are more experienced in avoiding threats, *e.g.*, predation (Johnson *et al.* 1992, Lake *et al.* 2006, Gunnarsson *et al.* 2012). Additionally, we expected males to have higher survival estimates than females, because female ducks experience greater mortality during breeding season than males (Johnson *et al.* 1992, Devries *et al.* 2003, Brasher *et al.* 2006, Lake *et al.* 2006). Moreover, sedentary mallards from a local urban population were expected to have higher probability of being resighted in the next non-breeding season, compared to birds not observed during the breeding season, because urban habitats reveal lower pressure from avian raptors, lack of hunting and abundant anthropogenic food resources (see above).

2. Materials and methods

2.1. Study area

The mallards were captured in the city park in the small town of Ełk in north-eastern Poland (53.8176 N, 22.3516 E) with a population of about 61,782 inhabitants (GUS 2021) (Fig. 1). The study area is surrounded by several lakes while the Ełk River flows through its centre. This is the coldest region in northern Poland with the lowest average temperatures in January (–4.8ºC in the period 1966–1995, Stopa-Boryczka & Boryczka 2006).

2.2. Field study

In total, 160 mallards were caught in the study area between 2005 and 2016. Individuals were baited with pieces of bread that led them to enter into loop-traps made of fishing monofilament line (diameter 0.35 or 0.40 mm) placed on the ground, which were then pulled and tightened

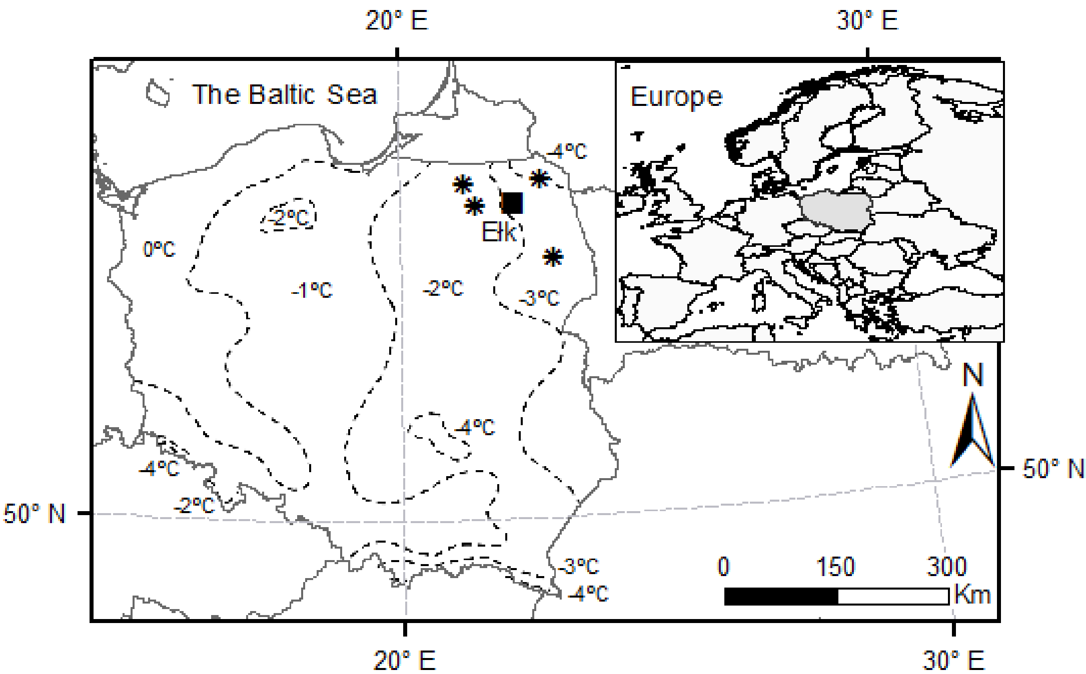

Fig. 1. Data were collected in the city of Ełk. January isotherms (Lorenc 2005) are shown as broken lines. The nearest meteorological stations are marked with asterisks.

on the bird's leg for successful capture (Meissner & Fischer 2017). Birds were aged and sexed according to plumage characteristics (Bauer & Glutz von Blotzheim 1968, Boyd *et al.* 1977) and four sex-age groups were distinguished: juvenile female (N=55), juvenile male (N=44), adult female (N=29) and adult male (N=32). We defined juveniles as individuals in their first year of life, and adults as individuals in their second year of life or older. Captured birds were marked with metal leg rings of oval shape with unique number sequences visible from one side. Between 2005 and 2009 additional colour plastic rings with engraved unique codes were added on the other leg. In total 100 mallards were marked with metal ring only and 60 birds with an additional plastic leg ring (Table 1). The inscription on both ring types was big enough to be read easily from a distance. Metal and plastic leg rings of marked individuals were identified with binoculars and/or from a picture made with a digital camera by sixteen volunteers (see Acknowledgements). A special project for volunteers was organized by Waterbird Research Group KULING to encourage observers to collect resightings of ringed mallards. In October mallards have completed pre-breeding (prealternate) moult, while in March egg laying has not yet started (Cramp & Simmons 1983, Engel *et al.* 1988). Thus, for further analyses all resightings recorded between 1st October and 31st March were classified as belonging to the non-breeding season. Multiple resightings of a given bird on the same day were treated as one record.

Table 1. The number of ringed (metal and/or plastic rings) and resighted mallards from 2005–2017.

	Ringed		Resighted	
Season	Metal	Plastic	Metal	Plastic
2005/2006	34	1		
2006/2007	4	28	1	19
2007/2008	8	5	8	21
2008/2009	13	18	8	26
2009/2010	3	8		17
2010/2011			1	13
2011/2012			1	5
2012/2013			2	8
2013/2014	8		4	9
2014/2015	10		14	6
2015/2016	20		29	2
2016/2017			25	1
Total	100	60	93	127

2.3. Statistical analyses

To identify factors affecting the probability of resighting of a given individual in the next non-breeding season after ringing, we used a generalized linear model (GLM) with binomial distribution and logit link-function (McCullagh & Nelder 1989). The binominal dependent variable (0 = not resighted, 1 = resighted) in the GLM analysis was related to type of ring (metal or plastic; the engraved plastic leg rings are easier to read than metal leg rings; Rock 1999, Meissner & Bzoma 2011), sex (male or female), age when ringing occurred (juvenile or adult) and presence (1) or absence (0) during breeding season in the study area, the number of seasons between 2005/2006 and 2015/2016 when a given individual was seen (to check if the probabilities of resighting of individuals were the same in each season), winter harshness in the season when individuals were ringed, winter harshness in the next season after ringing and the number of days an individual was resighted in the next non-breeding season after ringing (N days resighted). The latter variable was included because more days spent in the field in particular non-breeding seasons may have increased the probabilities of resighting birds in those years. Winter harshness was defined using the Hellmann index (Ijnsen 1988), which is the sum of all negative mean daily temperatures between 1st October and 31st March. We used the mean of daily average temperatures from the four nearest meteorological stations (Fig. 1, Białystok, Kętrzyn, Mikołajki and Suwałki; online database https://tutiempo.net). We used odds ratio (OR) to quantify the strength of the association between factors in the models and the probability of resighting of a given individual in the next non-breeding season. We performed GLM analyses in packages 'MASS' (Venables & Ripley 2002) and 'aod'

(Lesnoff & Lancelot 2012) in R (R Development Core Team 2020).

To estimate probabilities of apparent survival (ϕ) corrected for the resighting probability (*p*) from live resighting data we used the Cormack-Jolly-Seber mark-recapture method (Cormack 1964, Jolly 1965, Seber 1965) using MARK 9.0 software (White & Burnham 1999). In the analyses we have only considered birds marked with metal leg rings, because only this type of ring was used in all seasons. We included sex-age groups (*g*) in our models of ϕ and *p* because both age and sex are known to have an impact on survival of mallards (Johnson *et al.* 1992, Smith & Reynolds 1992, Lake *et al.* 2006, Gunnarsson *et al.* 2012). A global model was defined to include as many parameters as possible (only two-way interactions were considered), but with accurately estimated parameters only. Bootstrap goodness-of-fit testing (GOF test) of 1000 simulations were done to examine the fit of the starting global model with the data. A variance inflation factor $\hat{c}$ was calculated as the observed deviance of the global model divided by the mean expected variance from the results of bootstrap simulations to quantify the amount of overdispersion, that is, the sampling variance exceeding the theoretical model-based variance (Burnham & Anderson 2002). Moderate amounts of overdispersion are common in analyses of mark-recapture data and values of $\hat{c}$ = 1 to 3 indicate that the global model is acceptable (Lebreton *et al.* 1992). Model fit was assessed with quasi-Akaike's Information Criterion (QAICc; Akaike 1973, Burnham & Anderson 2002). Model selection was based on the difference in QAICc values between models (ΔQAICc). By definition, the best fitted model had a ΔQAICc of zero, and other models were equally parsimonious if ΔQAICc, ≤ 2 (Burnham & Anderson 2002, Arnold 2010). Estimates of apparent survival and resighting were calculated using the model averaging procedure of Program MARK, where parameter estimates were weighted by the Akaike weight of the model from which they were derived. To investigate whether birds from different sex-age groups were resighted at a different frequency, we calculated an indicator of ring resightings (IRR) for each individual marked only with metal rings. This indicator was obtained by dividing a total number of resightings of a particular bird in each non-breeding season by the total number of volunteer visits in the field in the same non-breeding seasons, each of which represents the probability of resighting of a given individual. Kruskal-Wallis test was used to verify differences between IRR among the sex-age groups. These analyses were performed using Statistica 13.1 (Dell Inc. 2016).

3. Results

In total, 39 (39% of ringed) of the mallards ringed with metal ring only were resighted as compared to 34 (57%) for those birds ringed with additional plastic rings.

3.1. Factors affecting probability of resighting in the next non-breeding season

We found that the ring type significantly influenced the probabilities of resighting in the next non-breeding seasons (Wald Statistic=5.3, p=0.022; Table 2). Individuals with plastic rings were three times as likely to be resighted in the next season (OR=3.06; Table 2). As we anticipated, greater winter harshness during the non-breeding season following when birds were ringed negatively affected the probability of resighting of an individual in the next non-breeding season (Wald Statistic=5.8, p=0.016; Table 2). Resighting probability in the next non-breeding season was four times higher if the bird was observed to be present in the study area during the most recent breeding season (Wald Statistic=5.6, p=0.017; OR=4.01; Table 2). None of the other variables in the analyses was significantly related to resighting probability (Table 2).

3.2. Apparent survival

Neither sex nor age was found to affect probability of resighting of an individual in the next non-breeding season (Table 2). Likewise, neither sex nor age had a significant influence on IRR among individuals marked with metal rings (Kruskal-Wallis test, $H_{3,47}$=0.43, p=0.94). Hence, we assumed that the probability of resighting

Table 2. Effects of selected factors on the probability of resighting of a given individual in the next non-breeding season after ringing according to the GLM model. For descriptions of variables, see method section.

Explanatory variable	Coefficient estimate	SE	Z	P	Odds Ratio (OR)
Intercept	0.276	1.03	0.27	0.789	1.32 (0.18–10.21)
Type of ring	1.118	0.49	2.29	0.022	3.06 (1.20–8.20)
Age	0.190	0.39	0.49	0.624	1.21 (0.56–2.59)
Sex	0.215	0.37	0.58	0.565	1.24 (0.59–2.59)
Number of seasons a bird was resighted	0.132	0.09	1.41	0.160	1.14 (0.95–1.28)
Winter harshness during first season	–0.028	0.01	–2.41	0.016	0.97 (0.95–0.99)
Winter harshness during subsequent season	–0.016	0.01	–1.39	0.163	0.98 (0.96–1.01)
Number of resighting days	0.0003	0.01	0.03	0.973	1.00 (0.98–1.02)
Presence during breeding season	1.390	0.59	2.38	0.018	4.01 (1.35–13.91)

of a given individual from all sex-age groups was similar. The structure of the global model ϕ (.) p (t) seems accurate based on the GOF test (GOF test <0.01, $\hat{c}$=1.79 ± 0.11). The overall best model for survival is the one with no effects φ (.) for this parameter (Table 3, model no 1). However, the model ϕ (g) p (t), *i.e.*, with a group effect for survival probability, was equally parsimonious (ΔAICc=0.26). The second model for survival included sex-aged groups. The survival estimates were lower for females than males (young females: 0.54 ± 0.08 and adult females: 0.59 ± 0.11; young males: 0.76 ± 0.05 and adult males: 0.72 ± 0.08).

Resighting probabilities were time-dependent (Table 3) and estimates fluctuated during the study (Fig. 2). Resighting probabilities showed a bimodal pattern with the maximal estimates 0.48 in 2007/2008 and 0.98 in 2013/2014, 0.98 in 2014/2015, 1.00 in 2015/2016. The minimum resighting estimate was <0.001 in 2008/2009 (Fig. 2).

Table 3. Cormack-Jolly-Seber candidate models with apparent survival (ϕ) and resighting probability (p) for mallards ringed in Ełk between 2005 and 2016 (N=100). No. 1 = the null model, where (.) is mean constant, (t) is time dependent, and (g) is age and sex groups. ΔAICc = difference between AICc of the current model and the minimum AICc value; w_i = normalized Akaike weight; K = number of parameters.

No.	Model	ΔAICc	w_i	K
1.	ϕ (.) $p(t)$	0.00	0.53	13
2.	ϕ (g) $p(t)$	0.26	0.47	16
3.	ϕ (t) $p(t)$	21.80	<0.01	23
4.	ϕ (.) p(.)	59.59	<0.01	2

4. Discussion

Our results of apparent survival rates are in line with what has been reported from mallards in USA (*e.g.*, Nichols *et al.* 1987, Giudice 2003), Sweden (Gunnarsson *et al.* 2012, Söderquist *et al.* 2021) and Finland (Gunnarsson *et al.* 2008). Similar survival rates to our results were also obtained in Sweden based on farmed mallards, which were ringed before release to wild (0.64 in females and 0.71 in males; Söderquist *et al.* 2021). Other study results based on survival rates of mallards came from two private farms which breed in captivity and released into the wild in the USA showed lower survival rates than ours (0.27, 0.47 and 0.55 for females, and 0.29 and 0.35 for males; Soutiere 1989). It is important to keep in mind that these studies, unlike ours, were based on data of birds shot or "found dead" which are harder to get than resighting data, or on pulli and juveniles which both have lower survival than older

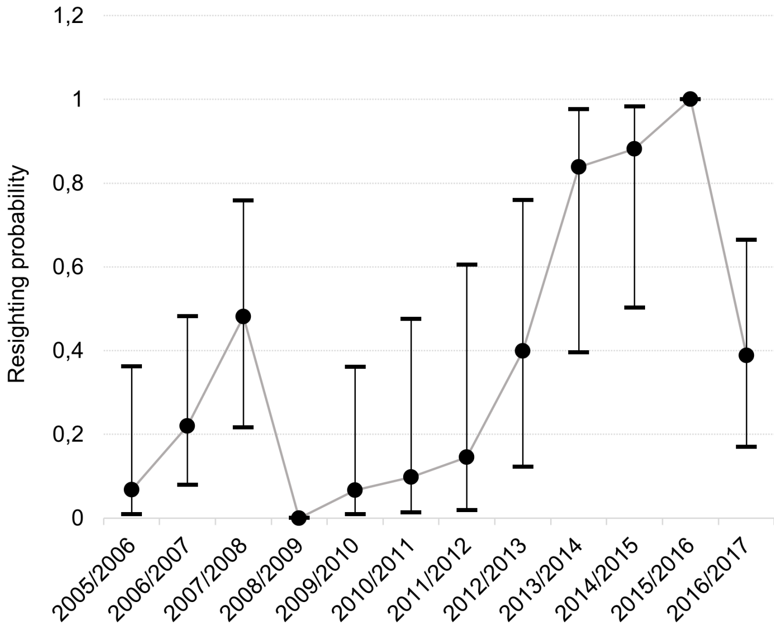

Fig. 2. Resighting probabilities (estimates ± SE) of mallards in non-breeding seasons from 2005/2006 to 2016/2017.

birds (*e.g.*, Soutiere 1989). Moreover, hunting effort and predator pressure negatively affects annual survival rates of rural mallards (Figley & VanDruff 1982, Smith & Reynolds 1992, Luniak 2004, Gunnarsson *et al.* 2008, 2012, McDougall & Amundson 2017) whereas there is no hunting pressure in cities. Many raptor species are poorly pre-adapted to survive in the urban landscape and avoid cities (Luniak 2004), but domestic cat and dog predation are important anthropogenic causes of bird mortality (Erickson *et al.* 2005). However, animal control law enforcement efforts tend to be more strictly enforced for dogs than for cats (Dauphine & Cooper 2009) and free-ranging dog populations are normally effectively controlled, while cats are a major threat to birds (Erickson *et al.* 2005, Loss *et al.* 2013).

Our data showed only differences between sex groups in estimates of survival rates, however, sex and age were not observed to affect probability of resighting of an individual in the next non-breeding season. Similar results were reported for mallards (Gunnarsson *et al.* 2008, 2012, Söderquist *et al.* 2021), as well as for other dabbling ducks (Nicolai *et al.* 2005, Varner *et al.* 2014). Males of dabbling ducks do not assist with egg incubation or brood rearing (Afton & Paulus 1992), thus their energy effort and predation risk are lower than for females (Sargeant *et al.* 1984). Hence, duck females experience greater mortality during breeding than males, as they are more vulnerable to predation during nesting and chick care (Devries *et al.* 2003, Brasher *et al.* 2006). This means that the survival of females to the next winter is lower than for males.

The age effect on survival was not found to be significant in our study. Additionally, we found that neither sex nor age had a significant influence on the IRR value among individuals. Hence, volunteers identified the ring number of each individual regardless of the sex and age of mallards. Other studies on recovery rates of dabbling ducks, including mallards, have reported higher values for juvenile than for adults (*e.g.*, Giudice 2003, Gunnarsson *et al.* 2008, McDougall & Amundson 2017). Older birds are more experienced in avoiding threats, *e.g.*, predation (Gunnarsson *et al.* 2012) and hunting (Fox *et al.* 2015). Likewise, in a Swedish study on mallards, there were no clear effects on annual survival related to duck age (Gunnarsson *et al.* 2012). Juvenile mallards have the same structural body size as adults but have a lower body mass and have smaller nutrient reserves in their first winter (Reinecke *et al.* 1982, Olsen & Cox 2003), which may negatively affect their survival (Davis *et al.* 2011). However, discrepancies between our results and other studies are possibly due to site-specific impacts or sample size. Our research took place in an urban area which provides a refuge for mallards characterized by an abundance of anthropogenic food resources (Luniak 2004), which in part my explain similar resighting probabilities in our study. Artificial food such as bread is easily digestible and provides a readily available food source (Sears 1989, Polańska & Meissner 2008) and a regular food supply may lead to similar nutrient reserves in juveniles and adults. However, the increased amount of food available for wintering mallards did not eliminate the negative impact of the harshness of winter on probability of resighting in the next non-breeding season. Harsh weather can negatively affect individuals' body condition, which influences overwinter survival of mallards (Bergan & Smith 1993), and other duck species (Conroy *et al.* 1989, Haramis *et al.* 1986). Furthermore, winter temperatures may contribute indirectly to survival of mallards in the subsequent season because waterbirds shorten their migration distance or become sedentary in mild winters (Gunnarsson *et al.* 2012, Jordan *et al.* 2019), thus allowing allocating more resources to body condition instead of spending energy on migration (Bergan & Smith 1993).

Survival estimates of mallard were not time-dependent in our study, *i.e.*, they do not depend on particular non-breeding seasons. Similar results were shown in studies of mallards ringed in USA, Finland, and Sweden (Bergan & Smith 1993, Gunnarsson *et al.* 2008, 2012). Studies that have shown time-dependence on bird survival may be reflected by a long-term climate change (*e.g.*, Barbraud & Weimerskirch 2001, Jenouvrier *et al.* 2005), as these studies were based on data from many decades, in contrast to our study that lasted only 12 years. However, we have shown that resighting probability was time dependent. That resighting estimates were higher in some years compared to others are most likely related to volunteers' activity that increased in some seasons due to organized official competition among observers with special awards. The extremely low probability of resighting in 2008/2009 may have been caused by limited activity of volunteers in the study area.

As expected, we found that the probability of resighting individuals in the next non-breeding season was higher if the bird was resighted in the study area during the local breeding period. Mallards breeding in urbanized areas are often sedentary (Håland *et al.* 1980, Heusmann 1981, Zárybnický & Klvaňa 2008). The sedentary mallards from local urban populations would have a better chance for survival because urban habitats have lower pressure from raptors, lack of hunting and higher winter temperatures (Luniak 2004, Varner *et al.* 2014). Annual survival of mottled ducks and survival probabilities of songbirds were also higher in urban than wild or rural settings (Hõrak & Lebreton 1998, Varner *et al.* 2014).

The type of ring influenced the probabilities of resighting in the next non-breeding seasons. This is as expected, because other studies have shown that colour plastic rings can be easily read in the field and adding them to the normal metal leg ring greatly increases the resighting rates (Rock 1999, Meissner & Bzoma 2011).

Our study revealed that estimates of apparent survival of mallards between non-breeding seasons in a small town in the coldest region in north-eastern Poland were similar to what has previously been reported from Europe and other countries of the world, and that the estimates were independent of sex and age of individuals. The probability of resighting individuals in the next non-breeding season was higher if the bird was resighted in the study area during the preceding breeding period. That sedentary mallards from local urban populations have a relatively high resighting probabilities may be promoted by low predation, lack of hunting and higher winter temperatures as compared to rural birds. In addition, as we anticipated, greater winter harshness during the non-breeding season following when birds were ringed negatively affected the probability of resighting of an individual in the next non-breeding season. Considering the fact that the type of ring (metal or plastic coloured) significantly influenced the probabilities of resighting of individuals, it is recommended that apparent survival studies on birds should be conducted using colour rings. Moreover, we encourage to further capture-mark-recapture data collections to enable accurate estimations of duck survival, which not the least is a prerequisite for successful management and conservation efforts.

Faktorer som påverkar överlevnad och återfångst hos övervintrande gräsänder (*Anas platyrhynchos*) – en case studie i en liten stad i nordöstra Polen

Vuxna individers överlevnad är en av de centralaste demografiska parametrarna i studier av fåglars populationsdynamik. I stadsmiljöer, såsom parker, övervintrar ett stort antal fåglar eftersom de har tillgång till olika födoresurser på grund av människans aktiviteter. I vår studie analyserar vi överlevnaden hos ringmärkta gräsänder *Anas platyrhynchos* baserat på individobservationer utanför häckningsperioden i en liten stad i nordöstra Polen mellan 2005 och 2017. Våra resultat visar att överlevnaden hos honor (juveniler: 0.54; vuxna: 0.59) är lägre än hos hanar (juveniler: 0.76; vuxna: 0.72) och att sannolikheten för återfynd av en individ är högre om den observerats under den föregående häckningsperioden. Vår slutsats är att platstrogna gräsänder i urbana populationer har relativt hög överlevnad, vilket kan bero på lägre predationstryck från rovfåglar, frånvaro av jakt och högre vintertemperaturer. Vi fann även att vinterns temperatur negativt påverkade sannolikheten för återfynd. Under studien varierade sannolikheten för återfynd mellan åren med två toppar, först med värdet 0.48 under perioden 2007/2008 och sedan med värden 0.98-1.00 under perioden från 2013/2014 till 2015/2016. Denna årliga variation i sannolikheten för återfynd påverkades troligtvis av högre insats i form av officiella tävlingar i observering av änder under toppåren. Eftersom vi fann att typen av ring som användes (metall eller plast) påverkade sannolikheten för återfynd rekommenderar vi att framtida motsvarande studier använder sig av färgringar. Vi uppmuntrar att samla in mera märknings-återfångst data för att möjliggöra trovärdiga uppskattningar av änders överlevnad, vilket är en nödvändighet för framgång inom naturskydd och hållbar förvaltning.

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