Breeding Barn Swallows *Hirundo rustica* on organic and conventional arable farms in the Netherlands

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Abstract Populations of farmland birds are under pressure as a result of agricultural intensification. It has been proposed that less intensive approaches to farming, such as organic farming methods, may halt these population declines. In addition, organic farmers may have a more positive attitude towards nature and the environment which can possibly also have positive effects on the populations of breeding birds. We have compared the attitude of conventional and organic farmers towards the presence of Barn Swallows *Hirundo rustica* and the abundance of breeding Barn Swallows on organic and conventional arable farms in the Netherlands. We found that the abundance of breeding Barn Swallows did not differ between these two types of farms and that both organic and conventional farmers had a positive attitude towards the presence of Barn Swallows on their farms. Our results show that organic farming does not attract more Barn Swallows. However, agricultural intensification could have resulted in lower breeding success and, consequently, population declines, although there may be other contributory factors as well.

Keywords Agricultural intensification · Arable farming · Barn Swallow · Farmers' attitude · Organic farming

Introduction

Populations of farmland birds have been in steep decline for a number of decades (Siriwardena et al. 1998; Donald et al. 2006). As a result of these declines, species such as Skylark *Alauda arvensis*, Corn Bunting *Miliaria calandra* and Grey Partridge *Perdix perdix* have been put on Red Lists in several European countries (van Beusekom et al. 2004; Gärdenfors 2005). New developments on the world market, such as increased demands for cereals and biofuels, are likely to further intensify agriculture and possibly escalate the decreasing trend in farmland bird populations.

Barn Swallow *Hirundo rustica* is a typical bird species of agricultural areas, including grassland areas and arable areas. Similar to other farmland birds, Barn Swallow populations have been declining in recent decades in large parts of Europe (BirdLife International 2004), with possible causes being related to conditions in breeding grounds, migration and conditions at wintering quarters. Agricultural intensification has contributed to reduced populations in several ways. First, increased pesticide use and reduced grazing livestock is associated with a reduction in the number of invertebrates (Vickery et al. 2001; Benton et al. 2002). A reduction in food availability during the breeding season can reduce the breeding success (e.g. Hart et al. 2006). Secondly, especially in arable areas, farm specialisation may be a major cause of Barn Swallow population declines (Evans and Robinson 2004). Environmental conditions have been shown to have great impact on Barn Swallow populations, particularly in overwintering habitats and during migration (Baillie and Peach 1992).

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If agricultural intensification can be considered to be a major factor causing Barn Swallow population declines, it may be assumed that less intensive farming methods, such as organic farming, should be beneficial to such populations. We have carried out a study aimed at determining whether this assumption is valid. To this end, we have compared the abundance of breeding Barn Swallows on organic and conventional arable farms. We have also assessed the attitudes of conventional and organic farmers towards the presence of Barn Swallows. As respect for and conservation of the environment, nature and landscape have a central place in the philosophy of organic farming (IFOAM 2005), it has been hypothesised that organic farmers are more positive towards the presence of Barn Swallows than conventional farmers. This may result in better habitat conditions for Barn Swallows on organic farms and, consequently, in higher numbers of breeding Barn Swallows.

Materials and methods

The study was carried out on 40 arable farms in the province of Flevoland in the Netherlands (approximate location 52°32'N, 05°46'E) in the spring of 2005. Conventional farms were somewhat larger than their organic counterparts, but the difference was not significant [conventional 40 ha, organic 36 ha; paired-samples *t* test $t = 1.062$, $df = 19$, nonsignificant (NS)]. Farms were selected according to a pairwise set-up, with each pair consisting of one organic and one conventional farm. Farms of one pair were at least 600 m apart from each other. Conventional farms were never adjacent to an organically managed farm, including organic farms that were not included in this study. Dominant crops grown in the area are winter cereals, potatoes, sugar beet and onions. All organic farms have been managed organically for at least 5 years. Conventional farms applied pesticides and artificial fertilisers, while on organic farms the weeds were removed mechanically and, occasionally, biological pesticides or natural enemies were used to fight insect pests. Only manure was used on organically managed farms—instead of artificial fertilisers. The pairing procedure was based on the surrounding landscape, which was similar for both farms in a pair. Farm differences, such as crop rotation scheme and abundance of non-crop habitats (e.g. field margins, hedgerows), were not included in the pairing procedure as these are direct effects of differences in farm management. Organic farms grew more spring cereals than conventional farms and also grew a large variety of crop types. Relatively more potatoes, sugar beet and winter cereals were grown on conventional farms (see also Kragten and de Snoo 2008). Organic farms had somewhat

more non-crop habitat compared to conventional farms (4.4 vs. 3.6%, respectively, of farm area), but this difference was not significant (Wilcoxon $Z = 1.717$, NS). Woody elements (e.g. trees, hedgerows), which are of important to foraging Barn Swallows during bad weather circumstances, were present on all farms as tree lines around the farmyards. Some organic farms had a few small solitary trees between fields.

In June 2005, each farm was visited once to count “occupied” nests. All buildings were checked on the inside and the outside. Both farms of a pair were visited on the same day. Differences between organic and conventional farms in terms of the number of occupied nests were analysed using the Wilcoxon matched pair test. Farmers were asked to react to a statements included in a short questionnaire, which was designed to provide a picture of farmers’ attitudes towards Barn Swallows. The questionnaire included the following statements:

1. Barn Swallows are part of my farmyard.
2. Presence of nesting Barn Swallows is a risk for food hygiene.
3. Presence of Barn Swallows is hindering due to their droppings on windows, terrace, cars etc...
4. I always notice when Barn Swallows have returned.

Each statement could be given a score ranging from 1 to 5, with 5 reflecting the most positive attitude towards swallows. Differences in the attitudes of organic and conventional farmers were analysed using the Mann–Whitney test.

Results

At least one Barn Swallow nest was found on 60% of farms, with 65% of organic farms having Barn Swallow nests and 55% of conventional farms. Farm occupancy rates did not differ between the two farm types (logistic regression $\chi^2 = 0.328$, $df = 1$, NS). A total of 99 nests were found, with 17 nests being the most found on one farm. The mean number of nests ($\pm$ standard deviation) found did not differ significantly between organic and conventional farms (organic 2.40 ± 3.38 , conventional 2.55 ± 4.50 ; Wilcoxon $Z = -0.380$, NS).

Thirty-eight questionnaires were received and analysed. One organic and one conventional farmer did not fill out the questionnaire. Based on the reactions to the statements of the questionnaire, attitudes towards the presence of Barn Swallows did not differ between organic and conventional farmers (Table 1). Both organic and conventional farmers appeared to be generally positive towards the presence of Barn Swallows, and their presence was not viewed as a risk for food hygiene.

Table 1 Attitude of organic and conventional farmers towards the presence of Barn Swallows

Statement	Organic	Conventional	P
Barn Swallows are part of my farmyard	4.6 ± 0.5	4.5 ± 0.8	NS
Presence of nesting Barn Swallows is a risk for food hygiene	4.5 ± 0.7	4.0 ± 1.4	NS
Presence of Barn Swallows is hindering due to their droppings on windows, terrace, cars etc....	3.7 ± 1.2	3.7 ± 1.2	NS
I always notice when Barn Swallows have returned	4.9 ± 0.2	4.9 ± 0.5	NS

NS, Nonsignificant

Answers could be given on a scale from 1 to 5, with 5 reflecting the most positive attitude towards Barn Swallows. Values are given as the mean ± standard deviation

Discussion

The results of this study indicate that organic and conventional arable farms are both equally suitable as nesting sites for Barn Swallows. The mean number of Barn Swallow nests per farm did not differ between the two farm types, and the occupancy rates of the two farm types did not differ significantly. Based on our analysis of the responses to the questionnaire, the “swallow-friendliness” of organic and conventional farmers is comparable.

Similar results were found in a study comparing breeding Barn Swallow abundance on organic and conventional dairy farms in the Netherlands (Lubbe and de Snoo 2007). However, Christensen et al. (1996) found higher numbers of Barn Swallows above organically managed fields than above conventionally managed ones. Barn Swallows feed on aerial invertebrates, and several studies have reported that invertebrate abundance is generally relatively higher on organically managed fields (Hole et al. 2005). In 2004, on the same farms as where this Barn Swallow study was carried out, aerial invertebrate abundance was found to be higher on organic farms (Kragten et al. in preparation). Barn Swallows forage above fields with the highest food abundance (Evans et al. 2007). It is therefore possible that the relatively lower food abundance on conventional farms would result in lower breeding success and chick body condition. This is one possible mechanism by which the intensification of arable farming (e.g. use of pesticides and artificial fertilisers) could have resulted in Barn Swallow population declines. Future studies should therefore focus on the effects of arable farming intensification on Barn Swallow reproduction.

As a result of a higher food abundance, it may be possible that Barn Swallow pairs breeding on organic farms are in better condition than their counterparts breeding on conventional farms. This may lead to earlier starting dates of nests on the organic farms. If this were to be the case, we could have missed some of these nests during the counts in June, particularly on farms that were investigated at the end

of the field period. This may have been the origin of some bias, although this would likely have been limited because second nests are likely to have been initiated as well.

The number of breeding swallows on a farm may be positively influenced when the farm is located next to a food rich habitat, such as an organic farm. Barn Swallows generally forage within 400 m of their nest site (Ambrosini et al. 2002). As paired farms in this study were at least 600 m apart from each other, it is unlikely that the abundance of breeding Barn Swallows on conventional farms was influenced by the possible better foraging sites on organic farms.

The Pan-European Common Birds Monitoring programme has found that the numbers of Barn Swallows have been in decline since the 1980s (−9%) and 1990s (−7%) (EBCC 2008). However, these declines are much smaller than those observed for other typical farmland birds, such as the Skylark (1980s: −49%; 1990s: −28%), Corn Bunting (1980s: −64%; 1990s: −14%) and Grey Partridge (1980s: −79%; 1990s: −56%). A British study showed that Barn Swallow population levels were not correlated with agricultural intensification, but with climatic conditions during migration instead (Robinson et al. 2003). Therefore, future studies should focus on wintering grounds and migration. At breeding grounds, more effort is needed to study the breeding success of Barn Swallows in extensively and intensively managed farmland and preferred foraging habitats. The results of such studies may provide the tools for designing effective conservation plans for Barn Swallows.

Zusammenfassung

Der Brutbestand von Rauchschwalben *Hirundo rustica* auf biologisch versus konventionell bewirtschafteten Bauernhöfen in den Niederlanden

Intensivierungen in der Landwirtschaft wirken sich auf viele Populationen von Vogelarten des Kulturlands negativ

aus. Weniger intensive Bewirtschaftungsformen wie die biologische Landwirtschaft gelten allgemein als Möglichkeit diesen negativen Populationstrend aufzuhalten. Darüber hinaus haben biologisch wirtschaftende Landwirte möglicherweise eine positivere Einstellung gegenüber der Natur und Umwelt, was ebenso einen positiven Effekt auf die Brutvögel haben könnte. Die vorliegende Untersuchung vergleicht die Einstellung der Landwirte gegenüber der Präsenz von Rauchschwalben und die Häufigkeit der Art als Brutvogel zwischen biologisch und konventionell bewirtschafteten Bauernhöfen in den Niederlanden. Die Häufigkeit brütender Rauchschwalben unterschied sich nicht zwischen biologisch und herkömmlich geführten Höfen. Sowohl biologisch als auch konventionell arbeitende Landwirte waren gegenüber der Anwesenheit der Rauchschwalben auf ihren Höfen positiv eingestellt. In der Untersuchung zeigte sich, dass sich die Rauchschwalben von der biologischen Bewirtschaftung nicht stärker angezogen fühlen. Dennoch könnte die Intensivierung in der Landwirtschaft zu einer Verringerung des Bruterfolgs und damit zu einem Populationsrückgang geführt haben, wenngleich vermutlich auch noch andere Faktoren beteiligt sind.

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