MOVEMENTS AND SETTLING PATTERNS OF SEDGE WARBLERS (*Acrocephalus schoenobaenus*) IN THE CZECH REPUBLIC AND SLOVAKIA – AN ANALYSIS OF RINGING RECOVERIES

Petr Procházka, Jiří Reif

ABSTRACT

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In total, 1655 ringing recoveries of 1492 Sedge Warblers ringed or recovered in the Czech Republic and Slovakia were analysed in respect of breeding site fidelity, natal philopatry and movements. Out of 128 recoveries of adult birds from the breeding season, 96% came from the same locality showing a considerable breeding site fidelity. Out of 9 recoveries of birds ringed in nests and subsequently recovered during following breeding seasons, 8 settled at their birthplaces, only 1 male was found 26 km away from its native locality. After fledging, some juveniles dispersed in directions different from the migration routes. One young bird was recovered on its juvenile dispersal at the age of 35 days. On their migration to winter-quarters, Sedge Warblers headed initially between south-west and south-east. The highest concentration of recoveries was situated in the Pannonian Lowland. Birds from the eastern Baltic region and Scandinavia often migrate through the territory of the Czech Republic and Slovakia. The only winter record came from southern France.

P. Procházka, Charles University, Faculty of Science, Department of Zoology, Viničná 7, CZ-128 44 Praha, Czech Republic, E-mail: petr_prochazka@hotmail.com; J. Reif, Dolní Újezd 611, CZ-569 61 Dolní Újezd u Litomyšle, Czech Republic, E-mail: jirireif@yahoo.com

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Key words: Sedge Warbler, *Acrocephalus schoenobaenus*, migration, ringing recoveries, philopatry, site fidelity, dispersal.

INTRODUCTION

The Sedge Warbler is a species widespread in Europe (Hagemeijer and Blair 1997), occurring from arctic latitudes through boreal and temperate zone to the Mediterranean (however, its breeding there is only marginal) (Cramp 1992). In the Czech Republic and Slovakia it represents a regularly, locally even commonly, breeding species (especially in lowlands and fishpond areas – Šťastný *et al.* 1997).

The Sedge Warbler breeds in a wide variety of low and dense vegetation, especially in marshlands, moist depressions and even dry sites, *e.g.* fields (Ruthke 1955, Walter 1955).

The Sedge Warbler is a long-distance migrant, wintering in sub-Saharan Africa from Senegal east to Ethiopia and south to East Cape Province (South Africa) and northern Namibia (Moreau 1972, Zink 1973, Koskimies 1991). For occasional more northern winter records see Cramp (1992). Sedge Warblers are supposed to prefer wetter habitats in winter than other European *Acrocephalus* warblers in sub-Saharan Africa (Leisler 1981). The migration strategy of the Sedge Warbler is relatively well known. For accumulation of fat reserves, British Sedge Warblers seem to rely largely on slowly-moving and locally abundant insect species, such as the Plum-reed Aphid *(Hyalopterus pruni)* and mayflies *(Ephemeroptera)* (Bibby *et al.* 1976), an unpredictable and patchily distributed food resource in space and time (Hanski and Woiwod 1993). Once they have found a good stopover site in southern England or western France, they can gain sufficient fuel to fly directly from these fattening areas to sub-Saharan Africa by overflying more southerly latitudes, where the aphids have already declined in numbers (Bibby and Green 1981).

The dynamics and migration pattern of Sedge Warblers is best known for the British populations (Bibby *et al.* 1976, Insley and Boswell 1978, Bibby and Green 1981, Ormerod 1990 and others). It is less known for northern (Koskimies and Saurola 1985, Røstad 1986, Celminsh 1989, Chernetsov 1996, Hall 1996) and central Europe (Grüll and Zwicker 1982, Gyurácz and Csörgő 1994, Gyurácz and Bank 1995). The only detailed contribution on migration of this species relating to the data presented here was published by Literák *et al.* (1994). The latter paper, however, deals only with recoveries concerning the north-easternmost part of the Czech Republic. In the present paper, we analyse all the recoveries available in the Bird Ringing Centre of the National Museum in Prague to date.

The declines in the populations of this species in some European countries in the 1970s and 1980s (Håland and Byrkjeland 1982, Berthold *et al.* 1986, Hustings 1988, Marchant *et al.* 1990) were strongly influenced by several dry seasons in its west African winter-quarters (Peach *et al.* 1991). At the Polish Baltic coast after a moderate decline in the 1960s, the number of birds during the 1970s was quite stable and in the 1980s it considerably increased (average regression coefficient for 1961-1990 was +3.42, higly significant – Busse 1994a and b). Loss and deterioration of breeding habitats in Europe might have prevented the decreased populations from recovering to the pre-drought numbers (Foppen *et al.* 1999). Loss of habitats and their degradation on migration routes could be an important factor negatively affecting survival rates of migrant species such as the Sedge Warbler. Therefore, we would like to contribute to the knowledge of movements, fidelity and philopatry of the Sedge Warbler by means of an analysis of ringing recoveries from the territory of the Czech Republic and Slovakia.

MATERIAL AND METHODS

In the period 1934-1998 altogether 87 151 Sedge Warblers were ringed on the territory of the Czech Republic and Slovakia (Fig. 1).

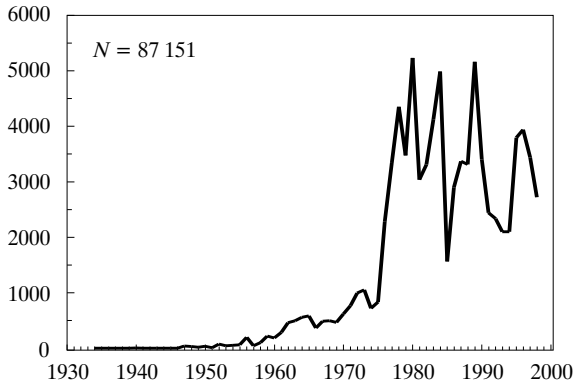

Fig. 1. Annual ringing totals of Sedge Warblers ringed on the territory of the Czech Republic and Slovakia in 1934-1998

In total, we analysed 1655 ringing recoveries concerning 1492 indiv. from the card catalogue of the Bird Ringing Centre of the National Museum in Prague. Out of them, 1339 were ringed on the territory of the Czech Republic (1495 recoveries), 62 in Slovakia (67 recoveries). 93 recoveries refer to 91 birds ringed by foreign ringing centres and subsequently recovered in the Czech Republic or Slovakia.

Most recoveries are recaptures made by ringers, only 1.1% (18 recoveries) are accidental findings (found dead, shot, killed). Birds ringed or recovered during the period 15 May – 15 July were considered as belonging to local breeding populations.

The distance of movement was calculated as the length of corresponding orthodrome (the shortest connecting line between two points on a spherical surface of an Earth model with diameter of 6371.1 km). The direction of movements was expressed as the azimuth of the orthodrome (Imboden and Imboden 1972).

By “breeding site fidelity” we mean the faithfulness of an adult bird to a breeding locality, *i.e.* recovery of a bird at the place of ringing in subsequent breeding period(s). The opposite situation, “breeding dispersal”, is the movement of an individual, which has reproduced, between successive breeding sites. Under “philopatry” we understand the faithfulness to a natal site, *i.e.* recovery at the place of birth in subsequent breeding season(s). By analogy, “natal dispersal” means the settling in a distance from a natal site. Finally, “juvenile dispersal” stands for post-fledging movements of young birds from natal areas to alternative sites, which become then the departure points for autumn migration (Greenwood 1980, Bauer 1987, Berthold 2000).

RESULTS

Breeding site fidelity and breeding dispersal

Altogether 128 recoveries concerning 110 Sedge Warblers ringed as adults during the breeding season and consecutively controlled within the same period in subsequent years were analysed in respect of breeding site fidelity. 96% of the ringing recoveries came from the same locality showing pronounced breeding site fidelity. Only 5 individuals settled at the distance of 2-23 km (mean = 9.1 ± 8.0 km, median = 6 km). No significant difference in the proportion of males and females among birds faithful to their breeding localities was found (χ^2 = 0.07, *df* = 1, *ns*).

64% of the recoveries came from the first following breeding season, 36% – from the next breeding periods. The oldest breeding bird was controlled in its at least seventh breeding season:

T 294719 M *ad.* 1 Jun. 1972 Sedlec, Břeclav, CZ (48°47'N, 16°42'E)
13 Jul. 1978 *ibidem*
controlled 6 years, 1 month and 12 days later

Philopatry and natal dispersal

Out of 32 recoveries referring to 29 Sedge Warblers ringed as nestlings, 9 recoveries came from subsequent breeding seasons. All of them were found in the same locality, except for a male that settled 26 km south-eastwards from its birthplace:

T 647087 *pull.* 13 Jul. 1991 Kelské Vinice, Mělník, CZ (50°19'N, 14°30'E)
28 May 1992 Sedlčánky, Praha-východ, CZ (50°10'N, 14°47'E)
controlled 26 km SE

When analysing philopatry in Sedge Warblers ringed as fledged birds during the breeding period, one have to bear in mind that the sample was a mixture both of birds hatched in the locality and birds caught on juvenile dispersal. Moreover, although we defined the breeding period for the Sedge Warbler from 15 May to 15 July, one case suggests that movements of first-year birds can begin quite early:

T 294719 *pull.* 29 May 1983 Jičín, CZ (50°26'N, 15°21'E)
10 Jul. 1983 Pohořelice, Břeclav, CZ (48°58'N 16°32'E)
controlled 184 km SSE

Out of 30 birds marked as first-year during the breeding season, 25 (83%) were found breeding in the place of ringing, 5 (17%) were controlled 24-186 km (mean = 93.2 ± 69.0 km, median = 110 km) from the place of ringing.

Juvenile dispersal

Out of 150 recoveries of first-year birds recorded in the year of ringing, 78 (52%) were found at another site. Short-distance recoveries (up to 100 km) of juvenile birds were located in all directions (Fig. 2); some of these can therefore be

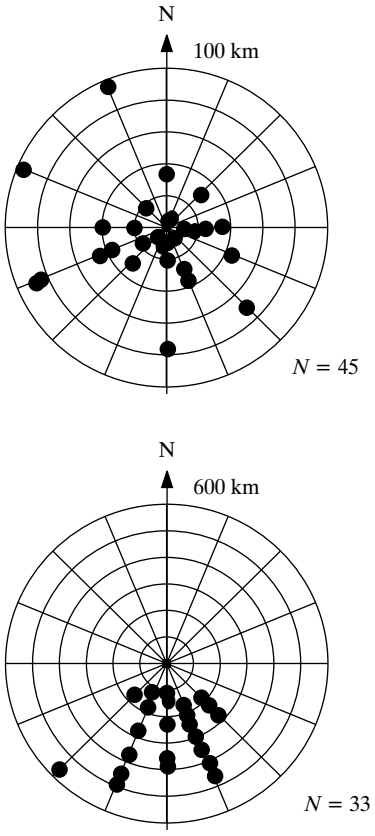

Fig. 2. Directions of short-distance (above) and long-distance (below) recoveries of juvenile Sedge Warblers in the year of ringing

assumed as movements related to juvenile dispersal. On the contrary, long-distance recoveries headed towards southern directions referring then to migration movements.

Several recoveries of juvenile Sedge Warblers from Lake Neusiedl (Austria) indicated that post-fledging movements could be considerably long, *e.g.*:

RADOLFZELL
BS 45739 *imm.* 18 Aug. 1980 Illmitz, Burgenland, A (47°46'N, 16°48'E)
24 Aug. 1980 Pohořelice, Břeclav, CZ (48°58'N, 16°32'E)
controlled 137 km N

An illustrative example regarding the age, at which the post-fledging movements occur, is given by the following recovery:

S 152596 *pull.* 1 Jul. 1999 Přeseka, J. Hradec, CZ (49°02'N, 14°44'E)
29 Jul. 1999 Planá nad Lužnicí, Tábor, CZ (49°21'N, 14°43'E)
controlled 35 km N

The bird was ringed in nest at the age of seven days and after 28 days, *i.e.* at the age of 35 days, it was controlled 35 km N of its birthplace.

Migration

On their autumn migration, Sedge Warblers first headed between SW and SE (Fig. 3, 4). The mean azimuth of initial direction of Czech and Slovak breeding populations was 193.8 ± 79.7°, median = 171.9°, $n = 26$). For the birds ringed in the Czech Republic and Slovakia after 15 July, between the direction of recoveries recorded in the same year up to 100 km (mean azimuth = 145.8 ± 101.5°, median = 146.1°, $n = 62$) and those more than 100 km (mean = 187.0 ± 45.4°, median = 176.4°, $n = 38$) there was a significant difference ($t = 2.4$, $p < 0.05$).

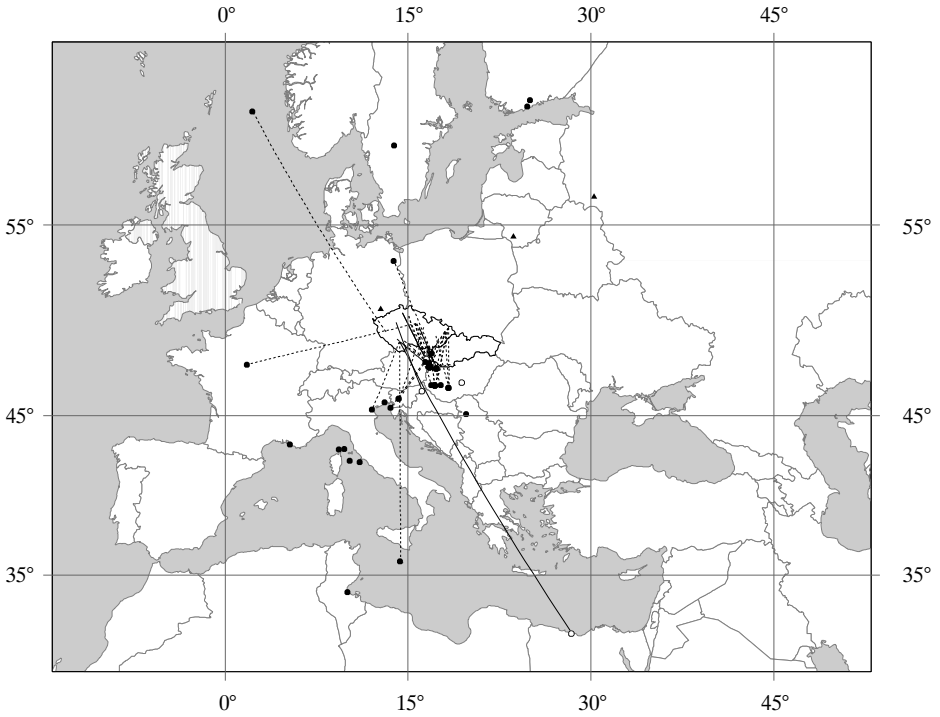

Fig. 3. Finding sites of Sedge Warblers ringed in the Czech Republic and Slovakia. Filled circles – finding sites of birds ringed and found out of the breeding season, open circles – finding sites of birds ringed breeding, triangles – finding sites of birds ringed out of the breeding season and found breeding, continuous lines – direct migration of birds ringed breeding in the Czech Republic or Slovakia, dashed lines – direct migration of birds ringed on migration.

On the territory of the Czech Republic and Slovakia, migrating birds from Sweden, Germany, Poland, Russia and especially those from the eastern Baltic region were recovered (Fig. 4, Table 1). Many birds, both breeding in and migrating through the territory under consideration were reported from the Pannonian Lowland.

The first (in the season) bird caught in the Czech Republic in the analysed sample was ringed on 4 April, the last one was controlled on 29 September:

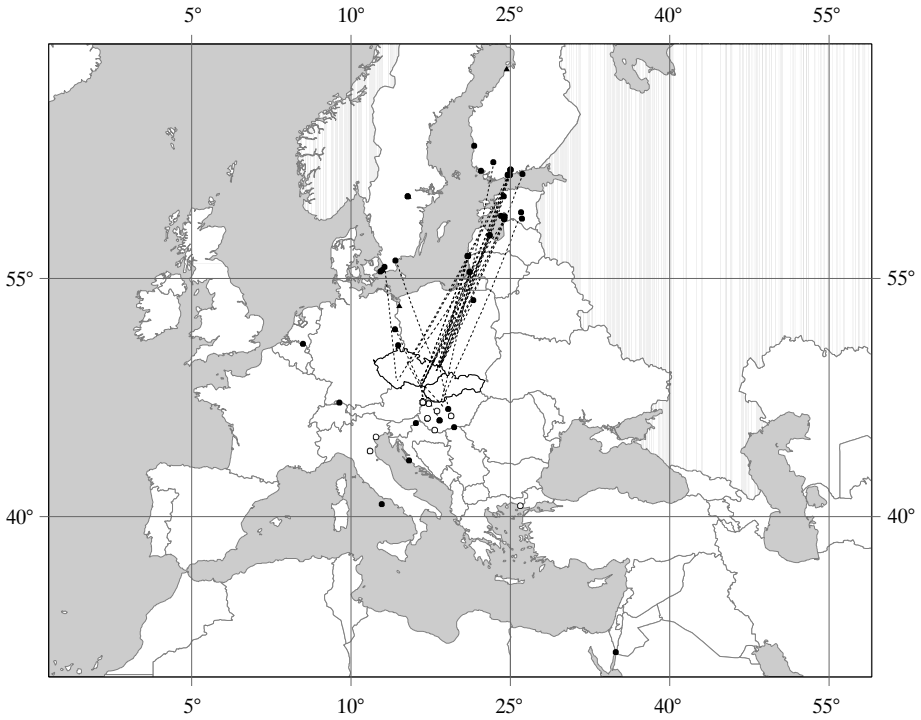

Fig. 4. Ringing sites of Sedge Warblers found in the Czech Republic and Slovakia. Filled circles – ringing sites of birds ringed and found out of the breeding season, open circles – ringing sites of birds ringed out of the breeding season and found breeding, triangles – ringing sites of birds ringed breeding, dashed lines – direct migration.

M 937175 *ad.* 4 Apr. 1984 Velký Dvůr, Břeclav, CZ (48°58'N, 16°32'E)
6 Aug. 1984 *ibidem*
N 341996 *imm.* 25 Aug. 1991 Žehuň, Nymburk, CZ (50°08'N, 15°18'E)
29 Sept. 1991 *ibidem*

The post-breeding movements can begin quite early (bird T 294719 – see *Philopatry and natal dispersal*). In mid-May, the Sedge Warblers from Fennoscandia still migrate through central Europe to their breeding grounds:

STOCKHOLM
1793365 *imm.* 27 Aug. 1975 Falsterbo, Skåne, S (55°23'N, 12°50'E)
15 May 1976 Hor. Čermná, Ústí n/O, CZ (49°59'N, 16°34'E)
controlled 651 km SSE

MATSALU
1046905 *imm.* 02 Aug. 1988 Pöhaste, Valga, EST (58°06'N, 26°08'E)
12 May 1990 Tovačov, Přerov, CZ (49°26'N, 17°17'E)
controlled 1124 km SW

MATSALU
1307080 *imm.* 23 Aug. 1989 Lao, Pärnu, EST (58°14'N, 24°10'E)
12 May 1991 Velký Dvůr, Břeclav, CZ (48°58'N, 16°32'E)
controlled 1145 km SSW

Table 1
Countries of ringing of Sedge Warblers recovered in the Czech Republic and Slovakia ("ringed") and those of recovering individuals ringed in the Czech Republic and Slovakia ("recovered")

Country	Ringed	Recovered
Austria	19	26
Croatia	1	–
Egypt	–	1
Estonia	9	–
Finland	14	2
France	–	3
Germany	4	2
Greece	1	–
Hungary	16	16
Israel	1	–
Italy	5	5
Latvia	7	–
Lithuania	2	1
Malta	–	1
Netherlands	1	–
Norway	–	1
Poland	2	–
Russia	–	1
Slovenia	1	4
Sweden	7	1
Tunisia	–	1
Yugoslavia	1	1
Total	91	66

Although no recoveries from winter-quarters are available, one Sedge Warbler was shot in December in southern France:

M 386087 *imm.* 26 Aug. 1960 Bohdaneč, Pardubice, CZ (50°05'N, 15°40'E)
22 Dec. 1964 Bouche du Rhône, Marseille, F (43°18'N, 5°22'E)
shot 1087 km SW

DISCUSSION

Both adult and first-year Sedge Warblers showed high faithfulness to the breeding and natal site. However, one have to bear in mind that the probability of recapture differs among localities due to the variable effort of ringers. Therefore, we think that the recorded proportion of both breeding and natal dispersal can be underestimated (for detailed discussion see Perdeck 1977).

Post-fledging movements of Sedge Warblers have been poorly studied so far, because it is difficult to follow individual birds during the pre-migratory period. Juvenile dispersal in the Sedge Warbler has been documented by several authors (Grüll

and Zwicker 1982, Nielsen and Bensch 1995, Chernetsov 1998a and b); however, it is still little understood. The phenomenon of post-fledging movements is supposed to be connected with avoiding competition among conspecifics in natal site. It is thought to be important for searching for future breeding grounds, looking for a suitable pre-migratory feeding ground (Chernetsov 1998a) or creating a navigation target area (Baker 1993). Nielsen and Bensch (1995) suggested that during the dispersal, juvenile Sedge Warblers move slowly through their preferred habitat predominantly in the general migratory direction. Our data show, however, that juvenile Sedge Warblers disperse in all directions, not only towards south, but also towards north (as previously shown by Grüll and Zwicker 1982 and Chernetsov 1998b). In the pre-migratory period, Sedge Warblers exploit food resources that are unpredictable and patchily distributed in space and time (Bibby *et al.* 1976, Bibby and Green 1981, Chernetsov and Manukyan 2000). Juvenile dispersal may thus enable young birds to find a suitable fattening locality before the onset of migration. A recovery of the bird on post-fledging movement (S 152596) at the age of 35 days in our sample is in good accordance with results of Mukhin (1999), who found that the average age at onset of nocturnal restlessness in juvenile Reed Warblers *(Acrocephalus scirpaceus)* is 36 days.

The autumn migration direction of central European Sedge Warblers is between SW and SE (Zink 1973). While western European and Scandinavian populations fly to West Africa, birds originating from the eastern Baltic region and eastern Europe winter in central and eastern Africa (Koskimies 1991). This pattern of directional preferences is also supported by recent orientation experiments carried out by Trocińska *et al.* (2001). As shown by recoveries of birds breeding in the Czech Republic and Slovakia, Sedge Warblers from this territory migrate southwards (including both south-west and south-east directions); recoveries from the Mediterranean are extended from north-eastern Italy to north-eastern Greece and Egypt. Recoveries of birds ringed on migration show even broader dispersion from France to Israel. This pattern of recoveries differs from that obtained by Literák *et al.* (1994). In this paper, ringing recoveries of birds caught in the north-easternmost part of the Czech Republic are investigated and it is demonstrated that this region is situated along the migration route of eastern Baltic populations which head in a narrower front (see also Koskimies and Saurola 1985). The concentration of recoveries from our sample in the Pannonian Lowland confirms the suggestion of Gyurácz and Csörgő (1994) that this area is an important stopover site for this species in central Europe.

European populations of Sedge Warblers winter in sub-Saharan Africa southerly of 17°N (Cramp 1992). Exceptionally, this species has been recorded in winter also in Israel and Egypt (Koskimies 1991). The only winter record in our sample, a Sedge Warbler shot in December in southern France, suggests that this species can occasionally make attempts to stay in southern Europe during winter similarly as recorded by Nissardi (1998) in the Reed Warbler. Possible confusion of the Moustached Warbler (*Acrocephalus melanopogon*), a species that winters in the Mediterranean region (Leisler 1973), with the Sedge Warbler seems to us quite improbable.

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