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POPULATION OF COMMON SWIFT IN POZNAN (POLAND) AND ECOSYSTEM SERVICES PROVIDED BY IT

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POPULACJA JERZYKA ZWYCZAJNEGO W POZNANIU I ŚWIADCZONE PRZEZ NIĄ USŁUGI EKOSYSTEMÓW

STRESZCZENIE: Celem badań było określenie skali zmian populacji jerzyka zwyczajnego (*Apus Apus*) zasiedlającej bloki mieszkaniowe w Poznaniu oraz ustalenie zmian w zakresie świadczonych przez nie usług ekosystemów. W artykule wskazano, że termomodernizacja budynków często prowadzi do likwidacji siedlisk, a tym samym do zmniejszenia populacji ptaków je zamieszkujących. Wykazano, że w Poznaniu pozostało tylko 15% bloków mieszkalnych nie poddanych termomodernizacji. Tylko 4% z budynków po renowacji posiada zainstalowane skrzynki lęgowe dla ptaków. Szacuje się, że utracono ok. 86% populacji jerzyka na Osiedlu Młodych – największej spółdzielni mieszkaniowej w Poznaniu. Utracono również usługi ekosystemów w postaci zjadania przez ptaki blisko 2,5 tony lub 25 tys. latających insektów na sezon z obszaru Poznania i okolic.

SŁOWA KLUCZOWE: jerzyk zwyczajny, *apus apus*, usługi ekosystemów, usługi regulacyjne, ptaki na budynkach

Introduction

A common swift (*Apus apus*¹) is one of most common birds in big Polish cities², currently swifts in Poznan mainly nesting on residential blocks. An intensive process of thermo-modernization of residential blocks is carried out in Poland since nineties. This modernization is often made incorrectly and is causing the loss of habitats of birds breeding on buildings, which in turns causes a reduction of their population in cities. Meanwhile, the birds provide ecosystem services to residents of cities among which one of the most important is the regulation of insect populations.

The first aim of this study was to determine the scale of population change of common swift colonizing residential blocks made in the concrete panels technology in Poznan. The second aim was to quantify ecosystem services provided by birds which exist nowadays and potentially if their habitats would still exist.

Regulating services provided by birds in Polish cities were studied by Kamiński³, Luniak⁴, Zimny⁵ but mainly as part of urban ecology or zoology studies. Abroad researches include also studies in small cities⁶ and agricultural areas⁷. None of these studies were dedicated to common swift. Additionally many researchers on ecosystem services provided by birds use only descriptive methods⁸. As Wenny et al.⁹ states there is the need to quantify

¹ Species authority: C. Linnaeus, *Systema naturæ per regna tria naturæ, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis*, Holmiæ 1758.

² W. Nowicki, *Ptaki Śródmieścia Warszawy*, Warsaw 2001.

³ P. Kamiński, *Bioenergetische Untersuchungen zur Jugendentwicklung der Dohle Corvus monedula*, "Journal of Ornithology" 1986 no. 127, p. 315–329.

⁴ M. Luniak, *Awifauna miasta – jej skład, zróżnicowanie oraz udział w procesach ekologicznych*, in: H. Zimny (ed.), *Funkcjonowanie układów ekologicznych w warunkach zurbanizowanych*, Warszawa 1990.

⁵ H. Zimny, *Ekologia miast*, Warszawa 2005.

⁶ P. Mikula, M. Hromada, P. Tryjanowski, *Bats and Swifts as food of the European Kestrel (Falco tinnunculus) in a small town in Slovakia*, "Ornis Fennica" 2013 no. 90, p. 178–185.

⁷ M.R. Abdar, *Seasonal Diversity of Birds and Ecosystem Services in Agricultural Area of Western Ghats, Maharashtra State, India*, "Journal Of Environmental Science, Toxicology And Food Technology" 2014 no. 8(1), p. 100–105.

⁸ CCI and BirdLife International, *Measuring and monitoring ecosystem services at the site scale*, Cambridge 2011; J. Kronenberg et al., *The importance of White Stork Ciconia ciconia for society: an analysis from the perspective of ecosystem services*, "Chrońmy Przyrodę Ojczyzną" 2013 no. 69(3), p. 179–203; Z. Brzozowska, *Situation in Poland p 1 In: The 1st Common swift Seminars, Berlin 8th – 11th April 2010 Summaries of the presentations*, 2010; E. Smeets, R. Weterings, *Environmental indicators: Typology and overview*, Technical report No 25/1999, Copenhagen 1999.

⁹ D.G. Wenny et al., *The need to quantify ecosystem services provided by birds*, "The Auk" 2011 no. 128(1), p. 1–14; G. Kruszewicz, *Ptaki Polski*, Warszawa 2005, p. 352.

ecosystem services provided by birds, and this research is part of this trend. There is also a wide range of international literature about behavioural studies of common swift, including amount of consumed insects¹⁰. But none of studies mentioned above were quantitative research on regulating services provided by common swift population in a given area like presented in this paper.

About common swift and their habitat

A common swift (*Apus apus*) is a medium-sized bird, similar to a barn swallow or a house martin but it is larger. Swifts have very short legs which they use primarily for clinging to vertical walls and they never settle voluntarily on the ground. Except when nesting, swifts spend their lives in the air; they drink, feed, and often mate and sleep on the wing. Swifts are insectivores, they feed on flying insects while airborne such as aphids, flying ants, mosquitoes, hoverflies and small beetles, catching huge numbers of them every day. This birds could travel long distances in search for food (the longest recorded distance was 200 km), but when there are good weather conditions they usually do not depart far from the nesting sites. Swifts are one of the fastest-flying birds found in Europe¹¹.

Swifts build their nests of airborne material caught in flight, bonded with their saliva. They used to breed in holes of caves or hollows of trees, but nowadays they mostly use building's hollows. In panel buildings they occupy mainly ventilation holes in attics and crevices between panels. Swifts, contrary to pigeons, make little or no mess (deposition of feces etc.)¹².

The common swifts return to the breeding places in their old colony approximately the same time each year, around the 1st of May in Europe. They are faithful to its breeding place so the pairs may breed together for many years. At the end of July the young fly out and around the 1st of August the parents leave Europe for Africa¹³.

¹⁰ T.L.F. Martins, J. Wright, *Cost of reproduction and allocation of food between parent and young in the swift (*Apus apus*)*, "Behavioral Ecology" 1993 no. 4, p. 213–223; T.L.F. Martins, *Fledging in the common swift, *Apus apus*: weight-watching with a difference*, "Animal Behaviour" 1997 no. 54(1), p. 99–108; B. Sicurella et al., *Weather conditions, brood size and hatching order affect Common Swift *Apus apus* nestlings' survival and growth*, "Bird Study" 2015 no. 62, p. 64–77.

¹¹ D. Graszka-owski, *Ptaki. Profesjonalny przewodnik dla początkujących obserwatorów*, Warszawa 2005, p. 177.

¹² D. Zyskowski, D. Zielińska, *Przewodnik do inwentaryzacji oraz ochrony ptaków i nietoperzy związanych z budynkami*, Szczecin 2014.

¹³ W. Nowicki, op. cit.



Figure 1. Main places in panel buildings where swifts build nests: ventilation holes in attics (left) and crevices between panels (right)

Source: Jakub Kotnarowski (CPSD).

Decline in population

During the second half of the twentieth century when ideology of communism was dominating in Central and Eastern Europe construction of panel buildings took place on a mass scale. This process also reached Poznan. Since nineties these panel building has been undergoing modernization to be more energy efficient and to refresh their appearance. This process has led to removal of hollows used by birds for breeding. Research on 58 buildings in Warsaw¹⁴ showed that after thermo-modernization there is at least loss of 74% of such places on building.

A similar process has been taking place all over the Europe. Authors from different countries report that there is about 50% decline in common swift population across Europe (table 1).

There is lack of detailed data on population of swifts in Poland. But most of authors agree that there is decline in population of swifts living in cities since nineties¹⁵. Brzozowska¹⁶ estimated decline in Szczecin on 85%.

¹⁴ M. Luniak, *Ochrona ptaków a modernizacja budownictwa*, in: P. Indykiewicz, L. Jerzak, T. Barczak (ed.), *Fauna miast. Ochronić różnorodność biologiczną w miastach*, Bydgoszcz 2008, p. 90–95.

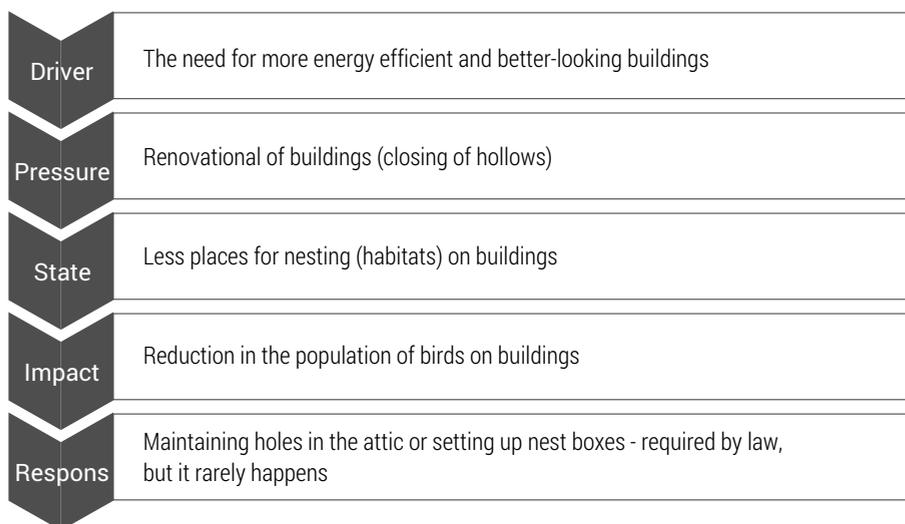
¹⁵ P. Kamiński, op. cit.; L. Tomiałojć, T. Stawarczyk, *Awifauna Polski, rozmieszczenie, liczebność i zmiany*, t. 2, Wrocław 2003; G. Kruszewicz, op. cit., p. 352.

¹⁶ Z. Brzozowska, op. cit.

Table 1. Decrease in population of common swift in the Europe

Country	Decrease in population
The United Kingdom	1995–2011 declines of 39% in England and 57% in Scotland
Slovakia	average of 50–60% in last 15 years (from 2012)
East Germany	57% since 1990

Source: K. Risely et al., *The Breeding Bird Survey 2012*, Thetford 2013; M. Cel'uch, et al., *Will the Common Swift survive in Slovakia?*, in: *Report and summaries of the presentations, and additional contributions, given to The Second Commonswift Seminars Berlin*, 10th–12th April 2012, p. 6; D. Zyskowski, D. Zielińska, *Przewodnik do inwentaryzacji oraz ochrony ptaków i nietoperzy związanych z budynkami*, Szczecin 2014.

**Figure 2.** Processes described with DPSIR methodology

This process could be described with DPSIR methodology¹⁷ (figure 2). The driver of thermo-modernization is the need of more energy efficient and better-looking buildings. This leads to renovation of buildings which causes a reduction of hollows on this buildings. As a resulting state there are less places for birds to breed. This state has an impact on birds population which is decreasing. The response to such loss should be maintaining the hollows or setting up nesting boxes, but in Poland, despite the law which obliges to make such compensation, this process occurs rarely. The main cause of this is, on one hand, costliness of such process and, on other hand, ineffectiveness of state offices to supervise implementation of law in this matter.

¹⁷ E. Smeets, R. Weterings, op, cit.

Ecosystem services provided by birds

Birds provide many ecosystem services for people and other organisms (table 2). Services like supporting and provisioning are not of great importance in cities. Also, nowadays most of provisioning services lose their importance like clothing, tools (e.g. quill pen) and others (e.g. stuffing beddings).

In cities the most important ones are regulating and cultural services. The most noticeable regulating service is pest control (rodents and insects). This service is usually acknowledged in ornithological literature as the most important and often is only one mentioned¹⁸.

As for cultural services provided by birds, they are often one of a few possibilities for people living in the cities to experience contact with nature. Most of birds except species like pigeons and aquatic birds are usually difficult to spot, but sounds of birds can be heard almost everywhere in cities.

Table 2. Ecosystem services provided by birds

Supporting	Ecosystem engineering (nests and tree holes)
	Pollination and seed dispersal
Provisioning	Cultivated and harvested food
	Natural medicines
	Clothing
	Tools
Regulating	Pest control (insects and rodents)
	Carcass removal
	Pollination and seed dispersal
Cultural	Nature-based recreation/ tourism
	Aesthetic benefits /inspiration /mental health
	Spiritual / religious experience

Source: based on D.G. Wenny, et al., *The need to quantify ecosystem services provided by birds*, "The Auk" 2011 no. 128(1), p. 1–14; J. Kronenberg et al., *The importance of White Stork *Ciconia ciconia* for society: an analysis from the perspective of ecosystem services*, "Chrońmy Przyrodę Ojczyzną" 2013 no. 69(3), p. 179–203; CCI and BirdLife International, *Measuring and monitoring ecosystem services at the site scale*, Cambridge 2011.

¹⁸ M. Cel'uch, J. Gúgh, J. Kalavský, K. Staples, *Will the Common Swift survive in Slovakia?, in: Report and summaries of the presentations, and additional contributions, given to The Second Commonswift Seminars Berlin, 10th–12th April 2012*, p. 6; L. Tomiałoć, T. Stawarczyk, op. cit.

Studies on residents of residential blocks in Rzeszów¹⁹ showed that despite these ecosystem services, only small group (12%) of people notice impact of birds on improving the welfare of themselves.

As for regulating services provided by swifts there could be found two data in literature about the amount of food gathered by pair of birds to feed nestlings during one day. The first is average weight – 50 g²⁰ and the other one is the number of flying insects – 20 000²¹. Flying insect if are not eaten by swifts could be nuisance for inhabitants of cities (e.g. by biting) and also negatively affect plants (e.g. by feeding on them).

Project and methodology

The project “Birds in the city” (Polish: *Ptaki w mieście*) was managed by Centre for Promotion of Sustainable Development (CPSD), which is a non-governmental organization based in Poznan (the author is a member of the board). The project was founded by a grant from Department of the Environment in Poznan Municipal Office.

The main aim of this project was to protect common swifts remained in Poznan on residential blocks by determining number of nesting sites and scales of ecosystem services.

The only comprehensive study about birds in Poznan²² is outdated and analyse common swift population only on smart part of city. To take a successful watchdog activity CPSD had to make a geolocalized database of buildings and determine if they are inhabited by birds.

The first part of this project took place in 2015. During this period volunteers checked residential blocks in Poznan if their elevation had been renewed and hollows had been closed. Data from this phase is freely available on the project webpage – www.mapaptakow.pl.

Next year the same team made ornithological observations in the biggest housing association in Poznan – Osiedle Młodych. The area of this housing association is 359 ha and there are 375 residential blocks placed there. They checked if remaining nonrenovated blocks and nesting boxes were colonized by birds.

¹⁹ J. Kostecka, *Edukacyjne znaczenie pojęcia świadczenie ekosystemów dla ochrony awifauny miast*, “Inżynieria Ekologiczna” 2010 no. 22.

²⁰ U. Tigges, *Common swift*, www.commonswift.org [10-08-2016].

²¹ P. Kamiński, op. cit.; M. Grzeniewski, M. Kowalski, *Ochrona ptaków gniazdujących w budynkach*, Siedlce 2010.

²² J. Ptaszyk, *Ptaki Poznania – stan jakościowy i ilościowy oraz jego zmiany w latach 1850–2000*, Poznan 2003.

Based on data from literature it was estimated how much of this birds usually were breeding on residential blocks in Poland before renovation. Bocheński et al.²³ estimated about 40 birds pairs per 10 ha in Koszalin (a city with the lowest result in study). Luniak²⁴ took another approach and estimated that there were average 4,12 birds pairs per building in Warsaw. This data was compared with a size of swift population on Osiedle Młodych.

The last part of the project was to quantify a pest control service provided by birds. To achieve this, literature data on how much of flying insects a swifts eats every day, was used. These amounts were multiplied by the number of observed pairs and the number of pairs estimated before renovation of buildings (the lowest one). It was assumed that feeding of nestlings lasts about 40 days.

Results

During the first part of the project (2015) 1324 residential blocks were surveyed in Poznan. Only 205 (15%) were not renovated. Nesting boxes were identified only on 47 blocks (4%), there were 530 boxes observed.

The second part of this project (2016) took place on Osiedle Młodych in Poznan. Volunteers observed 202 pairs of swifts.

Two studies about a number of birds nesting on residential blocks in Poland before renovation were found, there was lack of such data for Poznan. Using this data it was estimated that there should be from 1436 (based on per ha data) to 1545 pairs of swifts (based on per building data) on Osiedle Młodych. Taking the lowest quantity (1436) there is 86% decline in swift population.

The next step in this research was to estimate the quantity of ecosystem services provided by swifts on Osiedle Młodych. Currently occurring birds catch around 0,40 t and 4 040 000 of flying insect during one season, while estimated population should eat around 2,9 t or 28 720 000 of insects. This data is based on the number of birds so the difference is the same – we probably lose 86% of possible ecosystem services. This is around 2,5 t and 25 000 of flying insect which are not removed by swifts every season and could be nuisance for people of Poznan and surrounding areas.

²³ M. Bocheński et al., *Ochrona ptaków w mieście*, Gorzow Wielkopolski 2013.

²⁴ M. Luniak, *Bogactwo gatunkowe i liczebność fauny wielkiego miasta – przykład Warszawy*, in: P. Indykiewicz, L. Jerzak, T. Barczak (ed.) *Fauna miast. Ochronić różnorodność biologiczną w miastach*, Bydgoszcz, 2008, p. 17–26.

Discussion

This loss in population is a significant and similar to the one estimated by Brzozowska²⁵ in Szczecin. The difference between two methods of estimating how much birds were living on Osiedle Młodych was very low (7%), so it could be close to the actual number of birds living on this area before renovations took place.

In this study only breeding pairs of swifts were taken into consideration, real benefits could be much bigger because there are also many birds which do not breed (e.g. young swift which reaches sexual maturity after 3 years). In this case, the proportion of such birds in present population of swifts should be similar in the population that has been occurring. So estimated proportion of loss should be also valid in this case. There is need of research to estimate how many there are nonbreeding birds and how much they eat while they do not feed nestlings.

It is very likely that the similar decline in population and ecosystem services occurred on other residential blocks in Poznan. Also, the situation of other birds which use building to breed should be similar, especially for sparrows (*Passer domesticus*), jackdaws (*Corvus monedula*) and kestrels (*Falco tinnunculus*).

There are many positive examples of activities undertaken by local authorities in cities like Amsterdam, Aylesbury, Basel, West Sussex and Zurich which lead to maintaining their swifts populations²⁶. CPSD hopes that it will be also possible in Poznan thanks to using ecosystem services provided by these birds to promote their protection.

Ecosystem services provided by big colony of common swifts seems to significantly reducing population of flying insect. This service should be similar in other cities in the same climate zone as Poznan.

Conclusions

The substantial decline in population of swift occurred in Poznan and this is also a significant amount of lost benefits in reduction of bothersome insect population. The reason of this seems to be an unsupervised process of thermo-modernization which leads to not introducing compensation of lost habitats.

Till now CPSD was using ecosystem services without quantifiable values and it did not cause any change in actions of authorities and housing associations in Poznan. Now we have such data and we will be testing how this knowledge will affect their decisions.

²⁵ Z. Brzozowska, op. cit.

²⁶ E. Mayer, *Swift Facts*, www.swift-conservation.org [10-10-2016].

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