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DISTRIBUTION OF THE BREEDING DUCK SPECIES (ANATINAE) IN HUNGARY AND POPULATION CHANGES ACCORDING TO THE AUGUST WATERFOWL MONITORING DATA

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1. Introduction

1.1 Background

The waterbirds – especially the members of the order *Anseriformes* – represent an important natural resource, that is used widely by human society from the beginning of time. Their high level of mobility and easy observability make them good indicator species of the quality of wetlands. In the past century, as in most countries in the world, there was a general decrease in the number of waterbirds in Hungary, driven by habitat loss due to water regulation, agricultural intensification and infrastructure development. As a local effect of global climate change there is a noticeable aridification in Hungary that is likely to worsen this negative trend in the future. Several international agreements, EU directives and strong economic concern force us to conserve our waterbird populations.

The monitoring and sustainable management of waterbirds can only be carried out via international cooperation. For almost 50 years, the Wetlands International has coordinated the mid-winter waterbird censuses in Europe. It is facilitated here by the Hungarian Ornithological and Nature Conservation Society. The Waterfowl Research Group of the University of West Hungary has been organizing the Hungarian Waterfowl Monitoring Program (HWM) since 1996. This program focuses on bird counts outside of the reproduction period. However, smaller efforts of breeding duck population assessments in Hungary have only been taking place locally.

The aim of the author was to collect nesting data on breeding duck species in Hungary. Gathering and synthesizing these data make it possible to delineate these populations on maps, to estimate their sizes and to detect trends on a country-wide basis. To support the assumed trends originated from these collected data, the author analyzed the August counts of the HWM for some duck species. The correlation test between the August duck numbers and different weather factors is aimed at providing additional information to the climate change issue, which is unquestionably one of the main environmental challenges for the time being.

1.2 Objectives

The main goals of the author can be summarized in the following points:

- To collect and organize the available nesting data of duck species in Hungary from the past 50 years.
- To draw geographical representation of duck nesting data on presence/absence maps.
- To make more accurate, better supported, fresh estimations for breeding populations of duck species in Hungary.
- To detect changes of breeding sites in time and space based on the presence/absence maps.
- To compare duck species based on the similarity of their breeding sites.
- To identify the most important duck breeding sites.
- To analyze the geographical distribution of duck nesting data in Hungary.
- To detect trends in the August number of ducks.
- To study correlation between the spring/summer weather and the August duck quantity.
- To present a reasonable suggestion for a breeding duck monitoring system in Hungary.

2 Materials and Methods

2.1 The species involved in the study

The dissertation discusses all the 13 duck species known to breed in Hungary at present. These are:

Common Shelduck (*Tadorna tadorna*);Gadwall (*Anas strepera*); Teal (*Anas crecca*); Mallard (*Anas platyrhynchos*); Pintail (*Anas acuta*); Garganey (*Anas querquedula*);Shoveler (*Anas clypeata*); Red-crested Pochard (*Netta rufina*); Common Pochard (*Aythya ferina*); Ferruginous Duck (*Aythya nyroca*); Tufted Duck (*Aythya fuligula*); Common Goldeneye (*Bucephala clangula*); Common Merganser(*Mergus merganser)*

The HWM August count data were analyzed for those species where the amount of information made it possible to use statistical means. These species were namely the following:

Gadwall (*Anas strepera*); Mallard (*Anas platyrhynchos*); Garganey (*Anas querquedula*); Shoveler (*Anas clypeata*); Red-crested Pochard (*Netta rufina*); Common Pochard (*Aythya ferina*); Ferruginous Duck (*Aythya nyroca*)

2.2 Origins of data

The nesting data were obtained from different sources:

- **Egg-collections**: the author used information based on duck egg collections of the Hungarian National History Museum (Budapest), Mátra Hills Museum (Gyöngyös), Munkácsy Museum (Békéscsaba), Móra Museum (Szeged), Janus Pannonius Museum (Pécs), Institute of Wildlife Management and Vertebrate Zoology (Sopron) and the private collection of László Povázsay.
- **Publications**: The author collected most available information on duck nesting that had been published in print or through the internet from the year 1960. She gave special attention to ornithological themed journals (such as *Aquila, Madártani Tájékoztató, Puszta, Túzok, Madártávlat, Bíbic, Parus Press, Anser, Partimadár, Füzike, Calandrella, Szélkiáltó, Vasi Madártani Tájékoztató*).
- **Ringing data:** The author valued bird ringing data of ducklings (marked as *pullus*) as proof of nearby nesting. The ringing data were obtained from the Bird Ringing Centre of the Hungarian Ornithological and Nature Conservation Society.
- **Observations**: Simultaneously with the archive data gathering, recent observations were carried out by skilled ornithologists and by the author herself.

For putting the estimated population changes into context, the author invokes the European trend calculations based on the relevant publications of the Birdlife International.

The August duck count data have been collected since 1997 on all the designated HWM program monitoring sites.

The weather data were collected by the National Weather Service at 70 local meteorological stations all over the country, containing information on daily minimum and maximum

temperatures as well as on the quantity of precipitation. Based on these data the author used the following derived parameters for the analysis:

- number of days during spring below 0°C (frosty days)
- the sum of positive differences between the century-long monthly average and the daily minimum temperatures of the same month measured at the station in Budapest during spring months („coolness" of spring)
- the sum of absolute values of negative differences between the century-long monthly average and the daily maximum temperatures of the same month measured at the station in Budapest during summer months („hotness" of summer)
- average sum of monthly rainfall based on the data of all meteorological stations, also the summations of these monthly data for the spring and summer periods

2.3 Means and methods for data analysis

The breeding presence/absence maps were shown on 10x10 km UTM (*Universal Transverse Mercator*) systems with the use of the ArcView GIS 3.2 software. These maps were then used to create the data-lacking „white spots" and diversity „hot spots" maps. The author used hierarchical cluster analysis based on the overlap of the different species' breeding sites and picked Jaccard- and Rogers-Tanimoto indexes to measure the similarity. For drawing the dendrogram she applied the SYNTAX 2000 software.

The author primarily analyzed the HWM August count duck data by using linear regression. In those cases, where the slope of the regression line significantly differed from zero, she also applied exponential regression to be able to calculate average percentage of growth rates. The trends in August duck numbers were looked at on a country-wide level as well as for the main regions.

To detect similarities in changes of populations the author calculated correlation coefficients between the different species for the whole country and by monitoring regions. She also looked for correlation between August census data and some weather parameters (such as number of frosty days, „coolness" of spring, „hotness" of summer, amount of rainfall during spring/summer). Using the Student's t-distribution she determined which factors showed correlations with the duck populations at a 90% level of significance.

3 Results

3.1 Results by species

1. As for the **Common Shelduck** (*Tadorna tadorna*) there has not yet been a similar distribution map published for the country, as it is a relatively new breeder in Hungary. The collected data suggest that the size of the breeding population is between 5-10 pairs, and the trend is increasing.
2. The breeding map of the **Gadwall** (*Anas strepera*), created by the author, shows a marked decrease in the extent of breeding sites in the Transdanubian and the southern part of the Great Plain. The author estimates the breeding pairs at 100-150 pairs. The trends look to be somewhat contrary, as there is a decrease in the Transdanubian, but increase from East of the Tisza river. The August census data are congruent with these findings, suggesting that the increase in the Hortobágy region outweighs the decreases and has caused an overall significant increase during the past 14 years, resulting in an average 18% annual growth. The August number of Gadwalls showed a significant positive correlation with the „hotness" of July.
3. The breeding map of **Common Teal** (*Anas crecca*) contains all the known Hungarian nesting data of the species, as it is a new breeder in the studied interval. This sporadically nesting duck has had only 0-5 breeding pairs recently and has not shown a noticeable change according to the author.
4. The **Mallard** (*Anas platyrhynchos*) is the most common breeding duck species in Hungary and is likely to reproduce at all wetland sites throughout the country. There had not been any noticeable changes in the area of its breeding sites. However, its August population has shown a significant decrease by 7 % annually for the studied time period.
5. The **Northern Pintail** (*Anas acuta*) has never been a common breeder in Hungary, but its nesting data appears to show the population is waning, and new observations are lacking at several traditional breeding sites.The author estimates that there are no more than 20-25 breeding pairs left in the country.
6. The published data on **Garganey** (*Anas querquedula*) gave estimations for local breeding pairs in several cases, all of which highlighted a decrease in the population during the past decades. The August population also seems to be decreasing; however

the trend is not significant for the whole country. On the other hand, there is a significant and strong decline for the Great Plain region.

7. The breeding map of the **Shoveler** (*Anas clypeata*) demonstrates an East-Hungarian dominancy. The population size contains only 150-200 nesting pairs based on the estimation of the author, and it is much lower than the earlier estimations, suggesting a decreasing trend.
8. The westward expansion of the **Red-crested Pochard** (*Netta rufina*) is nicely pictured on the presence/absence maps. The recent breeding population is estimated to be around 100-150 pairs. The increasing trend could not be detected in the August numbers, and but it showed a strong positive correlation with the mean temperature in April.
9. The breeding map of the **Common Pochard** (*Aythya ferina*) reflects the distribution of artificial fishponds in Hungary. Its population size is cc. 4000-5000 pairs. The author warns for a decreasing trend. However, the August numbers showed an increase with an average annual growth rate of 3,6%. This finding is possibly a result of increasing breeding population in the Great Plain region. The August population correlates positively with the amount of rainfall during the spring/summer months or for the whole half year period from March till August. Also, it neagatively correlates with the "coolness" of March and the "hotness" of August.
10. The breeding sites of the **Ferruginous Duck** (*Aythya nyroca*) strongly overlap with those of the Common Pochard, as can be easily proved by the hierarchical cluster analysis. In parallel with the nesting data, the August population also had an increasing trend, which is especially gratifying for this globally threatened species. The increase was calculated to be around 7,9% on average for the mentioned period. It did not show significant correlation with the weather conditions in question.
11. The breeding map of the **Tufted Duck** (*Aythya fuligula*) marks the sporadic nesting attempts. The population size is maximum 70-100 pairs.
12. **Common Goldeneye** (*Bucephala clangula*) has had only one proven nesting attempt. Since this successful reproduction event in 2002, there has not been any other similar observation published.
13. The nesting data of the **Common Merganser** (*Mergus merganser*) prove that this species has become a new breeder of the Hungarian avifauna. The geographical

illustration of these recent nesting data can be viewed as the first breeding map for its Hungarian distribution.

3.2 Summary of the new scientific findings (thesis)

- Previously such accurate breeding maps had not been published, which covered the whole country for the studied species. For new breeders, such as the Common Goosander or the Merganser, this work has been the first breeding site mapping in Hungary. It is important to emphasize that all the marked quadrates on the maps are connected to an observation of – either a certain or a probable – nesting attempt. The sources of the information on which the maps are based can be traced back using the tables under the maps.Based on the collected information, the author assumed that there has been an increase in the breeding population of the Common Goosander, the Red-crested Pochard and the Ferruginous Duck during the last decade. On the other hand, she drew attention to the possible decline of the Gadwall, Pintail, Garganey, Shoveler and Common Pochard populations.
- The author showed with the method of hierarchical clustering that our diving ducks favoring the deeper fishpond habitats can be separated from the dabbling duck species which prefer the shallow natron lakes just by comparing the presence/absence breeding site maps.
- By layering the maps over each other, the author found that she got duck nesting information for the past 50 years from 29% of the country's area. Besides the mountainous regions the white spots are more typical in the southern - southeastern part of Hungary. The author identified and presented on maps the duck breeding diversity „hot spots" of the country, where at least 5 different duck species were known to breed in the past 50 years. She found that 81 of these 10x10 km quadrates met this criterion.
- Between 1997-2010 the HWM August duck populations showed significant increase in three species (Gadwall, Common Pochard, Ferruginous Duck), but significant decrease for the Mallard. In case of three other analyzed species

(Garganey, Red-crested Pochard, Shoveler) no significant change could be found on whole-country scale. In cases of August duck populations with a significant trend, the author also fitted an exponential curve in order to calculate the magnitude of the change. The annual yearly change was 0,18 for Gadwall, -0,07 for Mallard, 0,036 for Common Pochard and 0,079 for Ferruginous Duck during the studied interval.

- In the August census data there were several, stronger positive correlations between species locally, while no negative correlation occurred. This finding emphasizes the importance of local effects on the censuses, and suggests that interspecific competition may not be a major factor in shaping the duck numbers in late summer.
- In some cases significant correlations were found between the August census data and the studied weather parameters (frosty days in spring, temperature in spring/summer, rainfall in spring/summer), but in general no obvious positive or negative connections could be proven.

4 Conclusions and suggestions

The author emphasizes the importance of a long-term, consistent system for obtaining data on breeding waterfowl populations. She reviewed the international scientific literature on waterbird monitoring schemes and looked through the monitoring protocols applied in different European countries. Based on these foreign experiences she suggests employing the „two-check method" (i.e. pair count + brood count) as in the Czech Republic as a minimal starting point for a future Hungarian breeding waterfowl monitoring program. This method collects information not only about the number of birds, but also about sex ratio, group sizes, duckling numbers per family and their approximate age. These data would let us make more reliable estimates for the number of breeding pairs and for the calculations of recruitment in the future. In practice, the Hungarian Waterfowl Monitoring program could provide an excellent basis for extending observations to the reproduction period, thanks to the well-selected monitoring sites and also the skilled observers involved.

Nowadays, the most suitable means for data input and analysis are the web-connected databases that can have built-in programs for calculating output data. Simultaneously with

this recent doctoral work, the Hungarian Ornithological and Nature Conservation Society together with the Slovakian Ornithological Society and the Slovakian Academy of Sciences have started to develop such an on-line database for waterbird observations in 2010. The author suggests that it would be practical to connect this new Waterbird Database with the Hungarian Waterfowl Information Database, which is an older, off-line database that serves the HWM program. The author highlights that more work is needed to control the quality of input data, to make communication more effective with the observers and to further popularize the program among both professional and amateur birders.

5 The author's publications

5.1 Scientific publications connected with this research

BARABÁS L. & DR. FARAGÓ S.: A Magyar Vízivad Monitoring augusztusi réceszámlálási adatainak elemzése. Magyar Vízivad Közlemények 21. 2011 (*in press*)

BARABÁS L.: Récék fészkelő-állományának becslése földi számlálással. Magyar Vízivad Közlemények. 16: 267-286, 2008

BARABÁS L.**:** Helyzetjelentés a hazai récefajok (*Anatinae*) fészkelőállományainak közelmúltbeli változásairól.(lecture) Magyar Biológiai Társaság, Állattani Szakosztály. 993. előadóülés, Budapest. 2011. jún 1.

BARABÁS L.: A magyarországi fészkelő réceállomány területi változásai. (poster) . In: LAKATOS F. & VARGA D. (eds.): Erdészeti Tudományos Konferencia, 2007. december 11., Sopron. A szekcióülések előadásainak és posztereinek kivonata. MTA Veszpérmi Bizottsága

KOVÁCS GY. &BARABÁS L. (poster) A lúdalakúak (Anseriformes) költőállomány-becslésének problematikája. In: LAKATOS F. & VARGA D. (eds.): Erdészeti Tudományos Konferencia, 2007. december 11., Sopron. A szekcióülések előadásainak és posztereinek kivonata. MTA Veszpérmi Bizottsága. 126.

BARABÁS L. & KOVÁCS GY. (poster) Mapping the breeding duck populations in Hungary. In: Sjöberg, K. & Rooke, T. (eds.): Book of Abstracts of the International Union of Game Biologists XXVIII Congress. Uppsala 2007. 250

KOVÁCS GY. &BARABÁS L.: Vízimadár fészkelőállomány-felmérés a gyakorlatban – módszertani kérdések. (lecture) Élet a Duna-ártéren – határtalan természet. Tudományos tanácskozás. Pörböly, 22. Sept. 2007

BARABÁS L. & TŐGYE J.: Vonuló récék állományváltozásai a biharugrai halastavakon 1993-2005 között (poster) 7. Magyar Ökológus Kongresszus, Budapest, 2006. szept. 4-6. http://ramet.elte.hu/~mok2006/

BARABÁS L. & FARAGÓ S.: Assessing the breeding duck population in Hungary (poster) 1st European Congress of Conservation Biology, Eger, Hungary Aug. 22-26, 2006, http://www.eccb2006.org

BARABÁS L., BARABÁS B., TŐGYE J. & FARAGÓ S.: Non-parametric trend analysis of migrating waterfowl (poster) XXVIIth Congress of the International Union of Game Biologists, Hannover, Germany. Aug. 28-Sept. 3, 2005.

5.2 Other scientific publications

MOSKÁT, C., HANSSON, B., BARABÁS, L., BÁRTOL, I. & KARCZA, Z.: Common cuckoo Cuculus canorus parasitism, antiparasite defense and gene flow in closely located populations of great reed warblers Acrocephalus arundinaceus J. Avian Biol. 39: 663_671, 2008

VÖRÖS J., SZALAY F. &BARABÁS L.: A new method for quantitative pattern analysis applied to two European Bombina species (Anura: Discoglossidae). Herpetological Journal. 17 (2): 97-103., 2007.

BARABÁS L., GILICZE B., TAKASU, F., MOSKÁT CS.: Survival and anti-parasite defense in a host metapopulation under heavy brood parasitism: a source-sink dynamic model. 2004. J Ethol. 22:143-151.

MOSKÁT C., BÁN M., BÁRTOL I., BARABÁS L.- Heavy cuckoo parasitism on the great reed warbler in Hungary: How can hosts survive? (lecture) International Ethological Conference, Budapest, Hungary, 20-27 Aug, 2005. http://www.behav.org/IEC

Barabás, L.: A költésparazitizmus dinamikus modellezése (lecture) "Modellezés a viselkedésökológiában" Szeminárium, Debrecen 2002. http://delfin.klte.hu/~vocs/kurzus02

MOSKÁT, C., SZENTPÉTERI, J. &BARABÁS, L.: Nádirigó válasza kísérletes költésparazitizmusra: magyar és görög populációk összehasonlítása (lecture). V. Hungarian Ecological Congress, Acta Biol. Debr. Oecol. Hung. 11/1, 2000.