University of Sopron

Theses of doctoral (PhD) dissertation

Population dynamics and migration of nesting gulls (Laridae) in Hungary

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Sopron
2024

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1. Introduction

The aim of my research topic is to determine the nesting populations of the gull species breeding in Hungary: the Black-headed Gull (*Chroicocephalus ridibundus*), the Mediterranean Gull (*Ichthyaetus melanocephalus*), the Common Gull (*Larus canus*), the Yellow-legged Gull (*Larus michahellis)* and the Caspian Gull (*Larus cachinnans*) as accurately as possible, and to study the migration of these species based on bird ringing data, especially to process the results of coloured rings.

The basis of my motivation is that I have been engaged in bird ringing and migration research for three decades. My interest turned to colonial nesting waterfowl, especially gulls. Over the years, with many helpers, I ringed more than ten thousand gulls, primarily Black-headed Gull chicks. I also joined in the ringing of Caspian Gulls and Common Gulls, which occur as relatively new breeding species in Hungary.

In the Hungarian ornithological literature, it is possible to detect the changes of population conditions in the case of certain species almost from a historical perspective. Data series are available primarily on rare birds of prey, and large or otherwise significant bird species, such as the Great Egret (*Ardea alba*), the Great Bustard (*Otis tarda*), the White Stork (*Ciconia ciconia*), the Rook (*Corvus frugilegus*), the Imperial Eagle (*Aquila heliaca*) or the Saker Falcon *(Falco cherrug*).

The conditions of the Mediterranean Gull population were fairly documented between 1950 and 1995, but there is no standardized national database available for the following decades.

In Hungary, it is nearly impossible to find exact data on nesting pairs and population change of moderately common or moderately rare birds. In order to address this problem, BirdLife Hungary (MME) established the Hungarian Monitoring of Common Breeding Birds (MMM) program (BirdLife Hungary Monitoring Centre 1999–2011). Unfortunately, this did not work for the Black-headed Gull as the trend of its nesting population between 1999 and 2021 was uncertain.

The detailed or incomplete data series available for each species prompted me to attempt to study the population of the Black-headed

Gull – and the other nesting gull species – as thoroughly as possible over the long time frame.

Only two Hungarian publications from the mid-1990s analyse the migration data of Hungarian gull species. In the case of the Black-headed Gull, only one regional study, and in the case of the Mediterranean Gull, one national report was made more than two decades ago. The Hungarian Bird Migration Atlas completed in 2006 deals with all species ringed in Hungary, but the time that has elapsed since then and the limitations of the scope justify the studying of species migration from several aspects, with special regard to the possible effects of climate change.

1. Material and method

In my thesis I examined five species: the monotypic Black-headed Gull, the monotypic Mediterranean Gull, the polytypic Common Gull described with four subspecies, the polytypic Yellow-legged Gull with two subspecies and the monotypic Caspian Gull.

The data for taxonomy, occurrence and population change of these species were prepared from the most significant monographs and online sources.

Since the second half of the 1990s, the presentation of migration data of foreign countries has been made possible by studying the bird migration atlases of many European countries.

In order to reconstruct Hungarian populations in the past, I reviewed relevant domestic periodicals, manuals, books of regional descriptions, national park monographs and regional species lists.

Egg collections are also important assets to determine the historical occurrence of species, at least until the 1970s, as the processing of egg collections was completed in the 2010s. Nesting data originating from scientific literature was processed up to 2020. I used data released by the Ministry of Agriculture until 2021.

Although the early data of Hungarian bird ringing were destroyed in World War II, the processed data were regularly published in the periodical of the Hungarian Ornithological Institute (Aquila). For the

further processing of domestic ringing, I processed the basic data of the Bird Ringing Data Bank up to and including August 28, 2022.

The Bird Ringing Data Bank contains a total of 130518 data on gulls from the period processed, of which 65416 are from the years from 1992 to 2022. Out of all these, 14481 data (15.2%) can be attributed to my ringing activity, including observations, recoveries and retraps. In the case of the Black-headed Gull and the Mediterranean Gull, I have done nearly 50% and 30% of all domestic ringing in the past three decades, respectively, with the help of several birders.

More than 69% of the processed data relate to Black-headed Gulls. Out of more than 62000 ringed individuals over 13000 specimens were recaptured, observed and recovered. The Mediterranean Gull accounts for nearly 13% of the data, the number of ringed birds is nearly six thousand, while the number of recoveries, observations and dead recoveries is almost 27 thousand. Less than 1% of the data relates to the Caspian Gull, the number of ringed birds is less than 400 and the number of recoveries, observations and dead recoveries is slightly below 600.

To determine the migration from Hungary, I examined the recoveries of individuals ringed as chicks in Hungary in ten-year periods. In the case of the Black-headed Gull, the first period, 1908–1950, is longer in duration for the reasons mentioned above. Since colour-ring projects started in Hungary in the 1990s, for the last three periods I examined the data supplemented by colour-ring observations, in addition to the dead recoveries. The migration directions of each period were evaluated on the basis of averages, applying the non-parametric Kruskall–Wallis test, and with the pairwise Mann–Whitney test. The change in migration direction was investigated by regression analysis. Considering the distorting effects of the large differences in observation networks, only the birds found injured or dead recoveries reported as fresh carcasses were taken into account from each period during the data analysis, whereas carcasses several weeks old or the rings that were found were disregarded.

In case of the Black-headed Gull, the Mediterranean Gull and the Caspian Gull, I used the current migration direction of the individuals

ringed as chicks in Hungary, based on the recovery and observation data of roughly the last decade, the period between 2011 and 2022. The comparison was graphically visualised with a box plot, the pseudo-values were determined with the Kruskall–Wallis test and with the pairwise Mann–Whitney test. I illustrated the frequented locations of migration on a heat map.

3. Results – theses

1. Regarding the five species of gulls nesting in Hungary, significant changes in population dynamics occurred in the recent decades. The most common nesting gull species native to Hungary is the Black-headed Gull. Sporadic reports of its nesting originate from the initial period of Hungarian ornithological literature in the 19th century; samples from the species can also be found in early egg collections. The largest number of breeding pairs occurred in the mid-1980s, when its population was around 15000 pairs. Following trends in Western Europe, the current population has been affected by a very significant decline (75%), most likely as a result of the Common Agricultural Policy of the EU and climate change, both having a negative impact on the food base.

2. The Hungarian population of the Black-headed Gull winters in the central and western regions of the Mediterranean, starting migration very early (often leaving the breeding area as early as June), mainly in the southwest direction. In the last two decades, presumably due to climate change, wintering areas shifted towards the northwest, to the Atlantic coast. Comparing the migration directions of the different periods based on the averages, there was a significant difference (Kruskall–Wallis test $H(\chi 2)=29.58$; $p=0.0001$). Based on the results of the pairwise comparison (Mann–Whitney test), the first period (1908–1950) differed significantly from the average of the next five periods. Also, the last period (2011-2020) was also substantially different from all but the previous two (1991–2000 and 2001–2010).

If we supplement the data of the migration directions of the last three periods with the colour-ring observations, I get similar results (Kruskall–Wallis test $H(\chi 2)=116.7$; $p=0.0000$), except that the periods 1991–2000 and 2001–2010 were significantly different compared to all others. In both cases, a clear trend can be observed in the long-term change of migration direction, typically with a change of 4° over a decade.

The colony interchange in Black-headed Gulls ringed as chicks in Hungary can be detected mostly within the Carpathian Basin. The supposedly new settlers in the colonies originate from areas adjacent to the Carpathian Basin.

3. Hungarian Mediterranean Gulls migrate mostly along the continental flyways, following major European rivers. They first migrate along the Danube and then along the Rhine Valley to the Atlantic coast of France, where some of the birds overwinter and others continue to disperse throughout the winter along the Atlantic coast, from the British Isles to Morocco. In July, some of the birds are still migrating, while many of them reach the Atlantic coast, but do not start their dispersal. They disperse from November to December, mostly along the Atlantic coast, from Norway to Morocco. Many birds in their second calendar year spend the summer on the wintering grounds, a narrower region largely covering the Atlantic coast of France and the British Isles. The other route of the Hungarian birds leads into the western Mediterranean Basin through two flyways: one passing through the Po River Plain and the Camargue region in the northern part of the Adriatic, and the other one from the Great Lakes of Switzerland following the course of River Rhone through the Rhone Delta. There are also specimens overwintering inland and numerous individuals that change wintering sites. Hungarian marked adult birds mostly switched nesting sites to the west and northwest. Based on the data available within the Carpathian Basin, the change of nesting sites between major colonies is also present here. Regarding the breeding birds immigrating from abroad, a significant proportion of birds can be attributed to the Benelux countries (the Netherlands and Belgium). Similar to adults, young birds

appeared primarily in the colonies of Central France and the Benelux countries to start breeding there, but a significant number of birds chose Central European nesting sites. Some chicks returned to the core population of the species to the Black Sea.

The migration pattern of birds marked as chicks abroad is similar to that of breeding birds marked as adult abroad. A unique data and also the only evidence of immigration from eastern populations is the proven Hungarian breeding of an individual marked as a pullus in Greece.

Comparing the mean of the migration directions of each period, although the numerical values showed a slight difference, there was still a significant difference (Kruskall–Wallis test $H(\chi 2)=1077$; $p=0.0000$). Based on the results of the pairwise comparison (Mann–Whitney test), each period differed significantly from the average of the other two periods. In other words, the effect of climate change on migration can also be detected in this species.

4. The Common Gull first nested in Kiskunlacháza in 1988, followed by 2–4 nesting pairs in the coming years. The Yellow-legged Gull is a rare breeding species in Transdanubia. It first appeared in Sárszentmihály, later in Fertőújlak, where it nested few times, but it has breeding data from Pötréte as well. In the past few years it nested in Kis-Balaton and at Várpalota. The Caspian Gull first bred in Gátér in 1996 and has been breeding in the Hortobágy area since 1997. Its population in Hortobágy has been growing since 2003. Currently the national population is between 100 and 200 pairs. Hungarian marked birds are recovered in Central and Western Europe, both young and old individuals, and in winter they can also appear in the central Mediterranean Basin. We have birds from the central part of the Eastern European Plain for wintering, which certainly do not come from the hybrid zone.

5. To analyse the current migration pattern of the three most common domestic gull species, the Black-headed Gull, the Mediterranean Gull and the Caspian Gull, I analysed the recovery and observation data of

the last decade, between 2011 and 2022. There is a substantial difference between the mean direction of migration and the distance of all three species (Kruskall–Wallis test for direction: $H(\chi 2)=1554$ and distance $H(\chi 2)=2699$; $p=0.0000$; pairwise Mann–Whitney test: $p=0.0000$ in all cases). While the Black-headed Gull had the highest frequency of recovery data from Italy, the most recovery data came from France for the Mediterranean Gull and from Poland for the Caspian Gull. The heat map made on the basis of bypasses clearly distinguishes the frequented areas of migration: northern and southern Italy for the Black-headed Gull, the Atlantic coast of France for the Mediterranean Gull, the north-western part of the Carpathian Basin and the German-Polish Plain for the Caspian Gull.

4. Publications

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