

POLISH JOURNAL OF ECOLOGY (Pol. J. Ecol.)	53	1	129-133	2005
--	----	---	---------	------

Short research contribution

Adrian SURMACKI

Department of Avian Biology and Ecology, Adam Mickiewicz University
Umultowska 89, 61-614 Poznań, Poland, e-mail: adrian@amu.edu.pl

DO DENSE AND FAST GROWING CROPS PROVIDE FORAGING HABITATS FOR INSECTIVOROUS BIRDS?

ABSTRACT: The foraging behavior of Reed Warbler (*Acrocephalus scirpaceus*), Sedge Warbler (*A. schoenobaenus*) and Marsh Warbler (*A. palustris*) was surveyed on three crop types (spring cereals, winter cereals and oil seed rape) in western Poland. The foraging intensity was greatest in oil seed rape, while the lowest was in spring cereals. For Sedge Warbler, oil seed rape fields were visited mainly in May, while cereal fields were visited in June and July. The number of foraging visits decreased with increasing distance from a breeding marsh patch. There was no difference in distance traveled to different crop types. There was a significant negative correlation between marsh patch area and foraging intensity for all species combined. This study shows that oil seed rape may be useful as a foraging habitats for some farmland birds during the breeding season.

KEY WORDS: farmland, habitat use, crops, marsh patches

Many farmland birds whose diet is based on invertebrates forage on crops (Davies 1967, O'Connor and Shrubbs 1986, Schifferli 2001). Utilization of these habitats is especially important when provisioning nestlings (Tryjanowski *et al.* 1999, Schifferli 2001). Preferences of foraging birds vary across crop types even if they are

very similar (Delgado and Moriera 2002). In general, it has been shown that crops with a sparse and shorter structure (e.g. spring cereals) are more likely to be used (Odderskær *et al.* 1997, Morris *et al.* 2001, Schifferli 2001, Perkins *et al.* 2002). However, all species studied to date mainly search for food on the ground, often while walking on the soil surface. Studies on species representing other foraging strategies are lacking and therefore our concept of utility of particular crop types for farmland birds is incomplete.

In this paper I investigate the relative importance of three crops: spring cereals (barley, wheat), winter cereals (rye, wheat) and oil seed rape as foraging area for Reed Warbler (*Acrocephalus scirpaceus*), Sedge Warbler (*A. schoenobaenus*) and Marsh Warbler (*A. palustris*) during the breeding season. All species commonly inhabit farmland areas which contain small marsh patches and drainage ditches (Flade 1994, Surmacki 1998). The diet of their nestlings consist of small invertebrates living on above-ground vegetation (Cramp 1998) and the majority of food is searched for outside the breeding habitat (Catchpole 1972, Dowsett-Lemaire 1980). The effects of time of the season, breeding patch area and distance from

the field boundary on foraging intensity were also tested and are discussed.

Surveys took place in 1999 and 2000 in intensively cultivated farmland in Western Poland near Poznań (52°27'N, 16°57'E). Studied birds bred on 8 marsh patches between 0.14 and 9.84 ha in size surrounded by arable fields. Dominant marsh vegetation were reeds bordered with the a of hay meadows or herbaceous vegetation.

Each year, foraging birds were observed on 15 study plots (n = 30 over two years), located on fields adjacent to marsh patches. Plots were located on the following crop types: oil seed rape (n = 11), winter cereals (n = 12) and spring cereals (n = 7). Between May and July, on each plot half-hour observations were performed in 10–14 day intervals. Harvest time varied according to location and crop types, so some plots received less observations. During observation sessions “foraging flights” over a fixed part of the marsh/field border were counted. If possible, the distance of foraging bird from the marsh edge was classified to one of following ranges: 0–10 m, > 10–20 m, > 20–100 metres. Because plots varied with respect to the size and the number of breeding pairs, for each session a foraging intensity index (*FI*) was calculated. This was calculated as the mean number of flights per breeding individual standardized to 1000 m length of marsh/field boundary. Studied species are very similar in size, plumage and foraging behaviour, so some individuals were recognized only as *Acrocephalus* species. For this reason part of the analysis was done on pooled data from the three species. There was no significant difference in the intensity of foraging between 1999 and 2000 (Mann-Whitney U test, $z = -0.23$, $P > 0.05$) so data from two years were analyzed together.

Data on foraging intensity index were analyzed using a Kruskal-Wallis test. The Kellus test (Zar 1999) was used to identify significantly different groups. Frequencies of foraging flights were tested with a Chi square test. To find the relationship between intensity of foraging and patch area rank Spearman correlation was used. Statistical calculations were performed according to the rules given by Sokal and Rohlf (1995). For more details of the study area and method used see Surmacki (2001).

In total 285 foraging flights were seen. On 180 occasions (70%) birds were identified to species. The three species differed significantly in their timing of overall foraging (Chi square test, $\chi^2 = 40.54$, $df = 10$, $P < 0.01$, Fig. 1). In Reed and Sedge Warbler the highest number of foraging flights occurred in the second half of June, while in Marsh Warbler – in the first half of July (Fig. 1). In Sedge Warbler the timing of foraging on cereals and oil seed rape varied markedly (Chi square test, $\chi^2 = 24.25$, $df = 5$, $P < 0.01$, Fig. 1). Most of the foraging flights on oil seed rape were done at the beginning of the breeding season while the peak of cereal usage occurred in June (Fig. 1). In Reed and Marsh Warbler no differences between crop usage in relation to time were found (Chi square test, $\chi^2 = 7.48$, $df = 4$, $P > 0.05$ and $\chi^2 = 8.90$, $df = 5$, $P > 0.05$ respectively, Fig. 1).

The mean values of foraging intensity index (\pm SD) were 0.04 ± 0.12 (n = 154 observation sessions), 0.10 ± 0.28 (n = 164) and 0.09 ± 0.23 (n = 140) for Marsh, Sedge and Reed Warblers respectively. There were no significant differences between species in their foraging intensity (Kruskal-Wallis test, $H = 3.93$, $df = 2$, $P = 0.14$). The mean values of foraging intensity index (\pm SD) obtained for all species on spring cereals (0.79 ± 2.81 , n = 42 observation sessions), winter cereals (2.20 ± 4.35 , n = 70) and oil seed rape (3.17 ± 5.68 , n = 64) differed significantly (Kruskal-Wallis test, $H = 11.48$, $df = 2$, $P < 0.01$). Pair comparison revealed significant difference for oil seed rape and spring cereals (post-hoc Kellus test, $P < 0.01$). Differences between spring and winter cereals were close to significance level (post-hoc Kellus test, $P = 0.08$) while differences between oil seed rape and winter cereals were not significant (post-hoc Kellus test, $P > 0.05$).

In total, 197 foraging flights were classified to one of three distance band. Among them, bird species was identified in 133 cases as well. The frequency of foraging visits to three distance bands from marsh edge did not change significantly across species (Chi square test, $\chi^2 = 10.91$, $df = 4$, $P > 0.05$) and crop types (Chi square test, $\chi^2 = 7.59$, $df = 4$, $P > 0.05$). All species preferred to forage within 10 metres from the marsh edge where most observations were made (n = 99). In the

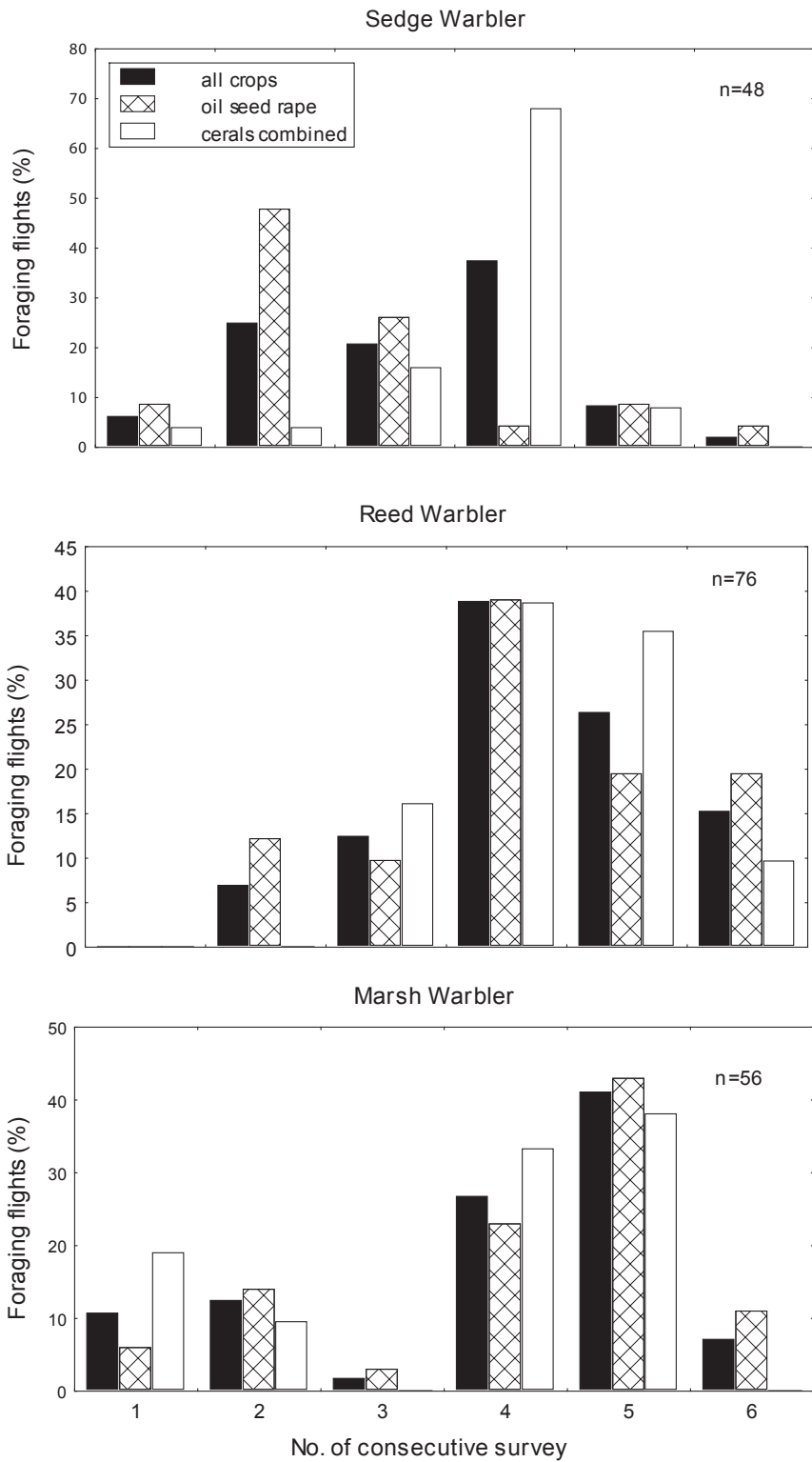


Fig. 1. Seasonal variations in the frequency of foraging of Sedge Warbler (*Acrocephalus schoenobaenus*), Reed Warbler (*A. scirpaceus*) and Marsh Warbler (*A. palustris*) on all crops combined. Number of surveys refers to following periods: 1) 1–15 May, 2) 16–31 May, 3) 1–15 June, 4) 16–30 June, 5) 1–15 July, 6) 16–31 July.

next two farther ranges 52 and 46 of foraging flights were observed, respectively. These observed values were not proportional to expected values (i.e. 20, 20 and 157 foraging flights respectively) calculated on the basis of distance ranges widths (Chi square test, $\chi^2 = 127.36$, $df = 2$, $P < 0.01$).

There was a negative relationship between patch area and intensity of foraging ($r_s = -0.37$, $P < 0.01$, $n = 176$).

Use of crops by *Acrocephalus* species showed a significant gradient from spring cereals to oil seed rape. This relation may be explained both by food abundance and its availability.

Surveys on epigenic insects in farmland in western Poland indicated that mean biomass of animals inhabiting crops was highest on oil seed rape, and lowest on spring cereals, while values recorded on winter crops were intermediate (Karg and Ryszkowski 1996). On the other hand it has been demonstrated that food availability, connected with the structure of crops, may be more important than abundance of prey items (Fuller *et al.* 1991, Odderskær *et al.* 1997, Morris *et al.* 2001, Schifferli 2001). *Acrocephalus* species catch their prey while moving on stems of reeds or herbaceous vegetation. Each species explores a slightly different vegetation zone to which it is morphologically adapted (Leisler 1975, Leisler *et al.* 1989). Considering varied structure, oil seed rape meets the requirements of all studied species. Cereals provide only vertical stalks which, through most of the season, are not stiff enough to support the weight of birds. The sequence of crop use observed in Sedge Warbler also seems to be adjusted to their development. Oil seed rape grows faster than cereals and it is also harvested earlier. On the other hand, overall timing of foraging of species correlates with timing of their breeding. Sedge Warbler arrives to breeding areas earliest, than is followed by late breeders: Reed Warbler and Marsh Warbler.

The foraging intensity was negatively correlated with the area of the breeding patch. Decisions on searching fields for food may be related with its availability within habitat island area, as suggested by Loman and von Schantz (1991). In isolated habitats, the mean density of breeding pairs increases

with decreasing "island" area. This means that, on a small island, a breeding pair has, on average, less resources compared to a pair on a big island. So, in small habitat patches there is a stronger pressure to search for food in the surroundings.

The number of foraging visits decreased with increasing distance from the marsh edge. Similar results have been recorded for other farmland passerines (Davis 1967, O'Connor and Shrub 1986, Boutin *et al.* 1999). Foraging near the marsh edge may reduce the energetic costs in food searching and reduce predation risk. In addition, crops near the marsh may be especially rich in invertebrates due to an edge effect (Karg and Kundzewicz 1992, Ryszkowski *et al.* 2002).

This study shows that for typical "gleaner" bird species, dense and tall crops like oil seed rape may be an attractive foraging habitat. Preferences of studied *Acrocephalus* warblers differ distinctly from ground-foraging species like Skylark or Yellowhammer, mainly due to different foraging strategy and microhabitats explored. Crops may be used throughout the season due to species-specific breeding phenology and crop-specific development. The close presence of oil seed rape fields may be advantageous for *Acrocephalus* species breeding in wet marginal habitats in farmland. This may be taken to account in management of cultivated fields.

ACKNOWLEDGMENTS: This paper is a part of my Ph.D. thesis. I wish to thank J. Bednorz, M. Borowiec and R. Mackowicz for their critical support. Thanks are also due to Piotr Tryjanowski for his comments and to the farmers who kindly allowed access to their land. I am especially grateful to Tim Sparks for his very constructive criticism and improvement of English.

REFERENCES

- Boutin C., Freemark K. E., Krik D. A. 1999 – Farmland birds in southern Ontario: field use, activity patterns and vulnerability to pesticide use – *Agric. Ecosyst. Environ.* 72: 239–254.
- Catchpole C. K. 1972 – A comparative study of territory in the Reed Warbler (*Acrocephalus scirpaceus*) and Sedge Warbler (*A. schoenobaenus*) – *J. Zool. Lond.* 166: 213–231.

- Cramp S. 1998 – The Complete Birds of Western Palearctic on CD-ROM – Oxford Univ. Press, Oxford.
- Davis B. N. K. 1967 – Bird feeding preferences among different crops in an area near Huntingdon – *Bird Study*, 14: 227–237.
- Delgado A., Moriera F. 2002 – Do wheat, barley and oats provide similar habitat and food resources for birds in cereal steppes – *Agric. Ecosyst. Environ.* 93: 441–446.
- Dowsett-Lemire F. 1980 – La territorialité chez la rousserolle verderolle – *Rev. Ecol. Terre Vie.* 34: 45–67.
- Flade M. 1994 – Die Brutvogelgemeinschaften Mittel- und Norddeutschlands: Grundlagen für den Gebrauch vogelkundlicher Daten in der Landschaftsplanung – IHW-Verlag, Berlin.
- Fuller R., Hill D., Tucker G. 1991 – Feeding the Birds Down on the Farm: Perspectives from Britain – *AMBIO*, 20: 232–237.
- Karg J., Kundzewicz Z. 1992 – Wstępna ocena wpływu ekotonu na wielkość biomasy owadów epigeicznych w agroekosystemach [Preliminary evaluation of the impact of ecotone on biomass of epigeic insects in agroecosystems] (In: *Produkcja pierwotna, zasoby zwierząt i wymywanie materii organicznej w krajobrazie rolniczym*, Eds. S. Bałazy, L. Ryszkowski) – Zakład Badań Środowiska Rolniczego i Leśnego PAN, Poznań, pp. 113–126.
- Karg J., Ryszkowski L. 1996 – Animals in arable land (In: *Dynamics of an agricultural landscape*, Eds. L. Ryszkowski, N. R. French, A. Kędziora) – Poznań, pp. 138–172.
- Leisler B. 1975 – Die Bedeutung der Fussmorphologie für die ökologische Sonderung mitteleuropäischer Rohrsänger (*Acrocephalus*) und Schwirle (*Locustella*) – *J. Orn.* 116: 117–153.
- Leisler B., Ley H., Winkler H., 1989 – Habitat, behaviour and morphology of *Acrocephalus* warblers; an integrated analysis – *Ornis Scand.* 20: 181–186.
- Loman J., von Schantz T. 1991 – Birds in a farmland – more species in small than large habitat island – *Conservation Biology*, 5: 176–188.
- Morris A.J., Whittingham M. J., Bradbury R. B., Wilson J. D., Krykos A., Buckingham D. L., Evans A. D. 2001 – Foraging habitat selection by yellowhammers (*Emberiza citrinella*) nesting in agriculturally contrasting regions in lowland England – *Biological Conservation*, 101: 197–210.
- O'Connor R. B., Shrubbs M., 1986 – *Farming and Birds* – Cambridge University Press, Cambridge.
- Odderskær P., Prang A., Poulsen J. G., Andersen P. N., Elmegaard N. 1997 – Skylark (*Alauda arvensis*) utilization and micro-habitat in spring barley fields – *Agric. Ecosyst. Environ.* 62: 21–29.
- Perkins A.J., Whittingham M. J., Morris A. J., Bradbury R. B. 2002 – Use of field margins by foraging yellowhammers *Emberiza citrinella* – *Agric. Ecosyst. Environ.* 93: 413–420.
- Ryszkowski L., Karg J., Kujawa K., Gołdyn H., Arczyńska-Chudy E. 2002 – Influence of landscape mosaic structure on diversity of wild plant and animal communities in agricultural landscapes of Poland. (In: *Landscape ecology in agroecosystems management*, Ed. L. Ryszkowski) – CRC Press LLC, Boca Raton, pp. 185–217.
- Schifferli L. 2001 – Birds in a changing farmland. *Acta Ornithol.* 36: 35–51.
- Sokal R.R., Rohlf F. 1981 – *Biometry*, 2nd ed. – W. H. Freeman, New York.
- Surmacki A. 1998 – Breeding avifauna of small mid-field ponds in North-western Poland. *Acta orn.* 33: 149–157.
- Surmacki A. 2001 – Foraging behavior of the Reed Bunting (*Emberiza schoeniclus*) breeding in a farmland – a preliminary results (In: *Bunting Studies in Europe*, Eds. P. Tryjanowski, T. S. Osiejuk, M. Kupczyk) – Bogucki Wyd. Nauk., Poznań, pp. 89–95.
- Tryjanowski P., Hromada M., Antczak M., 1999 – Breeding habitat selection in the Great Grey Shrike *Lanius excubitor* – the importance of meadows and spring crops – *Acta Ornithol.* 34: 59–63.
- Zar J. H. 1999 – *Biostatistical analysis*, 4th ed. – Prentice Hall, New Jersey.

(Received after revising August 2004)