

The Age of the Great Reed Warbler, *Acrocephalus arundinaceus* (L.) (Sylviidae), Cannot be Determined after the Complete Moult

Thomas O. Mero^{*} & Antun Žuljević

Nature Protection and Study Society - NATURA, Milana Rakića 20, SRB-25000 Sombor, Serbia;
E-mail: thomas.oliver.mero@gmail.com

Abstract: Previous attempts to determine the age of the great reed warbler, *Acrocephalus arundinaceus*, after the complete moult have exposed a number of uncertainties. The present study provides evidence that the age of adult birds of this species cannot be determined precisely by using the colours of the iris and the tarsus as well as by the presence or absence of tongue spots. Between 2008 and 2014, we ringed a total of 2783 individuals (1445 adults and 1338 nestlings) and 76.5% of the captured adult birds had olive-green irises. Recaptures revealed that the colour of the iris changed from olive-green to reddish-brown in 19.7% of the individuals and the change in the opposite direction was similarly frequent (21.3%). In 57.4% of the cases, the iris colour remained constant throughout the years. As the nesting season progressed, the colour of the tarsus changed from bluish-grey to flesh-pink, while the presence or absence of tongue spots did not display any trend. The most frequent combinations were an olive-green iris, a bluish-grey or flesh-pink tarsus and the presence of tongue spots. In birds of exactly known age (ringed as nestlings; n = 25), the combinations of the three variables varied strongly. Furthermore, the changes in the three variables did not demonstrate any relationship with the increasing age of the individuals. Our results suggest that these criteria may not be suitable for age determination, and a more reliable method is needed. At the same time, we advise that aging criteria should be verified in advance for birds of exactly known age before applying them to unknown individuals.

Keywords: ageing, iris colour, tarsus colour, tongue spots, *Acrocephalus arundinaceus*

Introduction

The aging of birds is important when migration, nesting or moulting is studied. For some species, reliable age determination after the complete moult in the field is not possible, e.g. in the cases of the Hawfinch, *Coccothraustes coccothraustes* (L., 1758), long-tailed tit, *Aegithalos caudatus* (L., 1758) and Eurasian tree sparrow, *Passer montanus* (L., 1758) (SVENSSON 1992). In some species, the colour of the iris (e.g. KUSCHERT 1980, NEWTON, MARQUIS 1982, PICOZZI 1981), the tail edges (e.g. SVENSSON 1992), the wing length (e.g. PICOZZI 1981) or the coverts (e.g. KING, MUDDERMAN 1995) can occasionally be used as marks for determining the age after the complete moult. However, there are species, such as the *Acrocephalus* warblers, whose age after the complete moult is difficult to determine and therefore it

is not recommended. However, juvenile and adult *Acrocephalus* warblers can readily be distinguished as described by BRENSING (1985).

In the last two decades, there have been several attempts to determine age in the great reed warbler, *Acrocephalus arundinaceus* (L., 1758), after its complete moult (BENSCH *et al.* 1998, PROCHÁZKA *et al.* 2012). Both BENSCH *et al.* (1998) and PROCHÁZKA *et al.* (2012) took into account three variables (based on experiences with the reed warbler, *A. scirpaceus* (Hermann, 1804), see KARLSSON *et al.* 1988): the colours of the iris and the tarsus and the presence or absence of tongue spots. Using these three variables, BENSCH *et al.* (1998) built a score system which was suggested for a more precise age determination of the great reed warbler. The same method was later used by PROCHÁZKA *et al.* (2012).

^{*}Corresponding author: thomas.oliver.mero@gmail.com

In the present study, we investigated the colours of the iris and the tarsus, and the presence or absence of tongue spots as characteristics used for determining age in the great reed warbler after the complete moult. The aim of this paper was to present the results based on our large dataset over a long period. Our results suggested that the use of these three variables after the complete moult could not be recommended for reliable age determination in this species. With this study, we wish to draw the attention of ringers and field ornithologists to the fact that the aging of the great reed warblers should be handled carefully.

Methods

The study was performed in the region of Sombor (45° N, 19° E) in North-western Serbia. Our study sites were spread in reed habitats over an area of 1178 km². The individual marking of great reed warblers by colour rings was carried out on nine mining ponds, an overall of 9.3 km length of large canals and an overall 116.0 km length of small canals. For a more detailed description of the reed habitats, see MÉRŐ, ŽULJEVIĆ (2014), MÉRŐ *et al.* (2014) and MÉRŐ *et al.* (*in press*). The field-work was conducted in the breeding seasons April - July of 2008-2014.

Great reed warblers were attracted with male songs played from mobile devices and captured using mist nets. During the seven years (2008-2014) we ringed a total of 2783 individuals: 1445 adults and 1338 nestlings. In addition, we recorded the colour of the iris for every captured adult individual following the score system: olive-green – a point score of 2, intermediate – a point score of 1, or reddish-brown – a point score of 0. During the breeding seasons of 2013-2014, we recorded additionally the colour of the tarsus (bluish-grey – a point score of 1 or flesh-pink – a point score of 0) as well as the presence (a point score of 1) or absence (a point score of 0) of tongue spots in 678 individuals. The various categories for the three variables were assigned following PROCHÁZKA *et al.* (2012). The colours of the iris and the tarsus were determined in indirect light (SVENSSON 1992). To avoid any potential observer-related variation in determining the characteristics, one of the authors (T.O.M.) checked all of the birds. In this paper, we report results exclusively on nesting great reed warbler individuals. For each territorial male, the mist net was set near the nest or nesting territory. Females were captured rather accidentally when defending the nest. The individuals colour-ringed in April and May were checked by identifying the colour ring in June with the aid of binoculars or a camera (mainly singing males).

A total of 172 individuals were recaptured (on 257 occasions) in the same year, while a total of 122 individuals were recaptured in different years (on 221 occasions). However, since the times that elapsed between captures and recaptures in the same year were short (at most 10 days) and no changes in the three variables were recorded, in these short periods, we excluded these recapture data from the analyses. In the case of individuals recaptured in different years, we report the numbers of great reed warblers with changing or with constant iris colour. Linear regression was applied to test the relationship between the colour of the tarsus and the presence or absence of tongue spots with the advance of the nesting season in both captured and recaptured individuals in 2013 and 2014. The change in tarsus colour in the recaptured individuals (n = 26) between the nesting seasons in 2013 and 2014 was tested using t-test. Additionally, we provided information on the combinations of the three variables in individuals with exactly known ages (ringed as nestlings); these were denoted by coding ranging from 2K to 5K (e.g. 2K corresponds to a bird in the second calendar year). Linear regression was applied to investigate the potential relationships between the three variables and age. Both sexes were included in the analyses, but not separately because of the low number of female recoveries (n = 26). Statistical analyses were performed using SPSS statistical software.

Results and Discussion

Individuals of unknown age

Altogether, we recorded 12 combinations of the three variables, with frequencies varying from 0.4% to 32.9%. The most frequent combinations were an olive-green iris, with a bluish-grey or flesh-pink tarsus and presence of tongue spots (Table 1). In 76.5% of the birds the iris was olive-green, while in 21.1% it was intermediate and in 2.4% it was reddish-brown (Table 1).

A change in colour of the iris was recorded in 52 individuals recaptured one or more times between 2008 and 2014. In 19.7% of the individuals the colour changed from olive-green through intermediate to reddish-brown, but a change in the opposite direction was similarly frequent (21.3%). In 1.6% of the individuals the colour of the iris changed, but then changed back to the initial colour. In 70 of the individuals (57.4%) the colour of the iris was constant throughout two, three or four years; in 40.2% of these cases it was olive-green, in 4.9% intermediate and in 8.2% reddish-brown. In contrast to our findings, BENSCH *et al.* (1998) and PROCHÁZKA *et al.* (2012) reported no such trends, and they con-

sidered olive-green iris to be a typical juvenile feature appearing mainly in the second calendar year, while a reddish-brown iris was considered an adult characteristic, mainly present in birds in the third calendar year or older. A reverse iris colour change was reported for the red-billed oxpecker, *Buphagus erythrorhynchus* Stanley, 1814, but when the bird was kept in a holding bag, the yellow colour then changed back to red (RAJMAKERS, ELLMER 2009). This suggested that the colour of the iris in some bird species might change back when affected by certain environmental factors.

As the nesting season progressed (2013-2014), the colour of the tarsus tended to change from bluish-grey to flesh-pink (linear regression, $F_{1,677} = 86.142$, $p < 0.0001$). In the case of recaptured individuals this depended on the times of capture in 2013 and recapture in 2014, i.e. the early or the late stage of the nesting season. The change from bluish-grey to flesh-pink was occurring most likely when the recordings in the early stage of the nesting season in 2013 and after recapturing in the late stage of the nesting season in 2014 were compared (paired t-test, $t_3 = 14.273$, $p = 0.0010$). However, the presence or absence of tongue spots was independent of the progress of the nesting season ($F_{1,677} = 0.081$, $p = 0.776$; Table 2). In contrast with our findings, PROCHÁZKA *et al.* (2012) reported that a bluish-grey tarsus and the presence of tongue spots are typical of juvenile birds, and that the tarsus changed to flesh-pink and the tongue spots disappeared in adult birds.

Individuals of exactly known age

Great reed warblers with olive-green iris were found for all four calendar ages that occurred, while an intermediate iris was observed in the 2K, 3K and 4K birds and a reddish-brown iris only in the 2K group (Table 2). Although the most frequent iris colour in the 2K birds ($n = 9$) was olive-green, we found two individuals with an intermediate and one with reddish-brown iris. Similar considerable variation in iris colour of individuals within the same calendar year was reported earlier in the sparrow hawk (NEWTON, MARQUISS 1982). In 33% of our 2K individuals, the combination of the variables reflected the typical juvenile character (Table 2) proposed by PROCHÁZKA *et al.* (2012). However, in 25% of 2K individuals the tarsus colouration and the tongue spots displayed the adult pattern (Table 2). Both tarsus colours and both the presence and absence of tongue spots were detected in both the 3K and the 4K birds, whereas in the 5K individual the three variables displayed the typical juvenile pattern described by PROCHÁZKA *et al.* (2012) (Table 2). The iris and tarsus colours and tongue spot scores varied

Table 1. Proportion of great reed warbler with different combinations of the colours of the iris and the tarsus and the presence or absence of tongue spots

Colour of the iris	Colour of the tarsus	Tongue spots	Number of individuals	Proportion %
olive-green	bluish-grey	present	223	32.9
		absent	59	8.7
	flesh-pink	present	159	23.5
		absent	77	11.4
intermediate	bluish-grey	present	44	6.5
		absent	19	2.8
	flesh-pink	present	44	6.5
		absent	36	5.3
reddish-brown	bluish-grey	present	4	0.6
		absent	5	0.7
	flesh-pink	present	3	0.4
		absent	5	0.7
Total			678	100

Table 2. The colours of the iris and the tarsus, and the presence or absence of tongue spots in the great reed warblers with exactly known age, in third or in higher calendar year

In calendar year	Colour of the iris	Colour of the tarsus	Tongue spots	Number of individuals
2K	olive-green	bluish-grey	present	4
			absent	2
		flesh-pink	present	2
			absent	1
	intermediate	bluish-grey	present	2
	reddish-brown	bluish-grey	present	1
3K	olive-green	bluish-grey	present	2
			absent	2
		flesh-pink	present	3
	intermediate	flesh-pink	present	1
4K	olive-green	bluish-grey	absent	1
	intermediate	bluish-grey	present	2
		flesh-pink	present	1
5K	olive-green	bluish-grey	present	1

in similar manner in the four age categories (Fig. 1), indicating that the changes in the three variables did not reveal any particular trend with increasing age, but were independent of age (iris colour: linear regression, $F_{1,23} = 0.142$, $p = 0.710$; tarsus colour: $F_{1,23} = 0.001$, $p = 0.970$; tongue spots: $F_{1,23} = 0.086$, $p = 0.773$). This was in contrast with the findings of PROCHÁZKA *et al.* (2012), who found that the tongue spots disappeared rapidly in the first year, while the colour of the iris and tarsus changed more slowly.

PROCHÁZKA *et al.* (2012) also tested whether the scores of the three variables or the changes in the scores during aging differed between sexes. The

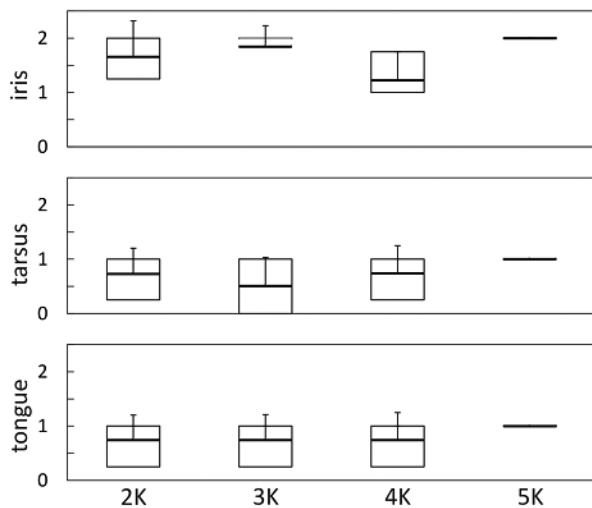


Fig. 1. The number of scores for colours of the iris and the tarsus, and the presence or absence of tongue spots in each age category (calendar year). The thick line indicates the median, the box delimits 25th and 75th percentiles

scores did not differ between males and females, but the “juvenile pattern” disappeared more quickly in males than in females. Of the 25 individuals whose exact age was known in our study, five were females, and their scores tended to display a similar pattern as in males: an olive-green iris, a bluish-grey tarsus and absent tongue spots in two 3K individuals; an olive-green iris, a bluish-grey/flesh-pink tarsus and tongue spots present in one 2K and one 3K individual; and an intermediate iris, a flesh-pink tarsus and tongue spots present in a 4K individual. The results of both our study and that of PROCHÁZKA *et al.* (2012) suggested that there is little difference in the mean

References

- BENSCH S., D. HASSELQUIST, B. NIELSEN, B. HANSSON 1998. Higher fitness for philopatric than for immigrant males in a semi-isolated population of Great Reed Warblers. – *Evolution*, **52** (8): 877-883.
- BRENSING D. 1985. Alterskennzeichen bei Sumpf- und Teichrohrsänger (*Acrocephalus palustris*, *A. scirpaceus*): Quantitative Untersuchung. – *Journal of Ornithology*, **126** (2): 125-153. (In German, English summary).
- KARLSSON L., PERSSON K., WALINDER G. 1988. Åldersbestämning av rörsångare *Acrocephalus scirpaceus* med hjälp av irisfärg, tarsfärg och tungfläckar. – *Vår Fågelvärld*, **47** (3): 141-146. (In Swedish).
- KING J. R., J. L. MUDDERMAN 1995. Ageing and sexing Marsh Tits *Parus palustris*. – *Ringing and Migration*, **16** (3): 172-177.
- KUSCHERT H. 1980. Zungenfleckung und Irisfarbe als Alterskennzeichen beim Teichrohrsänger (*Acrocephalus scirpaceus*). – *Vogelwarte*, **30**: 214-218. (In German).
- MÉRŐ T. O., A. ŽULJEVIĆ 2014. Effect of reed quality on the breeding success of the Great Reed Warbler *Acrocephalus arundinaceus* (Passeriformes, Sylviidae). – *Acta Zoologica Bulgarica*, **66** (4): 511-516.
- MÉRŐ T. O., A. ŽULJEVIĆ, K. VARGA, R. BOCZ, S. LENGYEL 2014. Effect of reed burning and precipitation on the breeding success of Great Reed Warbler, *Acrocephalus arundinaceus*, on a mining pond. – *Turkish Journal of Zoology*, **38** (5): 622-630.
- MÉRŐ T. O., A. ŽULJEVIĆ, K. VARGA, S. LENGYEL *in press*. Habitat use and nesting success of the Great Reed Warbler (*Acrocephalus arundinaceus*) in different reed habitats in Serbia. – *The Wilson Journal of Ornithology*.
- NEWTON I., M. MARQUISS 1982. Eye colour, age and breeding performance in Sparrowhawks *Accipiter nisus*. – *Bird Study*, **29** (3): 195-200.
- PICOZZI N. 1981. Weight, wing length and iris colour of Hen Harriers in Orkney. – *Bird Study*, **28** (2): 159-161.
- PROCHÁZKA P., V. JELÍNEK, M. POŽGAYOVÁ, M. HONZA 2012. How to age Great Reed Warblers (*Acrocephalus arundinaceus*) after complete moult. – *Sylvia*, **48**: 57-73. (In Czech, English summary).
- RAIJMAKERS, J. M. H., A. ELLMER 2009. Eye colour change in the Red-billed Oxpeckers. – *Afring News*, **38**: 19-21.
- SVENSSON L. 1992. Identification guide to European passerines. Fourth, revised and enlarged edition. Stockholm: Lars Svensson, 31-33.

Received: 30.01.2015

Accepted: 23.06.2015