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Migration behaviour of mute swans (*Cygnus olor*) wintering in České Budějovice, Czech Republic

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A b s t r a c t : The migration routes of mute swans (*Cygnus olor*) wintering at a second largest Czech mute swan wintering place at rivers Vltava and Malše in České Budějovice, Czech Republic, are described. 292 controls of 94 bird rings were conducted. The highest age of a ringed swan found in České Budějovice was 17 years, 1 month and 10 days (ringed as a female at least 3 years old). Average distance to the place of ringing was $68,4 \pm 72,3$ km; 53,1% of swans were ringed up to 50 km from the control place, 30,9% of swans were ringed 50-100 km from the control place and 16,0% of rings found were from a distance >100 km. Migration from nesting sites in the Czech Republic, Poland (Silesia), Germany (Saxonia) and Croatia was detected as well as contact with wintering places in Písek, Tábor, Týn nad Vltavou, Praha, Piešťany, Ptuj, Obervogau and Steyr. A confirmed contact with wintering populations around Graz suggests that the recent outbreak of bird flu H5N1 virus in swans in České Budějovice may be caused by the spring migration from the Austrian winter quarters.

K e y w o r d s : *Cygnus olor*, mute swan, capture-recapture analysis, South Bohemia, migration.

Introduction

Mute swan (*Cygnus olor*) is native to the Palearctics but has been widely introduced, both within its native range and elsewhere. Naturalised populations of mute swan in Europe and North America increased quickly and caused several unexpected effects like overgrazing of native aquatic vegetation, especially water-crowfoot *Ranunculus* spp. (MATHIASSEN 1973, COBB & HARLIN 1980, DELACH et al. 2001), and competition with other waterbirds (WATOLA et al. 2003). It is typical for introduced herbivores to overgraze their pastures in areas where they lack predators, but only 3% of introduced birds have been shown to cause effects on their new habitat through herbivory (EBENHARD 1988). One of these few birds is the mute swan itself. As in many cases of alien herbivory, many other species except the mute swan itself are claimed to be affected by the vegetation degradation caused by swan grazing (e.g. invertebrates and fish spawning - NUMMI & SAARI 2003). ELTRINGHAM (1963), BIRKHEAD & PERRINS (1986), TRUMP et al. (1994), BENGTSSON & MENANDER (2000), and PARROT & MCKAY (2001) reported damage to arable crops and to pasture caused by mute swans. Mute swans have a high survival rate with about 70% for juveniles, first-years and non-breeding adults, and up to 90% for breeding adults (REESE 1980, WATOLA et al. 2003). Immigration was reported as an important factor in the dynamics of their population (WATOLA et al. 2003).

The permanent Czech population of mute swan formed as lately as after the Second World War. Before 1940, only two confirmed nestings are known from Lednice, district Břeclav (ZDOBNITZKY 1909, GLÍŽ 1939). Around 1940, the half-wild mute swans started to nest in Olomouc on river Morava (HORA 1988). Since 1942, the naturalised mute swans nested close to Čimelice (district Písek). Another naturalised pair of mute swans (formerly kept at the Blatná castle) nested on the fishpond Sladovna, district Strakonice since 1948. In both cases, the nestlings dispersed freely and the ringed offspring of these two pairs was found throughout the southern and western Bohemia, as well as in Austria, Germany and Italy. These swans used wintering sites usually on the river Otava in Katoovice, district Strakonice, just a few km from their nesting places (HORA 1988). In 1960, the first nesting of mute swans was confirmed in the České Budějovice district. The female again belonged to the offspring of the pair from Blatná, the male was ringed by blue aluminium ring No. 12, but its origin is unknown (HORA 1988). The population was growing quickly. In 1966, at least 24 breeding pairs were recorded in the Czech Republic, in 1981 445 pairs, and in 1985 503 breeding pairs (HORA 1988). During the last years, the breeding population is stable or slightly declining. Currently, most of the swans are non-breeding individuals. E.g. SVOBODOVÁ & REŠL (2002) found 894 non-breeding individuals in South Bohemia compared to only 109 breeding pairs in June 2000.

Together with the increasing number of breeding pairs in the Czech Republic as well as in surrounding countries, the number of wintering individuals increased too. Formerly, only small flocks of mute swans occurred in extremely cold winters, e.g. in 1939/40 (ČERNÝ 1940). Since the end of the 1950s, first wintering sites occurred on ice-free stretches of rivers mostly in the city centres, where they are often fed by people (BEJČEK et al. 1995). In 1981, the number of mute swans wintering in the Czech Republic reached 2290, in 1985 4010, and in 1995 4430 individuals (HORA 1995). Currently, there is only a limited number of sites with larger flocks. The largest wintering site is situated on the river Vltava in Prague, which exists since the mid 1970s. In January 1985 1010 swans were recorded there (BEJČEK et al. 1995). Currently the number of swans wintering here is lower – January 1995 only 410 individuals (HORA 1995), in January 2005 only 226 mute swans on the river Vltava in Prague and its vicinity (BERGMANN et al. 2005). The other large nesting places are (according to the number of mute swans wintering in January 1995): České Budějovice (266 mute swans), river Berounka between Svatý Jiří and Bukovec (222), Hradec Králové (206), Olomouc (177), Strakonice (122), river Jihlava in Hrubšice (106), etc. (HORA 1995).

České Budějovice is the second largest wintering site of mute swans in the Czech Republic. The main flocks are usually located on the river Vltava close to the Dlouhý bridge (48°59'24"N, 14°27'41"E) and on the river Malše in the city centre close to the South Bohemian theatre (48°58'19"N, 14°28'28"E). The number of wintering mute swans fluctuate around 100-300. The first occurrence of mute swans here dates to the mid 1960s (HECL in HUDEC 1994). During regular January census HORA (1995) registered 212 mute swans in 1981, 270 in 1982, 78 in 1983, 250 in 1984, 239 in 1985, and 266 in 1995. In 1996, 351 swans were counted (HORA 1996) and in 2003 240-305 (BÜRGER and HAD in ANONYMUS 2003).

In this paper I present the first survey of migration routes used by mute swans wintering in the České Budějovice area. Migration from nesting places as well as transfers between different wintering sites are discussed and basic parameters of the swans migrating to České Budějovice are shown. The relationship between migration routes of mute swans and the probability of occurrence of bird flu are discussed.

Material and Methods

Mute swans were controlled during irregular intervals on their wintering site in České Budějovice (South Bohemia, Czech Republic). The main flocks are usually located on the river Vltava close to the Dlouhý bridge (48°59'24"N, 14°27'41"E), and on the river Malše in the city centre close to the South Bohemian theatre (48°58'19"N, 14°28'28"E). This wintering site is mostly used during peak winter months when all other waters are frozen. Therefore most of the controls were conducted between December and February of each respective year. The controls were performed from December 1994 until February 2006. During this time I conducted a total of 97 controls of wintering swans in the area mentioned above. The rings were usually read from the distance by binocular 7x50. If needed, the swan was captured and the ring number confirmed at close range.

Results

During controls of the mute swan wintering site in České Budějovice between 1994-2006, I registered 94 rings. Some of the swans were recorded repeatedly, resulting in 292 controls of these 94 bird rings. The average distance to the place of ringing was $68,4 \pm 72,3$ km (mean \pm SD), minimal distance 14,2 km, maximal distance 407,0 km. 53,1 % of ringed swans were found up to 50 km from the control place, 30,9% up to 50-100 km from the control place and 16,0% of birds ringed were from a distance >100 km. A list of recoveries >100 km is presented in Table 1. The average azimuth was $153^\circ \pm 52^\circ$ (mean \pm SD); there were no swans migrating from the azimuth 226°-357°, which suggests that their migration follows the watercourses and that the migrating swans only use areas abundant with fishponds, large rivers or any other wetlands. Interestingly, I found wintering birds ringed in July and August in Croatia on localities 307,8 and 321,3 km south of České Budějovice. But the rest of the birds almost exclusively migrated from northern areas in the Czech Republic, Poland and Germany. Few birds migrating from other directions (Austria, Slovenia, Slovakia) were ringed on their winter quarters and thus can be explained only by the change of their wintering sites.

The average time between ringing date and date of subsequent control was 977 ± 749 days. 19,5% of controls were conducted up to one year from the ringing date, 30,5% of controls in the second year after the ringing, 16,4% in the third year, 7,5% in the fourth, 6,8% in the fifth, 14,3% in the sixth year, and 3,8% in the seventh year. The longest-living birds were controlled more than seven, eight, and seventeen years after the ringing (Table 2.). The last mentioned bird had an offspring with at least 19 years, which migrated together with parents to the wintering site in České Budějovice. But this bird was found dead a few months later in the close vicinity of the wintering site showing symptoms of some infectious disease.

Another important question was, whether there is any change from/to the examined wintering site in České Budějovice to/from other wintering sites in the Czech Republic and vicinity. This question is particularly important after the finding that bird flu is transmitted by mute swans. Currently, it seems that bird flu occurred in České Budějovice just shortly after the end of a long period of low temperatures as a result of a spring mute swan migration from southern wintering sites in Austria and other countries. The list of the wintering sites found to be linked with the examined one is shown in Table 3. In the case of some swans, the fidelity to the wintering site was high (e.g.

PRAHA LB 1079, PRAHA LB 1312). But others changed their winter quarters very frequently, even to relatively distant localities. Among other wintering sites with confirmed contact to the České Budějovice wintering site are river Otava in Písek, Czech Rep. (44,3 km NNW, PRAHA LB 571, and PRAHA LB 572), river Lužnice in Tábor, Czech Rep. (51,8 km NNE, PRAHA LB 1312), river Vltava in Týn nad Vltavou, Czech Rep. (28,2 km N, PRAHA LB 1569), river Vltava in Praha, Czech Rep. (122,4 km N, PRAHA LB 1614), river Váh in Piešťany, Slovakia (248,3 km ENE, BRATISLAVA A 1229), river Drava in Ptuj, Slovenia (295,2 km NNE, LJUBLJANA X 68), river Mur in Obervogau, Austria (261,1 km NNE, RADOLFZELL RV 1898), and confluence of rivers Steyr and Enns in Steyr, Austria (100,2 km N, RADOLFZELL RV 2442).

The other birds were ringed on their nesting places or rarely on moulting places. Most of the records of nesting swans came from the district České Budějovice itself and from the nearby districts Tábor, Jindřichův Hradec and Písek. The migration distance of those swans did not exceed 69 km from the NE, N or NW direction. The other swans wintering in České Budějovice came from Lukavec (distr. Pelhřimov, Czech Rep., 76,0 km NNE, PRAHA L 6655), Dobřichovice (distr. Praha-západ, Czech Rep., 108,7 km N, PRAHA L 10818), Praha-centrum (distr. Praha, Czech Rep., 122,4 km N, PRAHA L 10828), Praha 4 – Podolí (distr. Praha, Czech Rep., 120,6 km N, PRAHA L 11181), Praha 10 – Hostivař (distr. Praha, Czech Rep., 118,6 km N, PRAHA LB 804), Ledečky (distr. Nymburk, Czech Rep., 154,8 km NNE, PRAHA LB 1402), Carlsdorf (Bischofswerda, Saxonia, Germany, 243,2 km N, HIDDENSEE 129542), Hlapčina (Medimurje, Croatia, 307,8 km SSE, ZAGREB UA 0486), Gornji Kuršanec (Medimurje, Croatia, 321,2 km SSE, ZAGREB UA 0737), and Pilica-Stawy (Silesia, Poland, 407,0 km ENE, GDAŃSK AC 1410) (for details of long-distance recoveries see also Table 1). The longest recoveries were recorded usually at the peak of cold weather.

Discussion

Currently, main interest is directed towards the occurrence of bird flu because mostly mute swans are affected by the virus type H5N1 in Europe. In some other countries also infected geese (especially bar-headed goose *Anser indicus*), other waterfowl (Anseriformes) and fowl (Galliformes) were reported. The first occurrence of the bird flu subtype H5N1 in the Czech Republic is dated to March 20th, 2006. A total of 1760 samples of wild birds found dead were tested between January 1st and April 9th, 2006, all with negative results except one. The first case was found in a sample from a mute swan found dead in Hluboká nad Vltavou, 6 km north of České Budějovice (OIE 2006b). Until April 18th, 2006, 12 positive cases were found at four places, all located on the river Vltava. The next outbreak was reported from České Budějovice (river Vltava) directly (6 dead H5N1-positive animals between March 25th and April 18th, 2006), another one was found in Týn nad Vltavou (river Vltava) (1 dead H5N1-positive swan April 4th, 2006). Here I provide the direct evidence about contacts between mute swan wintering sites in České Budějovice and Týn nad Vltavou (ring PRAHA LB 1569). The last outbreak occurred on the Vltava river dam Orlík just few km down-stream and in Mirochov (JH) (OIE 2006c). Importantly, before any Czech outbreaks of H5N1 became known, avian influenza was detected in two dead swans in Austria in the vicinity of Graz, Styria. This is in fact one of the sites of a confirmed contact with the České Budějovice wintering site (OIE 2006a). Thus, we can assume that after the occurrence of warmer weather, mute swans migrated north from Styria to South Bohemia causing several outbreaks along river

Vltava starting in its southern parts (upper reaches) in České Budějovice and Hluboká nad Vltavou and then continuing with the northbound migration to Týn nad Vltavou and later to Orlík as well.

The movements of mute swans reported correspond with the geographic bird flu dispersion. For a long time it was thought that central European mute swans are not migratory. But our knowledge has changed. In extreme winters, the movements of mute swans are more intense and are recaptures about 300-500 km from their nesting places as well as from their wintering places are common. These shifts to a few hundred km south are relatively rare on the beginning and at the end of the winter season, but very common if heavy frost occurs; usually in January or February (see also Table 3). It remembers to the old messages in former decades about the appearance of flocks of mute swans in the worst winter seasons, e.g. in winter 1939/40 (BEJČEK et al. 1995).

Mute swan ringing in the Czech Republic was conducted mainly between 1982 and 1996 by J. Jahelka and his co-workers (JAHELKA 1998). They ringed 1561 mute swans in South Bohemia. JAHELKA (1998) reported that between 1987 and 1994, 66,6-81,6% of birds ringed in South Bohemia as breeding adults or pulli spent the winter in the same region. A smaller portion was reported to move north to the Central Bohemian winter quarters (8,3-18,4 %) and 0,0-3,0% of the ringed swans wintered in Eastern Bohemia NE of the ringing places. A small portion of ringed birds was reported to spend winter in Germany (0,0-7,8%) and Austria (0,0-12,2%). 0,0-6,0% of the ringed birds were reported as wintering in other parts of Europe. But the question was which mute swans – if any – migrate to South Bohemia in winter? Here I report contact with at least 8 other wintering places in the distance of 28 to 295 km, including those located in Austria, Slovakia and Slovenia. I also confirmed the frequent contacts of the South Bohemian mute swan population with those of Poland, Germany, and Croatia.

During the recapturing, I recorded one of oldest Czech mute swans being ringed 6250 days before recapture (17 years, 1 month and 10 days). Because it was ringed as +3Y, it must have been at least 20 years old and it was still fertile in its 19 years as documented by record of its offspring in České Budějovice (see Table 2). REESE (1980) calculated the life expectancy table for mute swans in the USA up to 50 years; he recorded males living 9, 15 and 18 years and females living for 12, 16 and 20 years, the latter nested for 16 consecutive years; other authors had reported longevity records ranging from 16 up to 50 years (KORTRIGHT 1942, RYDZEWSKI 1962, KEAR 1972). The maximum age according to the longevity reports of EURING ringing schemes is 28 years (STAAV 1998).

After the expansion during the 1970s and 1980s of the 20th century, the Czech mute swan population stabilised. The population is not migratory except of the short periods with extremely low temperatures, when mute swans are roaming hundreds km around their nesting sites. Although these migrations were previously reported as uncommon and insignificant, it seems that they may play an important role in transmission of bird parasites and infections, such as the recently spread bird flu.

Zusammenfassung

Beschrieben werden die Zugwege von Höckerschwanen (*Cygnus olor*), die im zweitgrößten tschechischen Überwinterungsgebiet dieser Art an den Flüssen Moldau und Maltš in Budweis überwintern. 292 Kontrollen von 94 beringten Vögeln wurden durchgeführt. Das Höchstalter eines beringten Schwanes aus Budweis war 17 Jahre, 1 Monat und 10 Tage (beringt als zumindest 3 Jahre altes Weibchen). Die durchschnittliche Entfernung zum Beringungsort betrug 68,4 ±

72,3 km. 53,1 % der Schwäne wurden in einer Entfernung von bis zu 50 km vom Kontrollort beringt, 30,9 % wurden 50 bis 100 km vom Kontrollort beringt und 16 % waren >100 km entfernt. Zugbewegungen von Brutplätzen in Tschechien, Polen (Schlesien), Deutschland (Sachsen) und Kroatien sowie Kontakte zu Überwinterungsgebieten in Písek, Tábor, Týn nad Vltavou, Prag, Piešťany, Ptuj, Obervogau und Steyr wurden festgestellt. Ein nachgewiesener Kontakt mit Winterpopulationen aus der Umgebung von Graz weist darauf hin, dass der aktuelle Ausbruch des Vogelgrippe Virus H5N1 in Budweis durch den Frühjahrszug aus österreichischen Überwinterungsgebieten ausgelöst worden sein könnte.

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Tab. 1. List of mute swan recoveries from České Budějovice found >100 km from the ringing place.

Ringling centre, ring number, age, sex,
date and place of ringling,
date and place of control, distance to the ringling place, azimuth

BRATISLAVA A 1229, f.g., F
24.01.2004, Piešťany, distr. Piešťany, Slovakia; 44.58N, 14.29E,
19.02.2006, České Budějovice, r.Malše, Czech Rep., 248.2 km, azimuth 78°

GDAŇSK A 1410, pull
25.08.2001, Pilica-Stawy, Silesia, Poland; 50.28N, 19.39E
13.02.2005, České Budějovice, r.Malše, Czech Rep., 407.0 km, azimuth 112°

HIDDENSEE 129542, ?
18.07.1991, Carlsdorf, Bischofswerda, Sachsen, Germany; 51.09N, 14.16E
27.12.1996, České Budějovice, r.Vltava, Czech Rep.
03.01.1997, České Budějovice, r.Vltava, Czech Rep.
23.01.1997, České Budějovice, r.Vltava, Czech Rep.
29.01.1997, České Budějovice, r.Vltava, Czech Rep., 243.2 km, azimuth 183°

1410

LJUBLJANA X 68, +1Y, M

01.12.2000, Ptuj, river Drava, Slovenia; 46.25N, 15.35E

30.12.2002, České Budějovice, r.Vltava, Czech Rep., 295.2 km, azimut 16°

RADOLFZELL RV 1898, +1Y, F

24.01.1993, Obervorgau, Steiermark, Austria; 46.44N, 15.34E

02.01.1995, České Budějovice, r.Vltava, Czech Rep.

08.01.1995, České Budějovice, r.Vltava, Czech Rep., 261.1 km, azimut 17°

RADOLFZELL RV 2442, +1Y, F

30.11.1992, Steyr, Oberösterreich, Austria; 48.04N, 14.25E

28.01.1995, České Budějovice, r.Vltava, Czech Rep., 100.2 km, azimut 357°

ZAGREB UA 0486, pull

18.07.1998, Hlapčina, Medimurje, Croatia; 46.31N, 16.24E

28.12.1999, České Budějovice, r.Vltava, Czech Rep., 307.8 km, azimut 27°

ZAGREB UA 0737, pull

12.08.1996, Gornji Kuršanec, Medimurje, Croatia; 46.20N, 16.15E

03.02.1998, České Budějovice, r.Vltava, Czech Rep., 321.2 km, azimut 24°

PRAHA L 1692, +3Y, F

11.01.1979, Praha 7 – Trója, Czech Rep., 50.07N, 14.25E

21.02.1996, České Budějovice, r.Vltava, Czech Rep., 128.0 km, azimut 182°

PRAHA L 10826, pull

10.09.1990, Praha – Braník, r.Vltava, Czech Rep., 50.02N, 14.25E

26.12.1994, České Budějovice, r.Vltava, Czech Rep.

02.01.1995, České Budějovice, r.Vltava, Czech Rep.

08.01.1995, České Budějovice, r.Vltava, Czech Rep.

16.01.1995, České Budějovice, r.Vltava, Czech Rep., 118.7 km, azimut 182°

PRAHA L 10818, +2Y, F

31.08.1990, Dobřichovice, distr. Praha-západ, Czech Rep., 49.56N, 14.16E

10.01.1997, České Budějovice, r.Vltava, Czech Rep., 108.7 km, azimut 188°

PRAHA L 10828, 1Y

19.09.1990, Praha – centrum, r.Vltava, Czech Rep., 50.04N, 14.25E

26.11.1995, České Budějovice, r.Vltava, Czech Rep.

01.12.1995, České Budějovice, r.Vltava, Czech Rep.

29.12.1995, České Budějovice, r.Vltava, Czech Rep.

31.12.1995, České Budějovice, r.Vltava, Czech Rep.

10.01.1997, České Budějovice, r.Vltava, Czech Rep.

17.01.1997, České Budějovice, r.Vltava, Czech Rep., 122.3 km, azimut 182°

PRAHA L 11181, +2Y, M

13.04.1990, Praha 4 – Podolí, Czech Rep., 50.03N, 14.25E

02.04.1996, České Budějovice, r.Vltava, Czech Rep., 120.6 km, azimut 182°

PRAHA LB 804, pull

15.08.1994, Praha 10 – Hostivař, Czech Rep., 50.03N, 14.32E

28.12.1999, České Budějovice, r.Vltava, Czech Rep., 118.6 km, azimut 178°

PRAHA LB 1402, pull

16.07.1994, Ledečky, district Nymburk, Czech Rep., 50.17N, 15.11E

10.04.1996, České Budějovice, r.Vltava, Czech Rep., 154.8 km, azimut 161°

Tab. 2. Longevity of mute swans migrating to České Budějovice.

Ringling centre, ring number, age, sex

date and place of ringling

date and place of control

PRAHA L 11016, pull

14.07.1990, Smetanova Lhota, distr. Písek, Czech Rep., 49.26N, 14.05E

15.01.1995, České Budějovice, r.Vltava, Czech Rep.

22.01.1995, České Budějovice, r.Vltava, Czech Rep.

28.01.1995, České Budějovice, r.Vltava, Czech Rep.

27.11.1996, České Budějovice, r.Vltava, Czech Rep.

04.11.1997, České Budějovice, r.Vltava, Czech Rep.

2670 days = 7 years, 3 months and 21 days

PRAHA L 10602, +2Y, F

27.07.1989, Lomnice n.L., distr. J.Hradec, Czech Rep.; 49.05N, 14.43E

05.02.1998, České Budějovice, r.Malše, Czech Rep.

3115 days = 8 years, 6 months and 9 days = at least 10 years old

PRAHA L 1692, +3Y, F

11.01.1979, Praha 7 – Trója, Praha, Czech Rep.; 50.07N, 14.25E

21.02.1996, České Budějovice, r.Vltava, Czech Rep.

6250 days = 17 years, 1 month and 10 days = **at least 20 years old**

This swan had an offspring even in its 19th years– 05.08.1995 4 pull ringed, which were subsequently found to be migrating with their mother; one of them was later found dead in the České Budějovice suburbs:

PRAHA LB 1545, pull

05.08.1995, Vrábsko, distr. Písek, Czech Rep.; 49.28N, 14.06E

08.12.1995, České Budějovice, r.Vltava, Czech Rep.

04.06.1996, Haklovy Dvory, South Bohemia, Czech Rep.; 49.00, 14.24

(found dead)

Tab. 3. Drift between České Budějovice and other mute swan wintering places.

Ringling centre, ring number, age, sex

date and place of ringling

date and place of control

PRAHA L 1692, +3Y, F

11.01.1979, Praha 7 – Trója, Praha, Czech Rep.; 50.07N, 14.25E

21.02.1996, České Budějovice, r.Vltava, Czech Rep.

PRAHA LB 571, 1Y

26.12.1994, Písek, river Otava, distr. Písek, Czech Rep.; 49.19N, 14.09E

05.02.1998, České Budějovice, r.Malše, Czech Rep.

PRAHA LB 572, 1Y

26.12.1994, Písek, river Otava, distr. Písek, Czech Rep.; 49.19N, 14.09E

30.03.1996, České Budějovice, r.Vltava, Czech Rep.

24.12.1997, České Budějovice, r.Vltava, Czech Rep.

05.02.1998, České Budějovice, r.Malše, Czech Rep.

fidelity to the new wintering place for at least three subsequent seasons

PRAHA LB 1079, +2Y, M

12.07.1994, Lomnice nad Lužnicí, distr. J.Hradec, Czech Rep.; 49.05N, 14.43E

1412

4 years at České Budějovice, r.Vltava, Czech Rep., 4 subsequent winter seasons spent at one wintering place:

1994/95: 24.12.1994; 03.02.1995

1995/96: 26. and 31.12.1995; 01., 02., 09., 16., 19. and 25.01.1996; 02., 06., 13., 16., 21. and 27.02.1996; 04., 07. and 13.03.1996

1996/97: 27.11.1996; 07., 27. and 30.12.1996; 03. and 29.01.1997; 06. and 14.02.1997; 12.03.1997

1997/98: 24. and 29.12.1997; 06.02.1998

PRAHA LB 1312, 1Y

30.12.1994, Tábor, South Bohemia, Czech Rep.; 49.25N, 14.40E

4 years at České Budějovice, river Vltava, South Bohemia, Czech Rep., 2 subsequent winter seasons spent at the wintering place České Budějovice:

01.12.1995, 25.01.1996, 02.2.1996, 13.02.1996, 16.02.1996, 04.03.1996

27.11.1996, 07.12.1996, 10.01.1997, 17.01.1997

PRAHA LB 1569, +2Y, M

13.01.1996, Týn nad Vltavou, South Bohemia, Czech Rep.; 49.13N, 14.25E

30.12.1996, České Budějovice, r.Vltava, Czech Rep.

10.01.1997, České Budějovice, r.Vltava, Czech Rep.

17.01.1997, České Budějovice, r.Vltava, Czech Rep.

PRAHA LB 1614, pull

29.07.1996, Tučapy, South Bohemia, Czech Rep.; 49.17N, 14.48E

17.01.1997, České Budějovice, r.Vltava, Czech Rep.

23.10.1998, Praha 1 – Na Kampě, river Vltava, Czech Rep.; 50.04N, 14.25E

Praha 1 – Na Kampě, river Vltava, Czech Rep.; 50.04N, 14.25E

The direction of the migration changed from the south in its first year to the north in its third year

BRATISLAVA A 1229, f.g., F

24.01.2004, Piešťany, distr. Piešťany, Slovakia; 44.58N, 14.29E

19.02.2006, České Budějovice, r.Malše, Czech Rep.

LJUBLJANA X 68, +1Y, M

01.12.2000, Ptuj, river Drava, Slovenia; 46.25N, 15.35E

30.12.2002, České Budějovice, r.Vltava, Czech Rep.

RADOLFZELL RV 1898, +1Y, F

24.01.1993, Obervorgau, Steiermark, Austria; 46.44N, 15.34E

02.01.1995, České Budějovice, r.Vltava, Czech Rep.

08.01.1995, České Budějovice, r.Vltava, Czech Rep.

RADOLFZELL RV 2442, +1Y, F

30.11.1992, Steyr, Oberösterreich, Austria; 48.04N, 14.25E

28.01.1995, České Budějovice, r.Vltava, Czech Rep.

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