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MONITORING OF THE ARRIVAL TIME IN THE BARN SWALLOW (*HIRUNDO RUSTICA*) POPULATION FROM MOKRICE VILLAGE (CROATIA), 1980–2011

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This paper shows the results of observed barn swallow *Hirundo rustica* arrival from wintering in Africa, south of the Sahara, to the nesting area in the village Mokrice (northwestern Croatia). The local barn swallow population was monitored for three decades (1980–2011). Although there have been constant fluctuations in date of spring arrival, there was no significant change in the trend of the arrival time. Spring air temperature (March–April), measured at a nearby meteorological station, showed a trend of significant increase in the average temperature by approximately 2.2 °C in the same period.

Key words: barn swallow, arrival date, spring temperature, long–term trend

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Izloženi su rezultati opažanja u dolasku lastavica (*Hirundo rustica*) sa zimovanja iz Afrike južno od Sahare na područje gniježđenja u selo Mokrice (sjeverozapadna Hrvatska, Hrvatsko zagorje) u razdoblju od 1980. do 2011. godine. Iako su zabilježene stalne fluktuacije u datumu proljetnog dolaska, utvrđeno je da nije došlo do promjena u trendu vremena dolaska. Oscilacije temperature proljetnih mjeseci (ožujak–travanj) u najbližoj meteorološkoj postaji ukazuju na trend porasta prosječne temperature za otprilike 2,2 °C u istom razdoblju.

Ključne riječi: lastavica, povratak sa zimovanja, proljetna temperatura, trend

INTRODUCTION

Earth's climate is changing (IPCC, 2007). Over the last fifteen years, a large number of researches showing a correlation between climate change and changes in biological phenomena have been published (e.g. Walther *et al*., 2002; Parmesan & Yohe, 2003; Root *et al*., 2003; Parmesan, 2006). Increasing evidence indicates that climate fluctuation has consequences on avian phenology. One of the best documented responses includes earlier spring migration (e.g. Tryjanowski *et al*., 2002; Kralj & Dolenec, 2008). Effects of climate change on migration phenology has been recorded for short-distance migratory birds and also for long-distance migratory birds (e.g. Crick *et al*., 1997). Several papers documented differences within species in responding to climate change with arrival data (Rubolini *et al*., 2007; Sparks & Braslavská, 2001) Impacts on morphology (e.g. Yom-Tov, 2001), breeding date (e.g. Dolenec *et al*., 2011) population dynamics (e.g. D'Alba *et al*., 2010), clutch size (e.g. Møller, 2002), egg size (e.g. Tryjanowski, 2004), brood size (e.g. Dolenec, 2009) and distributions (e.g. Thomas & Lennon, 1999) have also been demonstrated. According to Jiguet *et al.* (2010), species are not equally at risk when facing cli-

mate change. Whether they are positively or negatively affected depends on many species-specific features.

The barn swallow is a small, insectivorous, socially monogamous long–distance migrant bird species (Cramp, 1998) and common breeding species in northwestern Croatia (Dolenec, 2002; 2003). The main aim of this paper is to describe the potential change in migration date of the barn swallow and identify he relationship between average spring air temperatures and arrival date.

MATERIAL AND METHODS

The local barn swallow population was monitored for three decades (1980–2011) in Mokrice village (250 houses and more than 400 other buildings; 46°00′ N, 15°55′ E; 140 m.s.a.l.), in northwestern Croatia. Arrival date for each year was calculated as the mean of the first five bird arrivals recorded for that year (only the birds that entered the local barns were recorded). This method was previously used by Both *et al*. (2005). Dates were converted to numerical values such that no 1 refers to 1st March. Mean temperature was calculated from the mean temperatures for March and April (months corresponding with migration period of the species). Local air temperature (1980–2011) was obtained from the weather station at Maksimir – Meteorological Office in Zagreb (ca. 20 km the centre of the study area, 123 m.s.a.l.); March–April, mean = 9.1 ± 1.33 °C, range = 6.5 to 11.5 °C; separately: March, mean = 6.7 ± 2.02, range = 1.7 to 10.3 °C and April, mean = 11.4 ± 1.55 °C, range = 8.2 to 14.5 °C. Local temperatures have been commonly used in different phenological studies (e.g. Sokolov *et al*., 1998; Hušek & Adamík, 2008; Dolenec & Dolenec, 2010a; 2010b).

After Kolmogorov-Smirnov test we used Pearson`s coefficient in statistical analyses. All statistical tests were two-tailed, and the differences were considered significant at $p < 0.05$. All statistical analyses were performed with SPSS.

RESULTS AND DISCUSSION

Mean first arrival date was 31st March (range = 23rd March to 09th April; SD = 4.29) (1980–2011). There was no significant correlation between average first arrival date and the entire research period (Fig. 1) (Pearson's coefficient $r = 0.005$, $p = 0.979$, $N = 32$; slope (linear regression) = 0.002). During the 32 years of study, local spring air temperatures (March–April) have significantly increased by approximately 2.2 °C in the arrival period (Fig. 2) ($r = 0.497$, $p = 0.004$, $N = 32$; slope = 0.07). Correlation between spring temperatures and first arrival date was not significant ($r = – 0.231$, $p = 0.205$, $N = 32$; slope = – 0.75).

The local population of the barn swallow in northwestern Croatia did not advance arrival date like the house martin (*Delichon urbica*) (Dolenec & Dolenec, 2011a). Non-significant trends in the barn swallow were also reported in the recent decade by several authors (e.g. Stervander *et al*., 2005; Sokolov & Gordienko, 2008). However, several authors demonstrated significant earlier trends (e.g. Rubolini *et al*., 2007; Biaduń *et al*., 2011) and Sparks & Braslavská (2001) illustrated significant later arriving.

Generally, in several bird species earlier breeding is evidently facilitated by warm springs (e.g. Dunn, 2004; Hušek & Adamík, 2008; Dolenec & Dolenec, 2011b; Dolenec *et al*., 2012) and earlier clutch initiation date is associated with larger clutch size and more young fledged (e.g. D'Alba *et al*., 2010). Thus, birds might be expected to migrate earlier in spring to take advantage of this opportunity (Mills, 2005). However, despite the

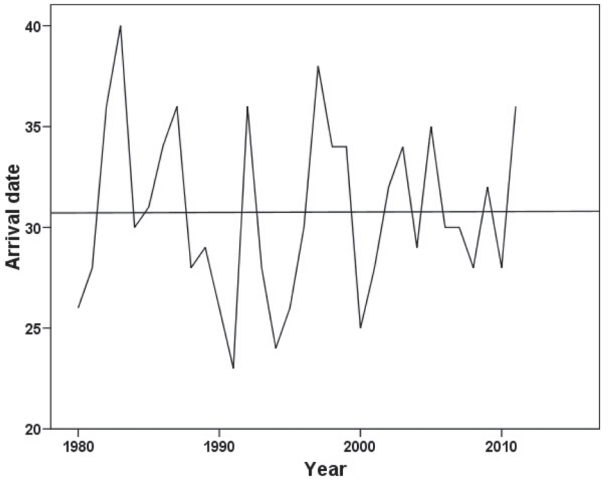

Fig. 1. Long–term trends in mean first arrival dates of the barn swallow (*Hirundo rustica*) in northwestern Croatia, 1980–2011 (1 = 1 March).

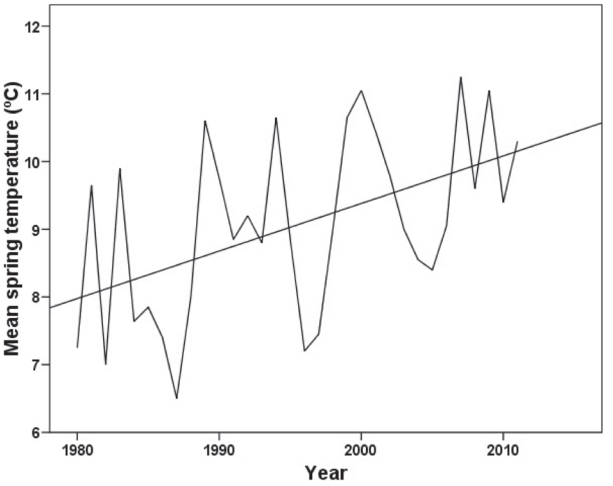

Fig. 2. Correlation between mean spring temperatures (March–April) and year in northwestern Croatia, 1980–2011.

warmer springs, arrival date of the barn swallow population in the research area did not change during the last three decades; however, breeding does start earlier (Dolenec *et al*., 2009). Further research into the connections between the arrival date, laying date and maximal food abundance is needed to give the explanation for this relation between climate change and bird phenology.

According to Newson *et al*. (2009), choosing and developing indicators of the impacts of climate change on migratory species is a challenge, particularly with endangered species, which are subject to many other pressures. To identify and implement conservation measures for these species, indicators must account for the full ensemble of pressures, and link to a system of alerts and triggers for action.

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SAŽETAK

Praćenje povratka sa zimovanja populacije lastavice (*Hirundo rustica*) iz Mokrica (Hrvatska), 1980–2011

Z. Dolenec

Sve više znanstvenih članaka sugerira da klimatske promjene posljednjih desetljeća izravno ili neizravno utječu na živi svijet, posebice se to odnosi na fenologiju. Od klimatskih parametara naglasak je na temperaturi, što proizlazi iz brojnih radova posebice inozemnih, ali i domaćih autora. Odgovor organizama na porast proljetnih temperatura posljednjih desetljeća varira između vrsta, unutar vrsta te između različitih područja. Tako rezultati ovog rada ne pokazuju utjecaj porasta proljetne temperature na povratak (proljetnu selidbu) na području sjeverozapadne Hrvatske, dok se primjerice u Italiji lastavice vraćaju sve ranije toplijih proljeća.