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Detailed description of the Ócsa Bird Ringing Station, Hungary

Location, methods and overview of results (1984–2015)

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Abstract The present paper acts as an introduction to a series that will describe the exploratory analyses of migration phenology and morphometrics of the most common passerine species at the Ócsa Bird Ringing Station. This station is situated in the Ócsa Landscape Protection Area that belongs to the Duna–Ipoly National Park, Hungary. The area is somewhat cooler and more humid than the surrounding agricultural fields and tree plantations, covered by a mosaic of diverse hygrophilous vegetation patches. Bird trapping is mostly based on Japanese mist-net lines crossing different plant communities. During the period of 1984–2015, a total of 422,862 birds were trapped and ringed here, while 202,739 local, 1,235 within country, and 443 foreign recaptures were also recorded. Each bird is characterized by the following data: location and time of capture, species, age, sex, scores of fat, pectoral muscle, wing tip abrasion, and moult, length of wing, 3rd primary, and tail, and body mass. After subjected to a rigorous quality check, digital data are deposited in the archive of the Hungarian Bird Ringing Centre, and the EURING data base. From time to time, other research projects also utilized the accessibility of wild birds captured here, thus collection of blood samples, ecto- and endoparasites was carried out at the station. The relatively long time span, large number of species and individuals, and the readily available environmental (weather, vegetation, etc.) data makes the avian data collected here a suitable base for studies of various disciplines like capture methodology, habitat preferences,breeding, migration, and wintering, effects of weather and climate change, and epidemiology of viruses and parasites.

Keywords: bird banding, Carpathian Basin, long-term data set, standard methodology, migration phenology, morphology, habitat preference, parasite

Összefoglalás Jelen cikk egy olyan cikksorozat bevezető része, amelyben egy közép-magyarországi gyűrűzőállomáson – Ócsai Madárvártán – leggyakrabban előforduló énekesmadarak vonulás időzítésének és testméreteinek exploratív elemzéseit közöljük. A gyűrűző állomás a Duna–Ipoly Nemzeti Parkhoz tartozó Ócsai Tájvédelmi Körzetben található. A terület egy jégkorszaki maradványláp, mozaikos vegetációval. A madarak befogása a területre jellemző különböző növénytársulásokban, döntő többségben japán típusú függönyhálókkal történik. Az 1984–2015 között zajló munka során 422 862 madarat fogtunk, gyűrűztünk, 202 739 saját, 1235 hazai és 443 külföldi vonatkozású visszafogásunk volt. A befogott madarakról a következő adatokat vettük fel: a madarak befogási helye 12 méteres pontossággal, ideje 1 órás pontossággal, faja, kora, ivara, zsír-, izom-, vedlés- és kopás kódja, szárny-, 3. evező-, és farokhossza 1 mm-es pontossággal, testtömege 0,1 g pontossággal, teljes vedlést végző madárnál az evező- és faroktollaknál egyenként 0–5-ös skálán. Az adatok – ellenőrzés után – a Magyar Madárgyűrűzési Központba és az EURING adatbázisba kerülnek. A standard adatfelvételen túl – időközönként és bizonyos fajoknál – egyéb vizsgálatok is történnek, pl. ekto, és endoparazita gyűjtés, vérminta gyűjtés stb. A viszonylag hosszú időintervallum, a nagy fajszám és fajonkénti adatszám, a háttéradatok (időjárás,

vegetáció mintázat) miatt az adatok számos madártani vizsgálatnak lehetnek forrásai, és képezhetnek összehasonlítási alapot más területeken zajló kutatások eredményeivel. A feldolgozás, értelmezés a legkülönbözőbb szempontok alapján történik: fogás-módszertani vizsgálatok, élőhely-preferencia, költés és telelés, vonulás, időjárási hatások, klímaváltozás, parazitológiai és virológiai vizsgálatok stb.

Kulcsszavak: madárgyűrűzés, Kárpát-medence, hosszútávú adatsor, standard módszerek, madárvonulás, morfológia, élőhely-preferencia, parazita

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Introduction

Avian migration research in Hungary dates back to as early as 1908, when this country was the third in the world to adopt and implement a national ringing scheme (Karcza & Magyar 2009). Organized forms of ringing activities have been carried out continuously since then and today, Hungarian ornithologists are regional leaders in the annual total number of birds ringed. In the last decades, the majority of these birds are captured and marked at Actio Hungarica sites. These sites have common standardized methodologies in trapping and handling birds, adopted from and named after the Actio Baltica system (Busse & Kania 1970, Busse 1974), and the European-African songbird migration network (Bairlein 1994). Today a total of 8 Actio Hungarica sites operate throughout the country, of which our focal site, the Ócsa Bird Ringing Station (ocsabirdringing.org) has the largest number of cumulative captures. Initial work started here in 1983, when the site was evaluated and chosen for as the location of a ringing station, and the position of the mist net lines were determined. One of the most attractive features of the area – asides from the diverse habitat – is the simple logistics, as it is easily reached from Budapest via public transport or road. Initially, the working staff lived in tents and reed huts through several years. In 2001, a brick building was constructed, considerably improving working and living conditions (electricity, internet connection, drinking water supply, heating, working and sleeping rooms). The building also serves as accommodation for visitors and volunteers, thus attracting more help throughout the season. Today, the ringing station is one of the most visited site from professionals and laymen alike, and serves as an educational facility, provides service for companies and conducts avian population research.

Here we describe in detail the site; the methods applied and present comprehensive results of bird ringing at the station. Our aim is to help evaluate previously and future

Figure 1. Location of the Ócsa Bird Ringing Station (red square) on a continental scale. The Carpathian montain range is a potential geographical barrier for migrating birds

1. ábra Az Ócsai Madárvárta (piros négyzet) elhelyezkedése kontinentális skálán. A Kárpátok a vonuló madarak számára potenciális akadályt jelentenek

published studies using the data generated at the site and also to fundament a series of future publications that aim to give comprehensive exploratory and descriptive statistics (Harnos *et al.* 2015b, 2016a) on migration timing and morphology of the most commonly captured species here (e.g. Harnos *et al.* 2016c,b).

Location

The ringing station (N47.2970, E19.2104) is situated on the western periphery of the town of Ócsa, Hungary, ca. 33 km from Budapest. From an avian migrants' perspective the station is in a large, low altitude basin (Carpathian Basin) surrounded by mountain ranges that may act as geographical barriers *(Figure 1)*. Of these, presumably the most important are the Carpathians as they encompass the region from north-west to south-east.

On a smaller spatial scale the station is situated on the edge of a wetland in the Ócsa Landscape Protection Area of the Duna-Ipoly National Park *(Figure 2)*. The wetlands here are one of the very few remaining post-glacial peat bogs in the Carpathian Basin. Their conservation value was recognized as early as 1978, when the area was declared protected. Furthermore, the area represents the only natural type habitat in the larger

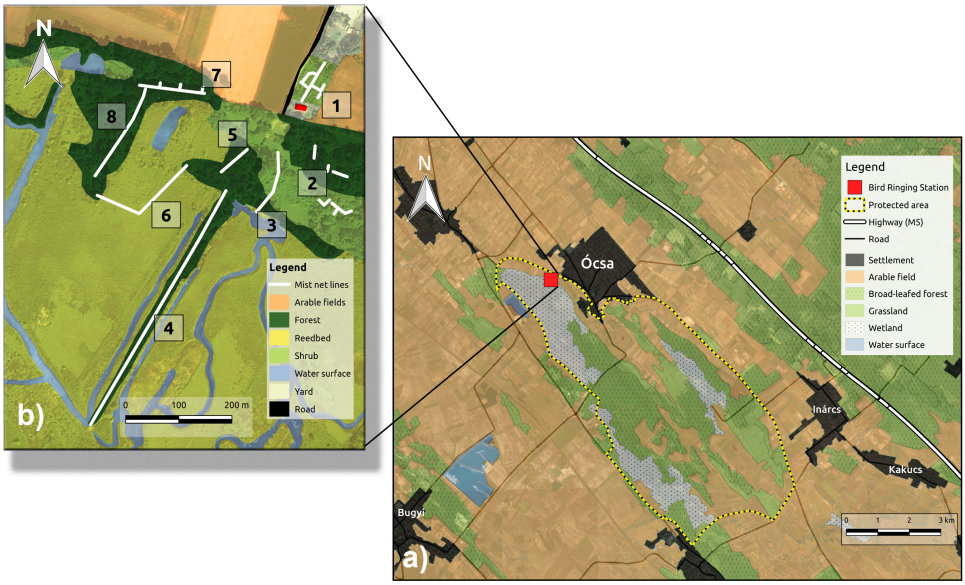

Figure 2. Location of the Ócsa Bird Ringing Station on landscape scale (a) and the habitat composition together with the position of standard mist net lines (b). The station is located on the edge of a protected wetland, that is the only natural type habitat patch in the vicinity. The area is otherwise an agricultural landscape interspersed with open-pit gravel mines and poplar plantations. The habitat surrounding the station is a mosaic of shrubs, forest type habitats and reedbeds. See text and *Table 1* for detailed description of habitats surrounding mist net lines

2. ábra Az Ócsai Madárvárta elhelyezkedése (a) és az élőhely összetétel a hálóállások (b) feltüntetésével. A madárvárta egy védett terület szélén van, amely az egyetlen ilyen vizes élőhely a környéken. Mezőgazdasági területek veszik körül, amelyeken belül több kavicsbánya és telepített nyárerdők vannak. A kutatási terület vegetációja mozaikos, jellemzően bokros, fás területek és nádasok alkotják

vicinity; practically it is surrounded by arable fields, poplar plantations with several interspersed open-pit gravel mines.

Climate

Ócsa is situated in a humid continental transitional climate zone. Summers are medium warm and dry here, with relatively cold winters. The annual average temperature is 10.1°C (minimum ca. -15.6 °C, maximum ca. 34.1 °C). The location is in the former glacial Danube riverbed, thus temperature values are somewhat lower than in the large scale surroundings. This is possibly one of the reasons why the glacial peat bog could survive after deglaciation. Annual precipitation is around 550–580 mm coming together with a ca. 2000 hours of sunshine. The direction of wind is often north-west, while the average wind speed is 2.5–3 m/s. The mean elevation is 100 m above sea level (Füri 2007).

Habitat

Prior to formal protection of the site, there was intensive peat extraction from the surrounding bogs (Füri 2007). Today, the spatial structure of the habitat generally follows the succession gradient from open water to closed broad-leaved forest. However, the areas affected by open-pit extraction went under a secondary succession and were recolonized by mainly reed *(Phragmites australis)* and swamp sawgrass *(Cladium mariscus)*, thus all open water surface disappeared. To reverse this process, new pits were dredged to create open water surfaces in late 2011. Simultaneously, a channel system was also created to maintain continuous water supply *(Figure 2 b)*. These works affected the vicinity of a few capture locations, however merely restored original habitat conditions. Habitats around the capture locations were further affected by secondary succession, typically increasing the height of fast growing shrubs and trees like poplars and willow species within the study period. This process had a major effect around only one mist net line (3.), where the initial dry standing heterogeneous reedbed was gradually replaced by European elderberry *(Sambucus nigra)*, partly covered by common hop *(Humulus lupulus)* and more recently also by European blackberry *(Rubus fruticosus)*.

Capture methods

Capture methods at the ringing station can be categorized to three groups; a) non-standard sporadically used methods, b) ringing at nest sites and c) standard methods. The first group of methods are predominantly used to capture raptors (cube nets, box-traps), and members of the Rallidae family (walk-in traps). The usage of these depends on season; raptor traps are only active in winter, while walk-in traps in autumn. Moreover, their usage also depends on environmental circumstances like snow cover and water level. Typically large and/or colonial breeders like White-tailed Eagles *(Haliaeetus albicilla)*, Grey Herons *(Ardea cinerea)*, Great Egrets *(Egretta alba)*, Night Herons *(Nycticorax nycticorax)*, Spoonbills *(Platalea leucorodia)*, Black Storks *(Ciconia nigra)*, Black-headed Gulls *(Larus ridibundus)*, Mediterranean Gulls *(Larus melanocephalus)* and Common Terns *(Sterna hirundo)* are ringed as nestlings within the framework of national colour ringing programs.

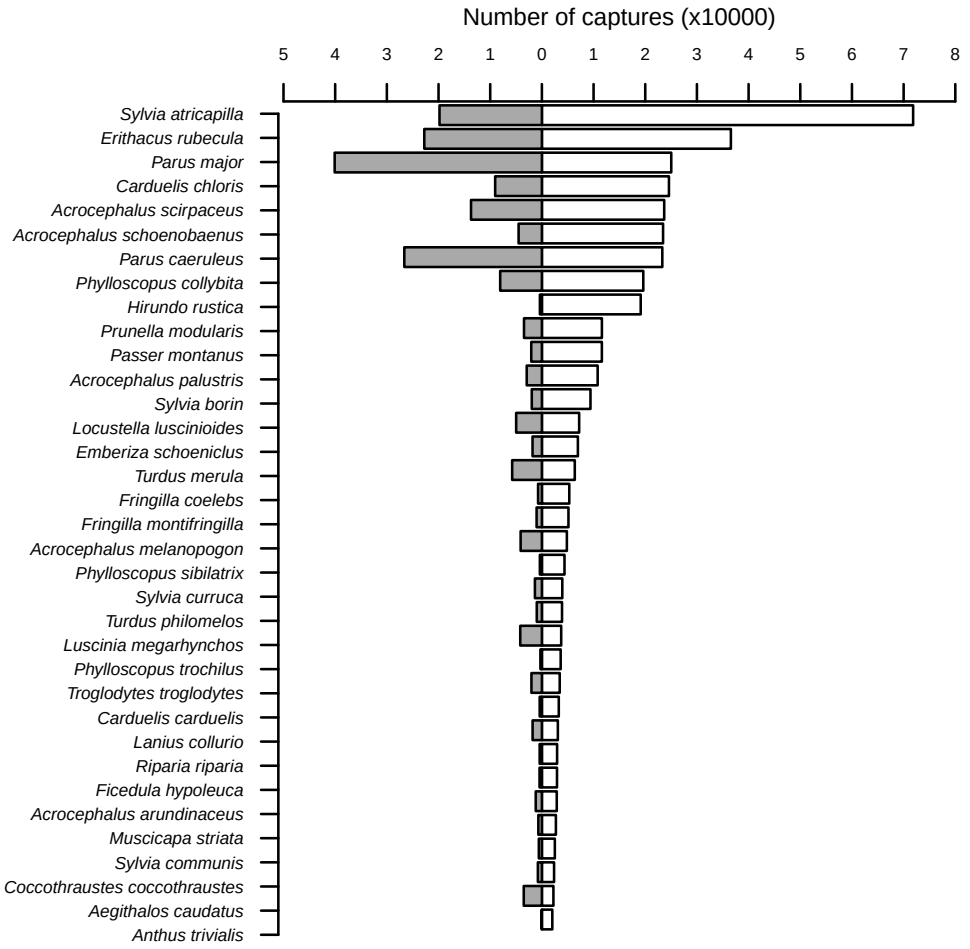

Figure 3. Capture (white bars) and recapture (grey bars) frequencies by species (1984–2015). Only the 35 most commonly ringed species are depicted

3. ábra A 35 leggyakoribb faj fogás (fehér) és visszafogás (szürke) gyakorisága 1984–2015 között

The majority of birds ringed at the station are passerines *(Figure 3)* captured with standard methodology that entails the usage of mist nets (dimensions: 12×2.5 m, mesh: 16×16 mm, shelves: 5). The locations of the mist net lines were initially chosen to sample the major habitat types in the vicinity of the station *(Figure 2, Table 1)*.

Table 1. Description of mist net lines
1. táblázat A hálóállások jellemzői

Mist net line ID	Habitat description	Number of nets
1	dry reedbed scattered with European elderberry and a few poplar bushes or trees	15
2	a patch of bush dominated by elderberry, poplar and willow species (*Salix* spp.)	12
3	dry reedbed with a few elderberry and walnut *(Juglans regia)*, partly covered by common hop and more recently also by European blackberry	10
4	a narrow line of poplar trees and willow bushes, surrounded by aquatic habitat mainly reedbed	40
5	a forested habitat patch covered by old poplar trees, more recently the blackberry is also spreading on the wet soil	5
6	shallow standing water covered by reed, with some willow bushes spreading	17
7	a line of Hungarian narrow-leaved ash (*Fraxinus angustifolia* ssp. *pannonica*) trees surrounded by open water, undergrowth is dominated by blackberry and elderberry.	13
8	a patch of willow and poplar bushes and trees surrounded by reedbed. Active since 2001 and only during the Constant Effort Sites Scheme (CES) period (see below for details)	15

All mist nets are opened at dawn, controlled every hour during the day, and closed at dusk. Under unfavourable weather conditions nets are controlled more frequently (ca. every half hour). In case of extreme heat, cold, or windy weather conditions all nets are closed. Tape-luring is used only in the vicinity of mist net line 1 *(Figure 2 a)* , which is relatively distant from all other mist nets *(Figure 2 b)*. Calls and songs of *Acrocephalus* warblers are played in August (Csörgő *et al.* 2008), while *Sylvia/Phylloscopus* Warbler and Tree Pipit calls are used through September.

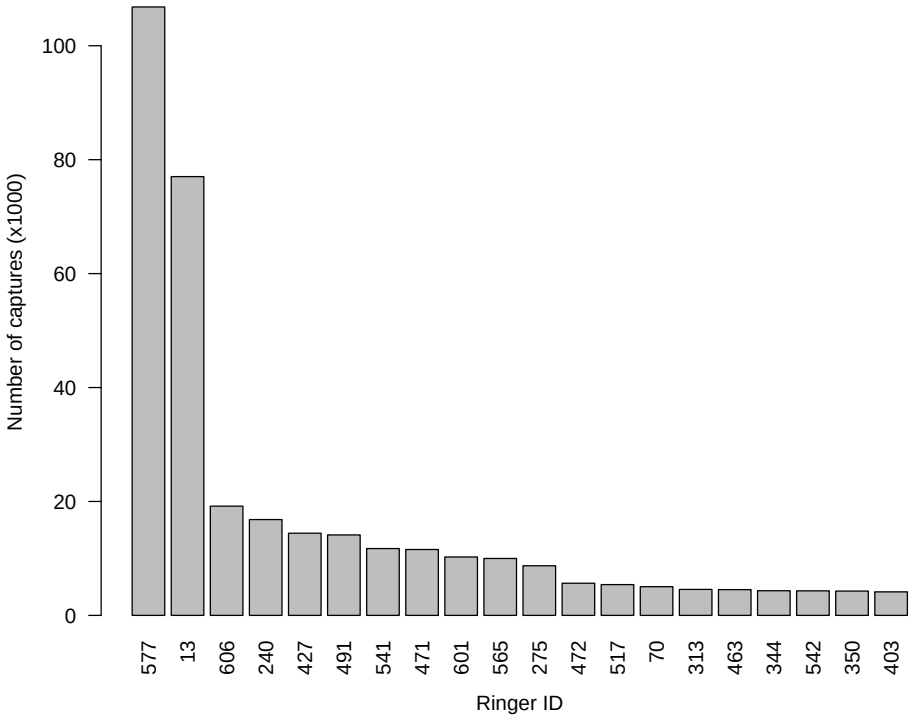

Figure 4. Number of birds handled by individual ringers in the 1984–2015 period. The majority of birds was ringed and measured by a handful of individuals

4. ábra Az egyes gyűrűzők által jelölt madarak száma 1984 és 2015 között. A gyűrűzés nagy részét kisszámú személy végezte

Ringing and measuring

A total of 110 ringers have worked at the station in the 1984–2015 period, however, 43% of birds were ringed by the first two persons and 80% by 20 ringers *(Figure 4)*. All ringers who worked at the Ringing Station have a ringing permit (that includes a license to catch wild birds) issued by the Hungarian governmental authorities. The standard rings of the Hungarian Bird Ringing Centre (MME/BirdLife Hungary) were deployed on all birds.

Biometric measurements are taken following standardized and published methods (Szentendrey *et al.* 1979, Svensson 1992, EURING 2015). The following data types are recorded:

- individual ring number;
- species;
- age category;
- sex (based on plumage cues, brood patch, cloacal protuberance, or – more recently – also molecular analyses of DNA samples);
- wing length (precision ± 0.5 mm);

- length of 3rd primary (precision ±0.5 mm);
- tail length (precision ±0.5 mm);
- fat score (0–8 scale) following Kaiser (1993);
- pectoral muscle score (0–3 scale);
- body mass (precision ±0.05 mm) measured using Pesola springs or a digital scale;
- wing tip abrasion (0–3);
- moult (moult of covers: 0–3 scale, moult primaries, secondaries and retrices, individually) following Ginn & Melville (1983) and Jenni & Winkler (1994);
- date (year, month, day (precision ±0.5 hour));
- capture location (each bird is placed into a bag marked differently corresponding to the mist net line and the number of net; precision ±6 m).

Data management

Ringing data is recorded into a field notebook simultaneously with ringing. Subsequently, days or even months later, these data are entered into a data base. Then digital data are subjected to rigorous quality check by means of statistical filtering: suspicious values are individually checked (Harnos *et al.* 2015b). Finally, quality-checked digital data are deposited in three parallel data bases: the archive of the Ócsa Bird Ringing Station, the archive of the Hungarian Bird Ringing Centre, and the EURING data base.

Capture effort and timing

The first mist-netting trials and preliminary bird ringing activities were carried out in 1983. Subsequently, all the year round bird ringing work started from 1984 to be continued up to the present. In 2001, a building was constructed to serve as accommodation and as a working station, and simultaneously permanent working staff has been employed. These factors enabled to increase capture effort throughout the year. Each year is divided into the following 4 time periods.

Spring migration period – Starting from mid-March, and lasts until the second decade of April. Continuous daily capture throughout the period with all standard net lines.

Breeding period – Starts as soon as the spring migration period is over, and lasts until the 9th of July. Each net line is opened once a week and the sampling follows Constant Effort Site (CES) protocols (Baillie 1986, Robinson *et al.* 2009).

Autumn migration period – Starts on the 10th of July and lasts until late October to mid-November, depending on weather. Continuous daily capture throughout the period with all standard nets.

Winter feeder period – Lasts until the first day of the spring camp. Weekly ringing near bird feeders, however the dates vary depending on weather. This is the only non-standard sampling period.

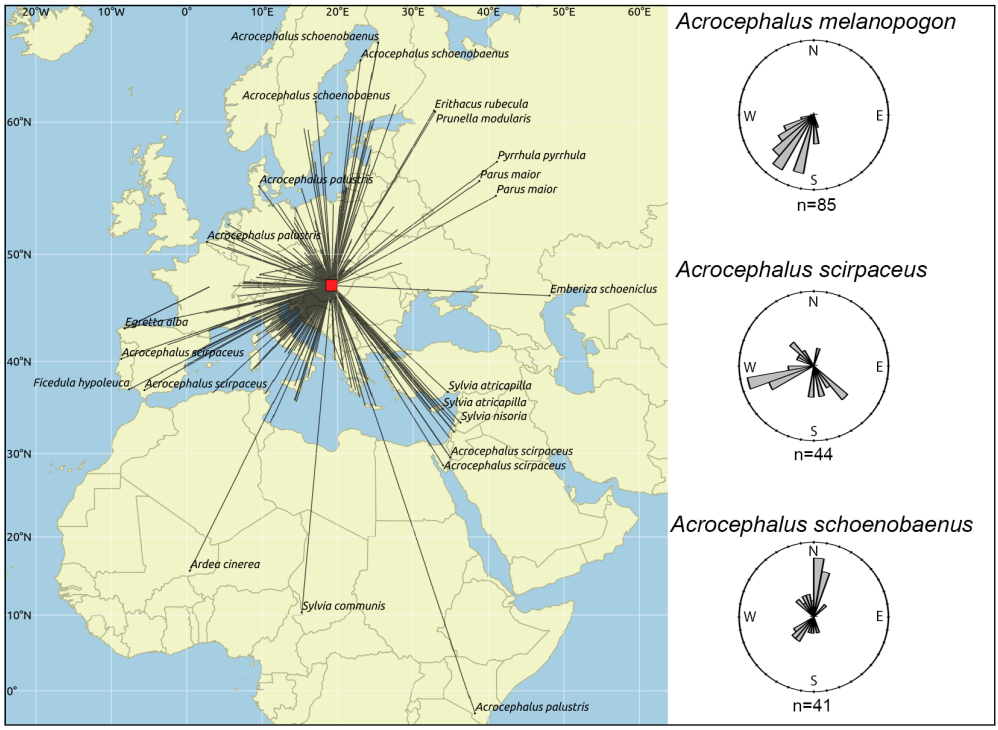

Figure 5. All foreign ring recoveries with ties to the Ócsa Bird Ringing station (i.e. recovered at the ringing station or ringed at the station and recovered elsewhere). The rose diagrams show the bearing distribution of foreign ring recoveries of three *Acrocephalus* warbler species with markedly different breeding and wintering distribution and/or migration strategies

5. ábra Az Ócsai Madárvártán jelölt és külföldön megkerült, illetve külföldön jelölt és itt megfogott madarak. A kördiagram 3 – eltérő költési és/vagy telelési területű, illetve vonulási stratégiájú – *Acrocephalus* faj egyedeinek jellemző mozgási irányait mutatja

Overview of results

The fact that every 10th bird ringed between 1984–2015 in Hungary was handled in the Ócsa Bird Ringing Station, illustrates the national importance of study site. Indeed, the 422,862 individuals of 169 species were ringed at the station together with the 202,739 local recaptures. All of the most abundant captured species are passerines *(Figure 3)*. Furthermore, a total of 1325 individuals were recovered over 5 km from the ringing station, of which 443 were foreign ring recoveries (i.e. recovered at the ringing station or ringed at the station and recovered elsewhere *(Figure 5)*. The spatial patterns of foreign recoveries reveal that there is a considerable hiatus of birds, regardless of species, arriving from the east. This is presumably the synergistic effect of the geographical barrier effect of the Eastern Carpathians, and the lower effort in ringing activities in eastern states compared to that in northern and western countries (http://euring.org/data-and-codes/ringing-totals).

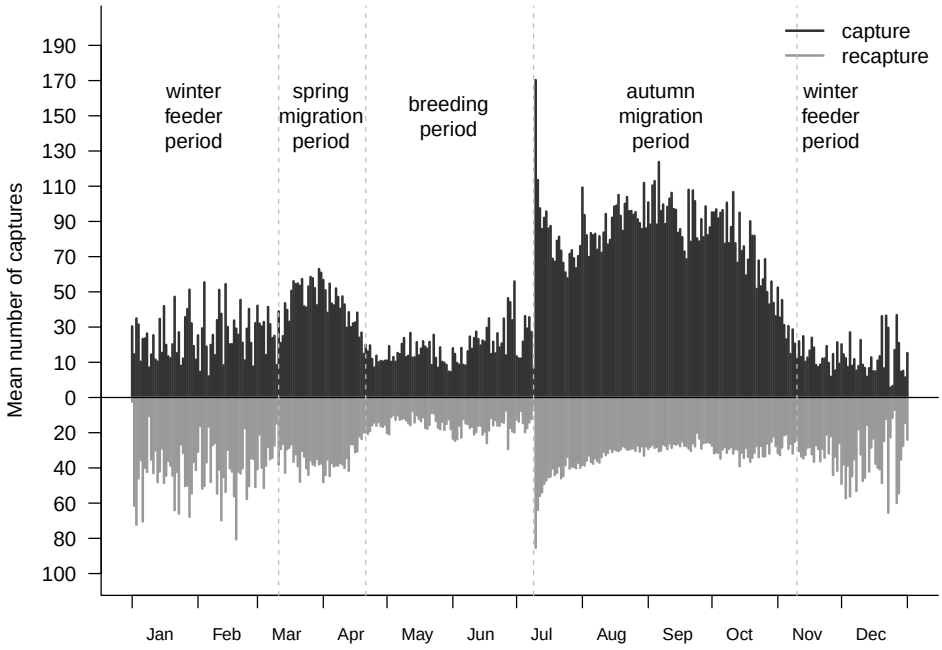

Figure 6. Mean number of total capture frequencies for each day of the year. All nets are open in spring and autumn, while standard sampling (CES protocol) is carried out in the breeding season. The difference in trapping effort causes the large abrupt increase in mean capture frequencies between at the beginning of the autumn migration period

6. ábra A napi fogás és visszafogás átlagos számai az év folyamán. A tavaszi és őszi vonulás során az összes háló ki van nyitva, a fészkelési időszak alatt a CES protokollnak megfelelően egy-egy állás csak 5–10 napon belül egyszer

The Carpathians also act as a line of demarcation to differentiate between migration strategies of trans-migrant and local breeding populations. For instance, three *Acrocephalus* species that all breed at the study site show markedly different recapture patterns *(Figure 5)*. *A. melanopogon*, a short distance migrant with a discrete breeding distribution in the Carpathian Basin that winters in the shoreline wetlands of the Balkans and Greece, has only recaptures with southern bearing. *A. scirpaceus*, on the other hand, is a common reedbed specialist throughout the continent yet the recapture bearing distribution shows hardly any birds with northerly origins, indicating that the Hungarian population is isolated from that of northern European countries. However, the fact that this species is a trans-Saharan migrant with two distinct wintering areas (West and East Africa) can be retraced by the foreign recapture bearing distribution. Similarly to the *A. scirpaceus, A. schoenobaenus* has a continental breeding distribution, yet the recapture patterns show that birds caught at the Ócsa Bird Ringing Station are local breeders and passage migrants originating from northern countries, suggesting that this species is traversing the Carpathians on migration (Csörgő & Gyurácz 2009a,b, Kovács *et al.* 2010, 2012).

Considering the overall mean daily capture frequencies throughout the study period, it is apparent that the different capture periods yield considerably different bird numbers *(Figure 6)*. In winter, when bird trapping is limited to three feeder sites and is only operating on a roughly weekly basis, capture frequencies predominantly depend on weather, hence there is large inter-annual and between-day variability in the number of ringed birds. Similar daily mean trapping rates are observable in the breeding period (CES period), however, with substantially lower between day mean variability. The transition from the CES period to the autumn migration period is striking, with approximately an order of magnitude larger daily capture yields especially early in the season. The reasons for this are two fold; first the trapping effort is drastically increased as all nets are opened on the 10th of July, and second, both dispersing local juveniles and early migrants are present in this period. In autumn, mean capture frequencies generally have a steep and steady decrease starting from mid-October.

Inter-annual differences in capture frequencies were also substantial *(Table 2*, *Figure 7)* in the study period, however a large proportion of this variability can be explained by the increase in the number of nets since 2001 *(Figure 7–8)*. On the other hand, the annual cumulative curve of daily captures shows that inter-annual variation does not grow steadily throughout the season. Typically annual capture totals depend on breeding period months, and winter capture rates *(Figure 8)*.

Table 2. Descriptive statistics of yearly capture and recapture frequencies and number of species at the Ócsa Bird Ringing Station

2. táblázat Az évi fogás, visszafogás és fajszám-gyakoriságok leíró statisztikái

	Captures	**Recaptures**	**Number of species**
Minimum	5792	1989	74
Median	12974	6512	94
Maximum	22902	10370	108

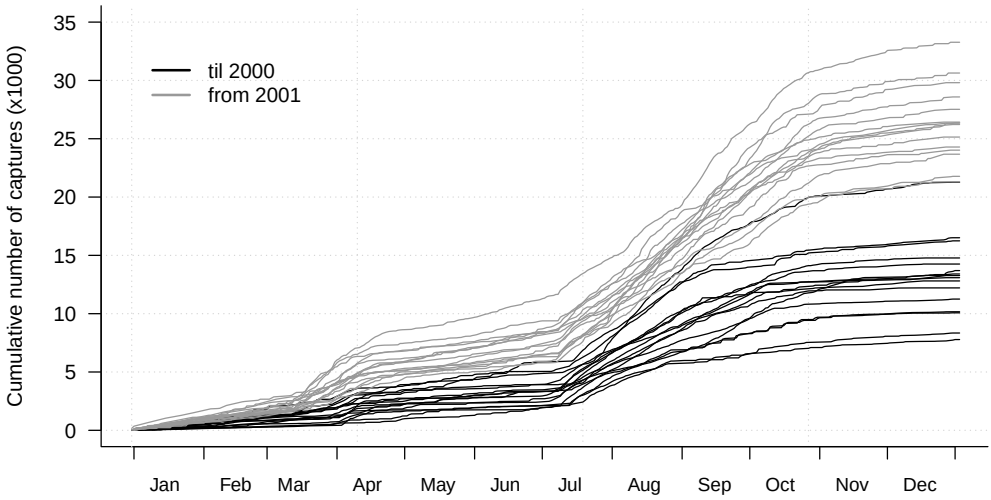

Figure 7. Annual cumulative capture frequencies in relation to day of year. There are large inter-annual differences in capture frequencies, however, since 2001 the number of nets and capture days have been increased that had an apparent effect on the number of captured birds

7. ábra Az évi fogások kummulatív görbéi. Az éves fogási mintázatok és számok nagy éves különbséget mutatnak. A nagyobb értékek jellemzően 2001-től jelentkeznek, amikortól megnőtt a hálóállások és a fogási napok száma

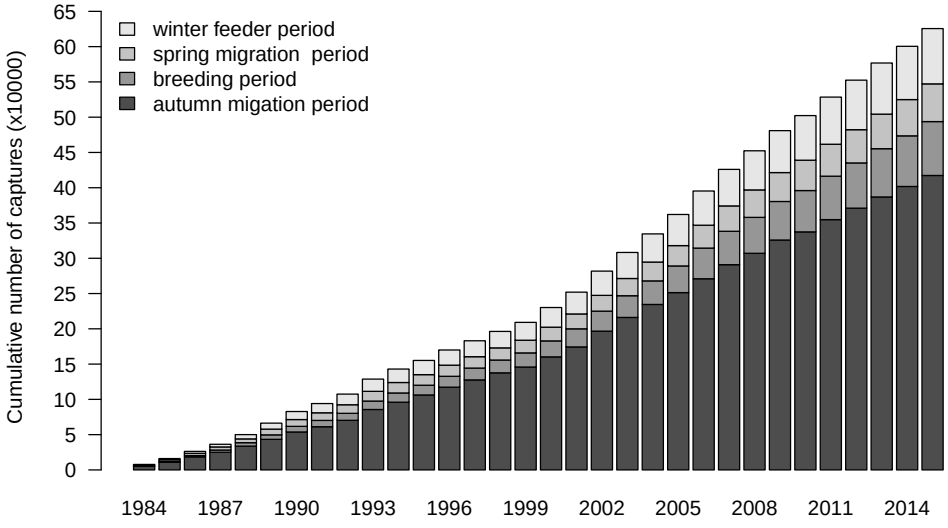

Figure 8. Cumulative capture frequencies by year through the study period. The rate of increase is larger since 2001 when the number of nets capture days were increased

8. ábra Kumulatív fogási gyakoriságok 1984–2015 között. A fogási számok 2001-től nagyobbak, nagyrészt a hálóállások és a fogási napok számának növekedése miatt

Further research projects

From time to time, other complementary research projects that require the handling of a large number of wild birds also rely on the infrastructure and activities of the Station. These projects include studies on the distribution and ecology of viruses, ticks (Acari: Ixodidae) and lice (Insecta: Phthiraptera). Other research projects required avian blood samples to identify immunological antibodies or to carry out DNA-based sex determination of sexually monomorphic birds. Naturally, only a small portion of ringed birds were subjected to these parallel studies. Considerable emphasis is placed upon motivating BSc, MSc, and PhD students, as well as their tutors, to utilize data for their thesis works. Connections to the Eötvös Loránd University (Budapest) and the University of Veterinary Medicine (Budapest) have been particularly fruitful. Hypothesis-based research using data obtained from the Station covered a wide range of topics from different fields of science. Ecological studies included research on capture (see e.g. Lövei *et al.* 2001) and statistical (Harnos *et al.* 2015b, 2016a) methodology , habitat preferences (e.g. Preiszner & Csörgő 2008, Ónodi & Csörgő 2012, 2013), moult (e.g. Kelemen *et al.* 2000), social behaviour (e.g. Báldi & Csörgő 1993, 1994b), sexual selection (e.g. Gál *et al.* 2012), wintering (e.g. Báldi & Csörgő 1994c, Csörgő *et al.* 2001, Kovács *et al.* 2011, Miholcsa *et al.* 2016, Miholcsa & Csörgő 2016), breeding (see e.g. Báldi & Csörgő 1991, 1994a), and particularly migration (e.g. Csörgő & Lövei 1995, Csörgő & Parádi 1998, 2000, Kovács *et al.* 2009, Nagy *et al.* 2009, Gyimóthy *et al.* 2011a,b, Harnos & Csörgő 2011, Csörgő & Harnos 2011, Harnos *et al.* 2015c,a) studies. Furthermore, effects of weather (see e.g. Gyurácz *et al.* 1997, 2003) and climate change (see e.g. Miholcsa *et al.* 2009, Csörgő *et al.* 2009, Kovács *et al.* 2010, 2012, Harnos *et al.* 2015a) on avian migration phenology have been intensively studied. Finally, epidemiological studies focused on evolutionary-ecological aspects of Usutu and West Nile viruses (Bakonyi *et al.* 2007, 2013), ticks (Hornok *et al.* 2012, 2016a,b) and tick-borne infections (Hornok *et al.* 2013, 2014), and lice (Vas *et al.* 2008, 2012) infesting birds.

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