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Source: Acta Ornithologica, 39(1) : 59-66

Published By: Museum and Institute of Zoology, Polish Academy of Sciences

URL: https://doi.org/10.3161/068.039.0112

ACTA ORNITHOLOGICA
Vol. 39 (2004) No. 1

Abandoned cropland as a habitat of the Whinchat *Saxicola rubetra* in SW Poland

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Orłowski G. 2004. Abandoned cropland as a habitat of the Whinchat *Saxicola rubetra* in SW Poland. Acta Ornithol. 39: 59–66.

Abstract. The study was carried out on 94 abandoned arable fields (0.1–83.5 ha) comprising a total area of 400 ha in the intensively farmed region of the Wrocław plain (54.8 km^2, SW Poland). A total of 101 Whinchat territories were found in the study area, all of them in abandoned crop fields with a well-developed layer of dried perennials from the previous year (*Tanacetum vulgare*, *Artemisia vulgaris*, *Solidago* sp.). Whinchats occupied 56 (60%) of the 94 fields surveyed. The probability of a Whinchat occupying a particular field was closely related to its size: the probability of occupation was 50% in fields of about 1.8 ha, and rose to 100% in fields larger than 13 ha. Single males occupied thirty-eight territories (37.6%). The number of Whinchat territories per occupied abandoned field lay between 1 and 14. Thirty-three fields held only a single Whinchat territory. The density of Whinchat territories was negatively correlated with the size of an abandoned field. Single males inhabited the smallest fields.

Key words: Whinchat, *Saxicola rubetra*, nature conservation, agriculture, land use, habitat island, abandoned fields, set-aside

Received — Oct. 2003, accepted — March 2004

INTRODUCTION

Over the last few years, many species of farmland birds have been disappearing from Western Europe (Tucker & Heath 1994, Chamberlain & Fuller 2000, review in Schifferli 2001, Atkinson et al. 2002). This phenomenon is mainly caused by a decrease in the diversification of the landscape linked to the elimination of uncultivated areas and changes in agricultural practices. Another factor limiting the number of birds in farmlands is the disappearance of their food sources (arthropods and naturally occurring plant species) resulting from the massive use of pesticides and specialised crops (Gates & Donald 2000, Smart et al. 2000, Robinson & Sutherland 2002).

One bird species observed to have suffered a dramatic decline in Western Europe is the Whinchat. It has stopped nesting in many intensively farmed regions and has been placed on the list of threatened species (Osieck & Hustings 1994, Tucker & Heath 1994, Lorgé 1998). The Whinchat's main habitat in Central Europe is fertile and moist meadows and pastures categorised in the *Festuco-Brometea* and *Molinio-Arrhenatheretea* classes (Glutz & Bauer 1988, Bastian & Bastian 1996, Oppermann 1999). In Europe, the Whinchat also inhabits high mountain meadows, young pine forests, railway-embankment, roadsides, bog meadows, small marshes in agricultural areas, areas degraded by human activity, newly planted tree stands in fields, heaths, and forest clear cuts (Dyrcz et al. 1990, Theiss 1993, Bastian & Bastian 1996, Cramp 1996, Tryjanowski 1996, Kujawa 2000, Pudil 2001, own data).

There has not been much information in the literature to date on the occurrence of Whinchats in abandoned agricultural fields in Western Europe (Brandl & Walberer 1982, Theiss 1993, Bastian & Bastian 1996). The relatively abundant nesting of Whinchats in abandoned agricultural fields has been reported recently in Poland

(Tryjanowski 1996, Dombrowski & Goławski 2002, Kleinschmidt 2003). Of 955 individual Whinchat territories described in Germany and Austria, 124 (13%) were found in abandoned agricultural fields (Bastian & Bastian 1996).

Some of the main reasons named in the disappearance of the Whinchat population are extensive drainage and changes in the environment caused by drainage activities as well as the disappearance of extensively used meadows and pasture lands (Bastian & Bastian 1996, Oppermann 1999). Whinchat numbers are considered stable in Poland by studies of this species' population in Europe. About 150 000 to 300 000 Whinchat pairs are estimated to be breeding in Poland (Tucker & Heath 1994, Bastian & Bastian 1996). Some authors (e.g. Tryjanowski 1995) point to a tendency towards a decline in Whinchat numbers in Poland.

The aims of this study were: 1) to determine the influence of abandoned of agricultural land on the abundance and distribution of the Whinchat breeding in large-scale farmed area; 2) to define the role of single males in the population studied, and 3) to formulate initial recommendations and methods to protect the Whinchat in areas of intense agricultural activity.

STUDY AREA

Research was conducted in the western and southern parts of the township of Święta Katarzyna, bordering the city of Wrocław (SW Poland). The size of the total study area was 54.8 km^2. The dominant form of land use in this region is agricultural, with ploughed fields comprising about 93% of the total area studied. Forests and other trees cover comprise barely 1.5% of the area, with the remainder (5.5%) used for buildings and roads.

An abandoned field was defined as one that had not been used for agricultural purposes for at least 2 years. Ninety-four abandoned fields comprising 399.87 ha were identified in the study area (Fig. 1), and they comprised 7.3% of the total study area. Detailed characteristics of the abandoned fields have been presented by Orłowski (2003). Size of most fields (64%) were below 3 ha (Fig. 1). The largest field confirmed had an area of 83.5 ha. The average size of a field was 4.2 ha ± 9.3 ha. Survey maps classified 92% (n = 85) of the fields as former crop fields (R). This kind of fields covered an area of 366.2 ha. The remaining fields (8.4%, 33.7 ha) were classified as former meadows (Ł) or pastures (Ps). The plant groups found in the abandoned fields were characterised by a high percentage of those species found in degraded environments. The dominant plant species included *Tanacetum vulgare*, *Artemisia vulgaris*, *Solidago* sp. and *Calamagrostis epigejos*. Weed species, characteristic of formerly farmed fields, are found most often in recently abandoned fields. The confirmed floral array can be generally classified as *Artemisietea vulgaris*, which is typical for secondary succession of predominantly anthropogenic groupings of perennials in degraded landscapes. Older fields were distinctly dominated by two groupings of floral dominants — *Artemisio-Tanacetetum vulgaris* and *Rudbeckio-Solidaginetum*.

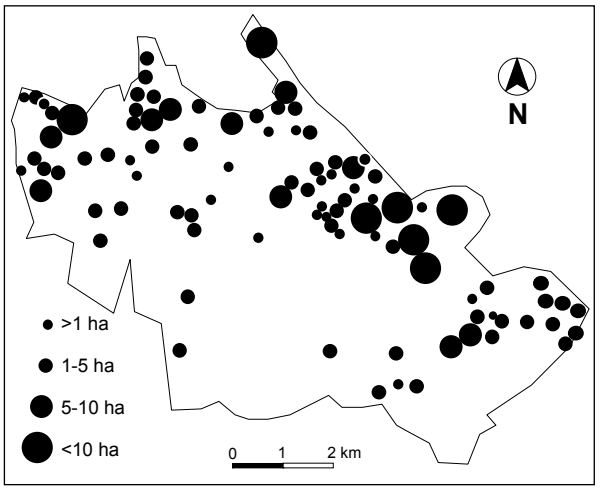

Fig. 1. Size and location of abandoned fields in the study area.

The youngest abandoned field occupied by a Whinchat was taken out of agricultural production about three years ago. Land located in the western part of the study area (including the largest field of 83.5 ha) was removed from agricultural production after the floods of 1997. The oldest field occupied by Whinchats was ascertained to have been abandoned about 20 years ago.

METHODS

Location of Whinchat territories

Whinchat territories were identified and observed from mid-May to the beginning of July in 2001. All potential territories were checked at least four times (from the middle to the end of May, beginning of June and second half of June). Additional observations (3–4) were conducted

using a spotting scope (20–60 × 70 mm) to determine the number of single males. Single males were observed in the early morning hours as well as during other times of the day. Single observations of a lone male's territory lasted from 0.5 to 1 h. Additional observations were made throughout the breeding season.

If a male was observed singing within a territory at least twice within a 14-day period, that territory was defined as occupied by a single male. If additional evidence of nesting activity was observed, that territory was deemed as occupied by a pair. Evidence of nesting activity included: nest building, feeding, observation of an alarmed pair and observations of fledglings in the territory. The basic four study visits were conducted in the early morning hours by foot along the axes of the field. Larger fields were checked by walking parallel lines about 100 meters apart. The length of the study visit depended on the size of the abandoned field. Visits lasted from 20 to 45 minutes for the smallest fields (under 3 ha) to about five hours for the largest one.

The birds' reaction upon the appearance of the observer in their field provided an easy clue in deducing the status (single male/pair) of a given territory. If a pair occupied a territory, both birds reacted by flying towards the observer and making intense alarm calls. The male usually was the first bird to appear. After a dozen or several dozen seconds in the presence of an alarmed male (making a loud "veet veet veet" call), the female appeared. The observer quickly left the territory upon witnessing a strong alarm reaction by a pair of birds.

Data analysis

The collected data was statistically analysed by using the Statistica 5 and Excel 2000 programs. A logarithmic transformation was conducted to normalize the data spread of the following variables: the size of the abandoned fields (Kolmogorov-Smirnov test, untransformed data $p < 0.01$; after transformation $p > 0.2$) and the density of territories (Kolmogorov-Smirnov test, untransformed data $p < 0.01$; after transformation $p > 0.2$). The variable number of Whinchat territories, was characterized by a lack of a normal spread both before and after the logarithmic transformation (Kolmogorov-Smirnov test, untransformed data $p < 0.01$; after transformation $p < 0.05$).

Aerial maps were analysed by using the computer program Arc-Explorer in the Windows operating system.

RESULTS

Occupation of the abandoned fields

The Whinchat was present in fifty-six (60%) of ninety-four abandoned fields studied (Table 1). Fields of less than 1 ha in size had the smallest chance of holding at least one Whinchat territory. Of the 22 fields found in this size category, only five (22.7%) were occupied by a Whinchat (Table 1). Statistically significant differences were found in the number of single males and pairs occupying specific sizes of abandoned fields (Wilcoxon test, $Z = 2.10$, $p = 0.035$, Table 1). There was a 50% to 100% chance of Whinchats occupying fields in the remaining size categories.

The probability of finding a Whinchat territory in a particular field was strongly related to its size (logistic regression model: $\chi^2 = 21.9$, $p < 0.001$, Fig. 2). A 50% chance of the presence of Whinchats achieved if the field covered about 1.8 ha, and reached 100% in fields with an area over 13 ha (Fig. 2).

Table 1. Range of sizes of abandoned fields and number of Whinchat territories.

size (ha)	Abandoned field			Whinchat territories			
	n	occupied by at least one territory	total area (ha)	males	pairs	total	territories/10 ha ± SD
< 1	22	5	10.98	3	2	5	15.94 ± 9.72
1–2	18	9	25.97	5	5	10	7.02 ± 2.21
2–3	20	15	47.97	6	11	17	4.74 ± 1.06
3–4	8	5	27.45	3	6	9	4.97 ± 2.01
4–5	9	7	39.45	4	8	12	3.87 ± 1.08
5–6	4	3	21.17	3	2	5	3.10 ± 1.15
6–10	6	5	48.24	4	8	12	3.14 ± 0.92
10–15	4	4	47.72	1	9	10	2.05 ± 1.30
> 15	3	3	130.89	9	12	21	1.40 ± 0.70
Total	94	56	399.84	38	63	101	–

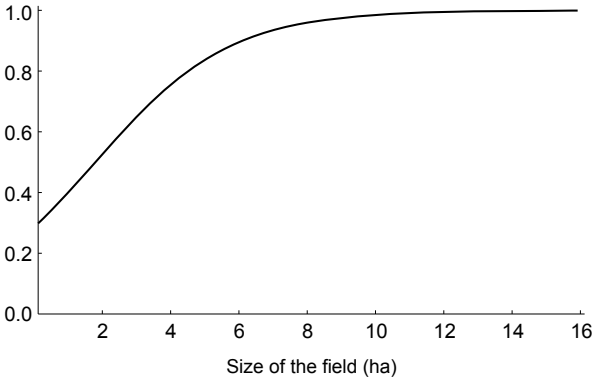

Fig. 2. Logistic regression model of the probability (%) of Whinchat occurrence in relationship to the size of an abandoned field.

The number of territories

A total of 101 Whinchat territories were confirmed (Fig. 3). A single abandoned field could hold from 1 to 14 territories. Thirty-three fields held only one territory (59% of all occupied fields). Two territories were found in 17 (30%) fields. Larger numbers of territories (3–14) were found in only 6 (10.7%) abandoned fields. The size of the smallest field occupied by a single male was 0.30 ha. In the case of a pair of birds, the minimum size of the field was 0.9 ha (Table 2). The number of Whinchat territories found in one field was positively correlated to its size ($r_s = 0.67$, $p = 0.000$, $n = 56$, Fig. 4). In all, 53 (64.3%) territories were located in fields that were less than 5 ha large ($n = 77$), comprising a total of 151.8 ha, 38% of the total area of abandoned fields.

Table 2. Population characteristics of the Whinchat.

Territories	N	%
Single males	38	37.6
Pairs	63	63.4
Total	101	100
The smallest abandoned field occupied by: a territorial male	0.3 ha	
a pair	0.9 ha	
with two territories	1.6 ha	
Density in abandoned fields (territories/10 ha)	2.5	
Total density in study area (territories/10 ha)	0.2	

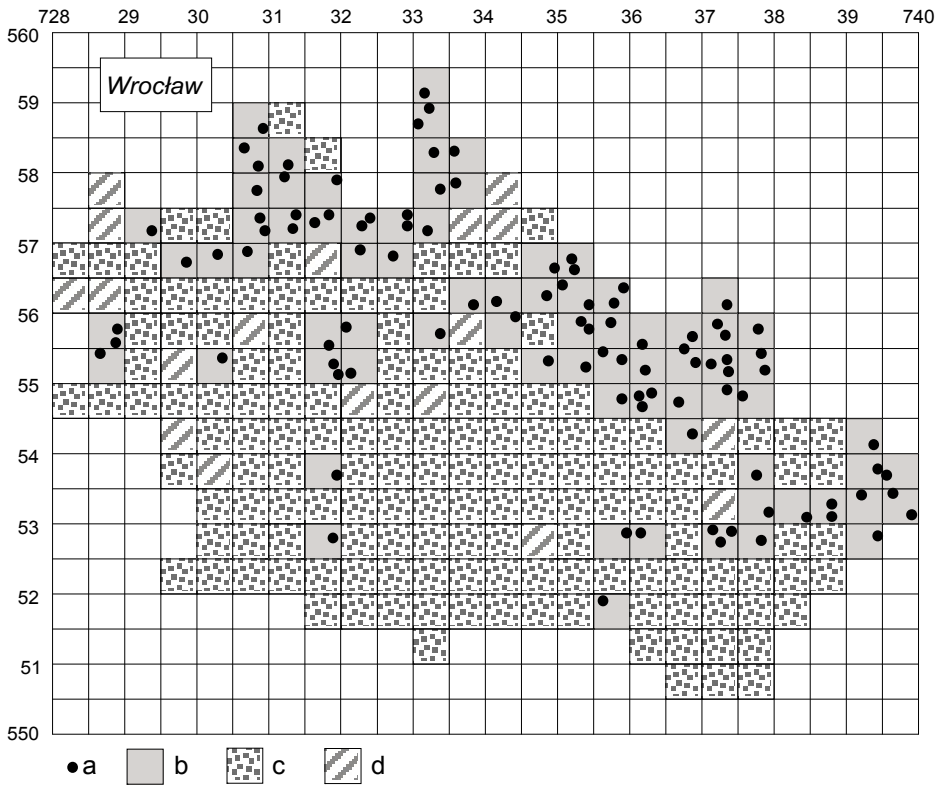

Fig. 3. Location Whinchat territories. Configuration of the geographic coordinates is based on "1965" system; 500 × 500 m grids. a — one Whinchat territory, b — at least 1 Whinchat territory, c — no abandoned fields, d — abandoned fields with the potential to support Whinchat territories.

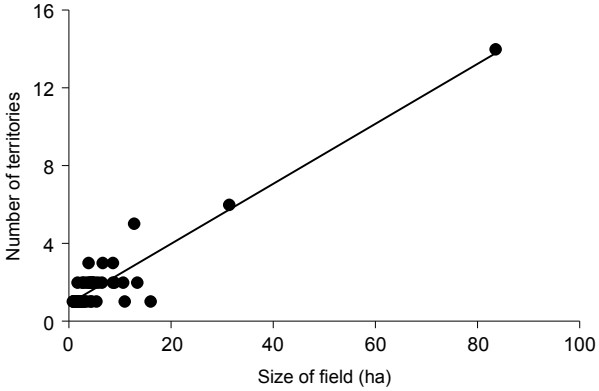

Fig. 4. Relationship between the size of an abandoned field and the number of established Whinchat territories.

The size of abandoned fields occupied by pairs and single males

As many as 38 of the 101 confirmed Whinchat territories were those of single males. They were located in 26 of the 56 occupied fields. Twelve fields were occupied by only one single male. The presence of two territorial males was confirmed in three fields. One abandoned field held the territories of seven males and a single pair. The highest total (9 males) was observed in a field over 15 ha in size (Table 1).

Table 3. Average sizes ± SD of abandoned fields occupied by single males and pairs.

Occupation	Abandoned fields		
	N	Average size ± SD (ha)	Range (ha)
single male	12	2.1 ± 1.4	0.3, 0.5
single pair	21	3.3 ± 3.6	0.9, 16.0
two males	3	3.6 ± 0.9	2.7, 4.5
two pairs	6	5.0 ± 2.1	3.5, 8.9
pair + male	7	5.4 ± 3.1	1.6, 13.4

Table 4. Results of the Mann-Whitney test on the differences between the average sizes of the abandoned fields occupied by single males and pairs. The average sizes of fields – see Table 3, ns – $p > 0.05$, *$p < 0.05$, **$p < 0.01$.

	Single male	Pair	Pair + male	Two pairs
single male	–	U = 98.5 ns	U = 13.0*	U = 4.0**
two males	U = 5.0 ns	U = 12.0 ns	U = 6.0 ns	U = 3.4 ns
pair	–	–	U = 31.0*	U = 17.0**

A statistically significant differences between the average sizes of abandoned fields occupied by single males, pairs and others were found (Kruskal-Wallis test, H = 16.31, p = 0.003, Table 3). Single males occupied the smallest fields (Table 3). The average size of a field occupied by a territorial male was smaller in comparison to a field occupied by a single pair and two pairs (Table 4).

The density of breeding pairs

The ecological density calculated for the area of all the abandoned fields was found to be 2.5 territories/10 ha. The density of Whinchat territories was negatively correlated to the size of the abandoned field (r = -0.82, p = 0.000, n = 56, Fig. 5). The highest density (> 10 territories/10 ha) was found to occur in the smallest (< 1 ha) fields. The density of Whinchat territories in the smallest occupied field (0.3 ha, 33.3 territories/10 ha) was twenty times higher compared with the density found in the largest field (83.5 ha, 1.7 territories/10 ha).

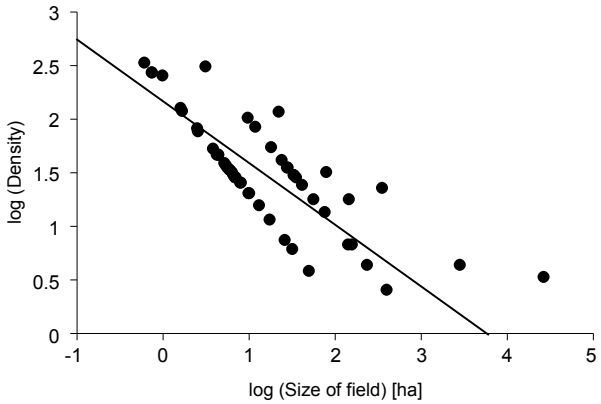

Fig. 5. Relationship between the density of Whinchat territories (territories/10 ha) and the size of the abandoned field; y = - 0.5752x + 2.1652.

DISCUSSION

The main cause of the decrease in Whinchat population in many European countries is the elimination of extensively used meadows and pastures (Tucker & Heath 1994, Bastian & Bastian 1996, Lorgé 1998). The results of this study show that this species can inhabit an intensively farmed agricultural landscape if there are abandoned crop fields. At the same time, a certain similarity begins to emerge in the territorial preferences of the Whinchat between

the semi-natural plant groupings of meadows and those of abandoned crop fields. Tall herbaceous plants occur in both these Whinchat habitats (Glutz & Bauer 1988, Bastian & Bastian 1996, Oppermann 1999, Kleinschmidt 2003, this study).

In this study, the smallest abandoned fields were occupied by single males. The negative correlation between the size of a field and the density of Whinchat territories in the agricultural landscape was previously described by, among others, Bezzel & Stiel (1975) in southern Germany. This could be caused by the fact that isolated Whinchat territories are larger in comparison to territories that are adjacent to each other (Bastian & Bastian 1996). This means that if the area is increased, for example, two-fold, an increase in the number of pairs will not be strictly proportional. This mechanism probably also explains the small difference in the number of pairs occupying much larger abandoned fields (5–30 ha). This fact has a practical implication in the protection of Whinchats, as it seems more beneficial to set aside several smaller fields (2–5 ha) than a single large one (15–50 ha).

In comparison with the territorial density of Whinchats found in meadows and pastures of central Europe (see Glutz & Bauer 1988), the density found in abandoned agricultural fields in this study is relatively high (1.7–33.3 territories/10 ha). In Germany in the 1970s, the density of Whinchat breeding territories in meadows was between 0.2 and 10 pairs/10 ha (Bezzel & Stiel 1975). In Central Europe (N Bavaria) in the 1990s, a density of 2.5–5 pairs/10 ha was considered exceptional (Theiss 1993). In the western regions of Poland, territorial densities did not exceed 1.6 pair/10 ha in areas under 315 ha in extensively farmed areas with many meadows (Dyrcz et al. 1991, Kuźniak 2000). A five-fold rise in the number of Whinchats (50.6%) has been noted in the past few years in the extensively farmed areas of Eastern Poland (Dombrowski & Goławski 2002). The abundance increased from 25 to 147–156 pairs in four rural areas (46.5 km^2) compared with the 1980s. The general density determined from specific study areas ranged from 0.3 to 9.3 pairs/km^2 (Dombrowski & Goławski 2002).

In 1977–79, quantitative research on farmland birds was conducted in 15.8 km^2 of the central part of the 2001 study area (Ławniczak 1980). Breeding Whinchats (2 pairs) were confirmed only in 1978 (Ławniczak 1980). In 2001, 9 Whinchat territories were confirmed in the same sector of the study area. So, the increase in numbers compared to the 1970s is strictly tied to the appearance of farm fields removed from agricultural production.

The size of Whinchat territories in Europe was found to be between 0.5 and 4.1 ha. Smaller territories (0.5–0.8 ha) have been confirmed in optimal habitats, in fields with tall herbaceous plants (see Bastian & Bastian 1996), while in this study, the size of the smallest abandoned field occupied by a pair of Whinchats was 0.9 ha.

The proportion of single males in the population studied (37.6%) is similar to results obtained in other regions of Europe. It is assumed that single males act as a population reserve (Bastian & Bastian 1996). In the 1950's in Switzerland, 24–26% of the males remained without partners (about 85% of these birds were in their first year of life — see Glutz & Bauer 1988). In the Netherlands, up to 45% of occupied territories were held by single males (Ossterveld 1999).

In European Union countries, Whinchats do not appear in set-aside fields, despite their high diversity of bird fauna (e.g. Berg & Pärt 1994, Henderson et al. 2000). This is probably caused by the lack of a well-developed base of high (over 1 m high) herbaceous plant cover from the previous year. According to Oppermann (1999), Whinchats use terrain covered by high herbaceous plants (including abandoned and overgrown fields) during the entire time they remain in Europe (from April to October). The same is seen in meadow habitat, in the spring when the year's plant growth is just beginning — Whinchats are mainly seen utilising last year's dried plant remains — for feeding, as singing perches, for nest locations, and patrolling for prey (Bastian & Bastian 1994, Oppermann 1999, Kleinschmidt 2003).

CONCLUSIONS CONCERNING THE PROTECTIONS OF WHINCHAT IN INTENSIVELY FARMED REGION

1. Excluding a portion of the farmed land from production for at least several years.

2. Introducing changes in agro-technical practices to a field that is allowed to lie fallow (managed in accordance with the Set-Aside Land Option procedures) to permit the growth of a tall, herbaceous, perennial plant cover (>1m) (*Tanacetum vulgare*, *Artemisia vulgaris*, *Solidago* sp.).

3. Enforce the prohibition on burning fields.

4. The Whinchat is found in abandoned fields with a well-developed, tall cover of perennials. Abandoned crop fields are the only places Whinchats are found in intensively farmed landscapes. Thus, it is important to maintain the previous year's dried

herbaceous plant cover until the following spring to promote the preservation of this species.

5. The number and area of abandoned fields could be a predictor of the abundance of Whinchats, and this two factors determine their distribution.

6. An increase in the population of Whinchats can be expected in Poland in the coming years, linked to the increase of land taken out of agricultural production.

7. Neglecting meadows leads to the gradual degradation and disappearance of its rich floral ecosystem and massive succession by plants linked to degraded areas. This can be viewed as detrimental, but seems to be beneficial to the Whinchat.

ACKNOWLEDGEMENTS

MSc. Anna Wąsowicz from the Department of Systematics and Phytosociology of the Plant Biology Institute of Wrocław University is thanked for help in characterising the plants in the abandoned fields studied. I am also grateful to Dr. Krzysztof Kujawa from the Research Center for Agricultural and Forest Environment of the Polish Academy of Sciences in Turew, Dr. Ian Henderson from British Trust for Ornithology and Dr. Lucjan Kleinschmidt from Department of Zoology of University of Warmia and Mazury in Olsztyn for invaluable remarks and helpful suggestions in the editing of this work.

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STRESZCZENIE

[Odłogowane pola uprawne jako biotop pokląskwy — badania w południowo-zachodniej Polsce]

W Europie zachodniej jednym z gatunków ptaków wykazujących silny spadek liczebności jest pokląskwa. Głównym środowiskiem wystę-

powania tego gatunku w Europie środkowej są żyzne i wilgotne łąki oraz pastwiska, niewiele natomiast wiadomo o występowaniu pokląskwy w odłogowanych polach uprawnych.

Celem pracy było określenie: 1) wpływu odłogowania gruntów rolniczych na liczebność i rozmieszczenie populacji pokląskwy; 2) udziału samotnych samców w badanej populacji oraz 3) sformułowanie wstępnych zaleceń i sposobów ochrony pokląskwy w rejonach intensywnego rolnictwa.

Badaniami objęto (54.8 km^2) zachodnią i południową część gminy Święta Katarzyna, graniczącą z obszarem miasta Wrocławia. Za odłóg uznawano pole, które nie było użytkowane rolniczo od co najmniej 2 lat. Ogółem na badanym obszarze stwierdzono 94 odłogi o łącznej powierzchni 400 ha (Fig. 1). Odłogi zajmowały 7.3% całkowitej powierzchni badań. Pod względem ilości przeważały odłogi poniżej 3 ha powierzchni (Tab. 1). Średnia wielkość odłogu wynosiła 4.2 ha ± 9.3 ha. Zbiorowska roślinne odłogowanych pól uprawnych charakteryzował wysoki udział gatunków ruderalnych (wrotycz pospolity *Tanacetum vulgare*, bylica pospolita *Artemisia vulgaris* oraz nawłocie *Solidago* spp.).

Pokląskwa występowała na obszarze 56 (60%) spośród 94 skontrolowanych odłogów. Prawdopodobieństwo wystąpienia pokląskwy było silnie uzależnione od wielkości odłogu i przy odłogach o powierzchni około 13 ha osiągało 100% (Fig. 2). Ogółem stwierdzono 101 terytoriów pokląskwy (Fig. 3). W pojedynczym odłogu zlokalizowanych było od 1 do 14 terytoriów pokląskwy. W 33 (59% wszystkich zajętych) odłogach stwierdzono pojedyncze terytoria. W 17 (30%) odłogach zlokalizowanych było po dwa terytoria. Większą liczbę terytoriów (3–14) stwierdzono tylko w 6 (10.7%) odłogach. Liczba terytoriów pokląskwy zlokalizowanych w jednym odłogu była pozytywnie skorelowana z jego powierzchnią (Fig. 4). Zagęszczenie ekologiczne obliczone na obszarze wszystkich odłogów wyniosło 2.5 terytorium/10 ha (Tab. 2). Ogółem w najmniejszych odłogach o powierzchni poniżej 5 ha (n = 77), zajmujących łącznie 151.8 ha (38% powierzchni wszystkich) zlokalizowanych było 53 (64.3%) terytoriów. Spośród 101 stwierdzonych terytoriów pokląskwy, aż 38 zajętych było przez samotne samce, które występowały w 26, spośród 56 zajętych odłogów. Samotne samce zajmowały najmniejsze odłogi. Średnia wielkość odłogu zajętego przez terytorialnego samca (n = 12) była mniejsza w porównaniu z odłogiem pojedynczej pary (Tab. 3 i 4). Zagęszczenie terytoriów pokląskwy było negatywnie skorelowane z powierzchnią odłogu (Fig. 5).

Do skutecznych form ochrony pokląskwy na obszarach intensywnego rolnictwa powinny należeć: wyłączenie części areału gruntów z produkcji rolniczej na okres co najmniej kilku lat oraz wprowadzenie zmian w zabiegach agrotechnicznych podczas odłogowania pól uprawnych (prowadzonych z procedurami Set-Aside Land Option) umożliwiających wytworzenie się wysokiej, okrywy roślinnej (> 1 m) z wieloletnich bylin (wrotycz, bylica pospolita, nawłocie).