

MONITORING THE AUSTRIAN RELICT POPULATION OF EUROPEAN ROLLER *Coracias garrulus* – A REVIEW OF PRELIMINARY DATA AND CONSERVATION IMPLICATIONS

Monitoring reliktnih avstrijske populacije zlatovranke *Coracias garrulus* – pregled preliminarnih podatkov in varstvenih prizadevanj

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Up to the mid-1980s the formerly continuous breeding range of the European Roller *Coracias garrulus* in the pre-alpine lowlands of southern Austria had declined to a remnant population in the districts of Feldbach and Bad Radkersburg (Gornja Radgona) in south-eastern Styria. Since 2001 we have studied population numbers and nesting success as well as spatial and seasonal patterns of habitat use, by locating used nest sites and with the help of roadside counts for locating core feeding areas. Population numbers have stabilized since the mid-1980s at between 7 and 15 breeding pairs (bp). Due to a lower proportion of unsuccessful breeding attempts, annual nesting success has increased to 1.3 – 3.3 juv. / bp per year since the end of the population decline in the mid-1980s. All currently used nesting sites are situated in the lower section of the Sulzbach river valley, less than 400 m from the river. With bird usages of 40.5% and 44.9%, respectively, agricultural lands are used for feeding to the same degree as cultivated grasslands (meadows). More hunting birds were found on agricultural lands during April and May whereas, from June to mid-September, freshly cut fallow and grasslands, as well as higher parts of the river valley along hillsides, were more frequently used for feeding. Logistic regression analysis of 32 habitat parameters measured in 50 m-plots around perching sites and in adjoining areas not used for feeding indicates that European Rollers prefer areas with large cumulative length of telegraph wires and boundaries between fields. Areas with large numbers of potential perching sites and greater proportions of grasslands and fallow land for feeding are also favoured. Due to its small size the population is expected to be extremely susceptible to inbreeding and stochastic fluctuations of population numbers. To mitigate the risk of extinction, we recommend extension of the current range into adjoining farmland areas on both sides along the Austrian-Slovene border by implementing suitable farming practices and grassland management.

Key words: European Roller, *Coracias garrulus*, relict population, Austria, population numbers, reproduction, nest site, habitat, feeding site selection, prey availability, conservation

Ključne besede: zlatovranka, *Coracias garrulus*, reliktna populacija, Avstrija, velikost populacije, razmnoževanje, gnezditveni prostor, habitat, izbor prehranjevališč, razpoložljivost plena, varstvo

1. Introduction

Since the late 19th century the range and population size of European Rollers *Coracias garrulus* has dramatically declined in western and northern Europe, bringing the species to extinction in southern Sweden, Denmark and Germany. Scattered remnants of its formerly continuous Central European population remain in the Baltic states and eastern Poland (GLUTZ VON BLOTZHEIM & BAUER 1980, SAMWALD & ŠTUMBERGER 1997). In contrast to its earlier decline in northern Europe, the species was still widespread in southern Austria and Slovenia until the 1950s. However, in the wake of large-scale intensification of agriculture after World War II the breeding distribution and numbers of the Austro-Slovene population collapsed during the 1960s and 1970s (BRAČKO 1986, SAMWALD & SAMWALD 1989). In Slovenia, where population numbers have been estimated at 0 – 5 breeding pairs (bp) for 1998 – 2004, the species is currently restricted to scattered and mostly vagrant birds (BOŽIČ 2003, F. BRAČKO & B. ŠTUMBERGER *pers. comm.*), while a small remnant population has survived in south-east Austria around Bad Gleichenberg and Straden (Styria), a few kilometres from the Slovenian border. Data concerning the nesting ecology, reproduction rate and the dramatic decline of European Rollers during the second half of the last century in south-east Austria were analysed by SAMWALD & SAMWALD (1989), with a short update up to the mid-1990s published by SAMWALD (1996). For the preparation of a management plan by local conservation authorities we have investigated the breeding distribution, nest site selection, reproduction and habitat use of the Austrian population since 2001. A preliminary review of our data with a brief discussion of their implications for the conservation of the Austrian population is presented here.

2. Study area and methods

Since the mid-1980s the breeding distribution of European Rollers in Austria has been restricted to a handful of low lying, narrow river valleys (220 – 342 m a.s.l.) in the prealpine hill country of south-eastern Styria, all used intensively for maize production (SAMWALD & SAMWALD 1989). Our study area of 66.4 km² is situated in the districts of Feldbach and Bad Radkersburg (Gornja Radgona) in the middle and lower reaches of northern tributaries of the Mur river, i.e. the Sulzbach, Poppendorfer Bach and Drauchenbach river. It includes all currently, and at least six formerly, used nesting sites. The latter were deserted towards the end of the population decline

between 1985 and the mid-1990s. Since 2001 we have organized annual population surveys by locating used nesting holes, investigated breeding success and, based on the results of a survey of actual land-use around active and currently abandoned nesting sites (16.9 km²), studied the spatial and seasonal pattern of habitat use. To study feeding site selection and habitat requirements we located core feeding areas by mapping perched and actively hunting birds during roadside counts (n = 13) throughout the whole study area between April and September 2002. In addition, since 2003, 31 nestlings and 11 adult birds, the latter mostly caught in nest boxes while feeding nestlings, were ringed with metal and individual combinations of colour rings.

3. Results

3.1. Population numbers and reproduction

In the course of the 1960s and 1970s the original population, which was estimated at 300 – 500 bp by SAMWALD & SAMWALD (1989), contracted to a remnant range of 25 – 30 km² along the Poppendorfer Bach, Sulzbach, Drauchenbach, and Kutschenitzta rivers. With the exception of 2 to 3 nesting sites, close to the Slovene border at St. Anna a. Aigen, which were deserted till 1995, numbers of the Austrian population have been stable between 8 and 12 bp since the mid-1980s (SAMWALD 1996). Between 2001 and 2004 we found 7 to 15 bp / year in the area. In contrast, the annual nesting success has increased from 0.0 to 1.7 juveniles / bp during the period 1978 to 1984 to 1.3 – 3.3 fledged juveniles / bp for 1985 to 2003, over which period the population decreased by approximately 76% from an estimated 75 bp in 1978 to 18 bp in 1985 (SAMWALD & SAMWALD 1989). The currently higher reproduction rate correlates with lower numbers of unsuccessful or deserted breeding attempts (mean = 13.3%, min – max = 0 – 33%, n = 102, 1985 – 2003), in comparison to the period 1978 – 1984, when annual proportions of unsuccessful nesting attempts varied between 14 and 75% (mean = 58.7%, n = 39). 58.2% of the currently used nesting areas are covered by arable land (42.4% used for maize production) and 14.5% by cultivated grasslands (Figure 1). With the same long-term pattern of reproduction and nesting success for different sub-populations (in different river valleys) within and outside the recent breeding area, land-use patterns, i.e. the area of different field or habitat types, appear not to be responsible for the higher breeding success since the mid-1980s.



Figure 1: Feeding habitat of European Rollers *Coracias garrulus* in south-east Austria, Karbach; summer 2003 (Photo: M. Tiefenbach).

Slika 1: Prehranjevalni habitat zlatovranke *Coracias garrulus* v jugovzhodni Avstriji, Karbach; poletje 2003 (foto: M. Tiefenbach)

3.2. Nest sites

Between 2001 and 2003 we located a total of 15 actively used nesting holes (including 3 nest boxes). All were situated in small woodlands (0.2 – 2.0 ha) close to or in a narrow strip of riverine forest (width ≤ 10 m) along the main river in the low-lying section of the 1.5 – 2.5 km wide valley of the Sulzbach river. The mean of nearest distances between natural nest holes and the river was 231.6 m (SD = 202.9, min – max = 1 – 402 m, $n = 12$); on including abandoned nest sites, maximum distances to the river increase to 730 m. Most natural nesting holes used in the area obviously originate from nesting and sleeping holes made by Green *Picus viridis* or Grey-headed Woodpeckers *P. canus*. All nesting holes ($n = 12$; excluding nest boxes) were found within the main trunk of nesting trees, 4.5 – 10.2 m above ground (Figure 2). In order of decreasing frequency in our study area, nesting holes were found in willows *Salix* sp., Common Ash *Fraxinus excelsior*, oaks *Quercus* sp., Common Beech *Fagus sylvatica*, birch *Betula* sp. and Wild Cherry *Prunus avium*. All nest sites were situated within a maximum distance of 11 m (mean = 5.0 m, SD = 3.9, $n = 11$) from the edge of woodlands, in open or semi-open agricultural land outside closed settlements or more densely populated areas (Streusiedlungen). The nearest distances of nesting holes and used nest boxes to closed settlements varied between 98 m and 375 m (mean = 215.3 m, SD = 93.7, $n = 15$).



Figure 2: Adult European Roller *Coracias garrulus* feeding young in birch *Betula* sp.; Oberpurkla, Austria, June 2002 (Photo: P. Sackl)

Slika 2: Odrasla zlatovranka *Coracias garrulus* med hranjenjem mladičev na brezi *Betula* sp.; Oberpurkla, Avstrija, junij 2002 (foto: P. Sackl)

3.3. Habitat use

Of all hunting strikes recorded during summer 2002 ($n = 204$), agricultural lands (40.5%) were used for feeding to the same extent as cultivated grasslands (meadows; 44.9%). More hunting strikes and perched birds were found on agricultural land during late April and May, whereas from June to mid-September freshly cut fallow and grasslands were the most frequently used feeding habitats (Figure 3). A comparison of habitat characteristics during the breeding season by logistic regression analysis showed that 82.1% (July) to 100% (August) of 32 habitat variables measured in the field are correctly classified to feeding sites (50 m-plots around perching sites) and absence data sites, i.e. randomly selected 50 m-plots in adjoining farmland not used by the population. Besides distances from the main river to nesting holes, the cumulative length of telegraph wires and boundaries between fields, as well as the number of potential perching sites (solitary trees, bushes, poles etc.), and the area of grassland and fallow land within 50 m-plots, were accepted by stepwise regression as statistically significant for separating feeding habitats from areas not used for hunting (SACKL *et al. in prep.*).

Nearest distances of hunting birds from used nest holes and the main river showed significant seasonal changes. Except in late August and September most feeding patches were situated < 400 m from the Sulzbach river in the lowest part of the river valley (mean: 100.8 m in May – 526.6 m in September;

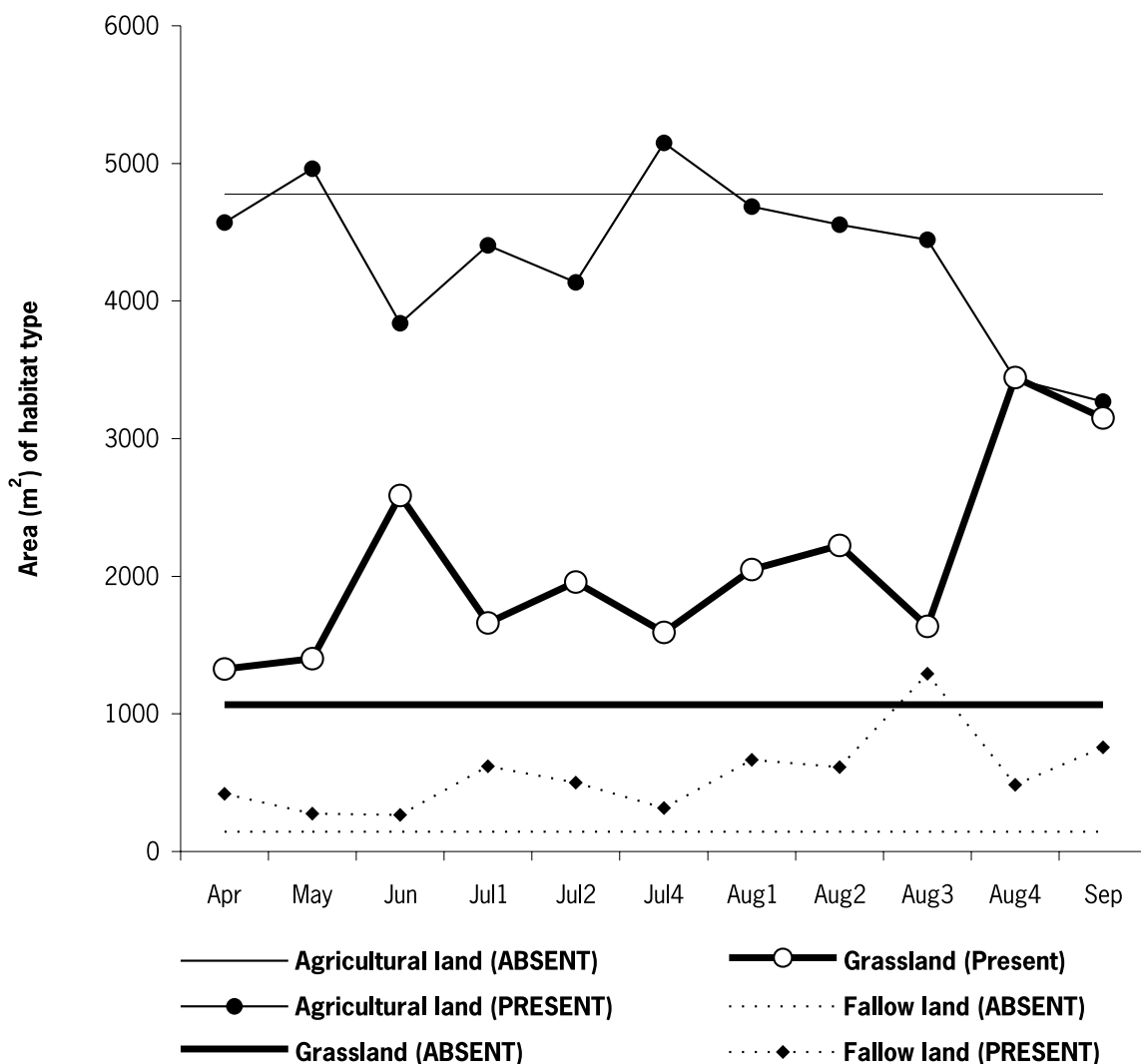


Figure 3: The area of arable fields, grasslands (cultivated meadows) and fallow land around perching-sites of European Rollers *Coracias garrulus* in south-eastern Austria during summer 2002 (50 m-plots). Horizontal lines indicate corresponding means for habitat types in 50 m-plots (n = 34) not used by European Rollers (absence data).

Slika 3: Območje obdelovanih polj, travišč (gojenih travnikov) in neobdelanega sveta okrog lovišč zlatovranke *Coracias garrulus* v jugovzhodni Avstriji poleti 2002 (površine z radijem 50 m). Vodoravne črte ponazarjajo ustrezne srednje vrednosti za habitatne tipe na površinah s 50 m radijem (n = 34), v katerih se zlatovranke ne zadržujejo.

Figure 4). As for many bird species, distances of hunting birds from the nearest nest site were lowest during the nestling period and shortly after fledging (Figure 4). During the latter period freshly fledged juveniles normally hide in tall trees close to nesting holes, where they are fed by adults. Between late July and mid-September mean distances from the main river steadily increased from 500 to 2500 m (Figure 4). During late summer, peripheral parts of the river valley and adjoining hillsides were more frequently used by independent juveniles and adult birds. In

August 2004, with the help of colour-ringed birds, we saw that in late summer, contrary to adult and some juvenile birds which remained stationary within their original feeding area around nest sites, some adults and most fledglings shifted their core feeding areas permanently away from nest sites to the periphery of the valley or into adjoining river valleys.

4. Discussion

In the wake of population decline in western Hungary

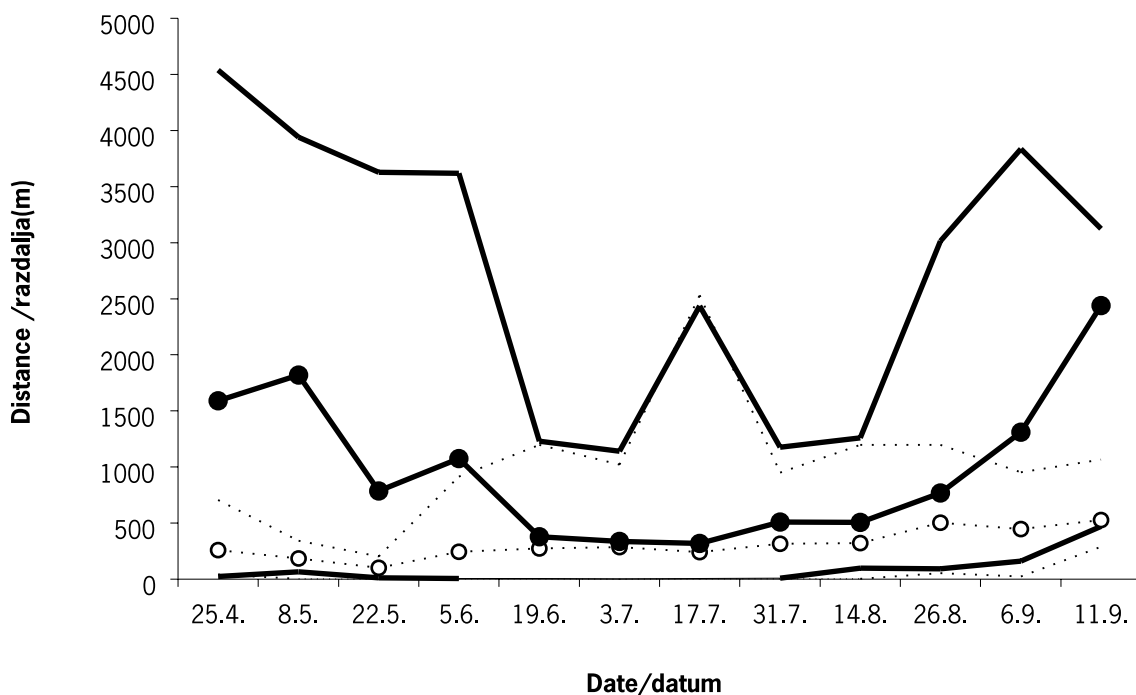


Figure 4: Seasonal variation of nearest distances (m) of perching-sites of European Rollers *Coracias garrulus* from the main river (MEAN = thick line with closed circles, MIN and MAX = thick lines) and from used nest sites (MEAN = broken line with open circles, MIN and MAX = broken line) in south-east Austria during summer 2002 (road site counts).

Slika 4: Sezonske spremembe v najkrajših razdaljah (m) počivališč zlatovranke *Coracias garrulus* od glavne reke (MEAN = debela črta s polnimi krogi, MIN in MAX = debela črta) in od aktivnih gnezdišč (MEAN = prekinjena črta s praznimi krogi, MIN in MAX = prekinjena črta) v jugovzhodni Avstriji poleti 2002 (obcestna štetja).

and Croatia, where the species is currently on the brink of extinction (MAGYAR *et al.* 1998, RADOVIĆ *et al.* 2003), the Austrian population and scattered birds in adjoining areas in Slovenia are isolated by at least 90 – 110 km from the nearest nesting areas (B. ŠTUMBERGER *pers. comm.*). Due to its small size, the population is expected to be extremely susceptible to inbreeding and to stochastic fluctuations of population numbers. To mitigate the risk of extinction by catastrophic events we recommend increasing population numbers and extending the current range into adjoining, currently abandoned farmland areas by implementing suitable farming practices and grassland management on both sides of the Austro-Slovenian border.

Factors relevant for the viability of the Austrian population, which act on migration and in winter quarters, are unknown. Thus, basic information on factors influencing nesting success, habitat requirements and mortality are essential for restoring viable population numbers and for reconstituting a continuous breeding range across the Austro-Slovene border. This can only be done by enhancing nesting success and the survival probability of individual

birds inside the current nesting area. Since 2002 road casualties along the main road of the Sulzbach river valley between Haag and Karbach, where rollers regularly hunt in late summer, have been responsible for an annual loss of 4.7 – 10.4% of the population (mean = 6.6%).

The loss of grassland areas to maize cultivation discussed by SAMWALD & SAMWALD (1989) suggests that the exact causes for the disappearance of the species throughout Central Europe are more complex. European Rollers depend on medium-sized to large insects for food. Western European studies have provided good evidence for a widespread decline over the last 40 years, not only of insectivore farmland birds, but also of the abundance of key arthropod groups like butterflies Lepidoptera, beetles Coleoptera and grasshoppers Saltatoria in bird diets, as a result of changes in land use, habitat quality and increased pesticide use (ROBINSON & SUTHERLAND 2002, BAKER 2004). In our study area rollers depend, during the breeding season, on riverine lowlands with high levels of ground water. Higher ground adjoining the hillsides is more frequently used during July and August,

coinciding with the availability of high densities of large grasshoppers in late summer (P. SACKL & M. TIEFENBACH *in prep.*). Grasslands with low vegetation, in particular freshly cut meadows, as well as unpaved tracks, ploughed fields or stubble are used for hunting in spring and late summer. Preliminary data from transect counts for estimating prey availability in different habitat types in the Sulzbach river valley in 2004 indicate that, during the breeding season, original grasslands used for hay-cutting harbour significantly higher densities of invertebrate prey than improved grasslands and maize fields ($Z = 3.96$, $P < 0.001$, $n = 132$, Mann-Whitney U-Test; Figure 5). Thus, following the large-scale transformation of grasslands into agricultural land since the 1960s, the abundance of arthropod prey has presumably declined significantly throughout the riverine lowlands of south-east Austria.

Furthermore, according to our data, European Rollers prefer smaller fields, mosaics of arable land interspersed by meadows and fallow land along tracks, roadsides and ditches, to large-scale arable fields for hunting. Hedges and grassy strips along field boundaries harbour large numbers and diversity of insects, with the overall abundance of invertebrates usually greater near the boundary (HOLLAND *et al.*

1999). During our studies we found that European Rollers carry out 50 – 75% of all hunting strikes within a strip ≤ 10 m from field boundaries. Consistent with this, transect counts (Figure 6) indicate that, in contrast to the central parts of all meadows investigated, arthropod abundances are significantly higher along grassland boundaries ($Z = 2.78$, $P = 0.005$, $n = 110$, Mann-Whitney U-Test).

The evidence shows that the drainage of most fertile lands throughout the riverine lowlands and their transformation into monotonous fields of arable land, the loss of adequate small-scale arable and fallow lands, and the loss of pastures and grasslands traditionally used for hay-cutting and fodder (KASER & STOCKER 1986), coincide with the decline of the Austrian population since the late 1950s. Although relevant data are not available, the short-term increase in nesting success since 1985 may indicate the role of farming practices. AVILÉS & PAREJO (2004) recently published evidence for high chick mortality in European Rollers in irrigated fields following insecticide use by farmers to avoid insect plagues. However, throughout Central Europe remnant populations of European Rollers inhabit intensively used agricultural land. We hope, that our research will contribute to understand habitat traits important for

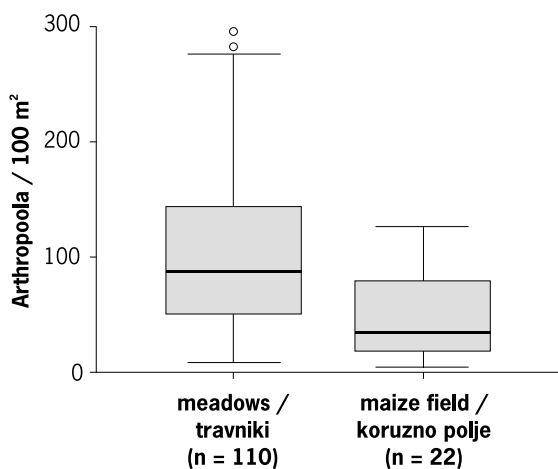


Figure 5: Median of the abundance of arthropods in six grassland areas and an adjoining maize field according to transect counts (transect length = 50 m, width of transects = 2 m) in the Sulzbach river valley, Austria, April – September 2004 ($n = 132$)

Slika 5: Mediana številčnosti členonožcev Arthropoola na šestih traviških in v sosednjem koruznem polju na osnovi transektnih štetij (dolžina transektov = 50 m, širina transektov = 2 m) v dolini reke Sulzbach, Avstrija, april – september 2004 ($n = 132$)

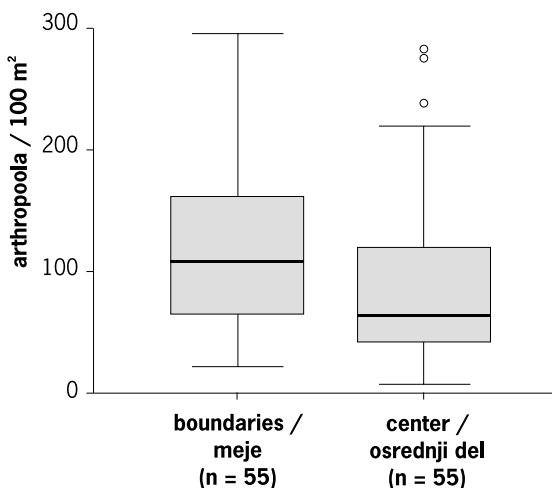


Figure 6: Median of the abundance of arthropods along boundaries (≤ 5 m from border line) and in the central parts of six grassland areas used for hay-cutting and fodder according to transect counts (transect length = 50 m, width of transects = 2 m) in the Sulzbach river valley, Austria, April – September 2004 ($n = 110$).

Slika 6: Mediana številčnosti členonožcev vzdolž meja (≤ 5 m od mejne črte) in v osrednjih delih šestih redno košenih travišč na osnovi transektnih štetij (dolžina transektov = 50 m, širina transektov = 2 m) v dolini reke Sulzbach, Avstrija, april – september 2004 ($n = 110$).

the species and the development of farming practices compatible with conservation.

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5. Povzetek

Od sredine osemdestih let 20. stoletja se je nekdanji sklenjeni gnezditveni areal zlatovranke *Coracias garrulus* v predalpskem nižavju južne Avstrije skrčil na skromen ostanek populacije v okrožjih Felzbach in Bad Radkersburg (Gornja Radgona) v jugovzhodnem delu province Steiermark. Od leta 2001 so avtorji preučevali velikost populacije, gnezditveni uspeh ter prostorske in sezonske vzorce izbora habitata z iskanjem aktivnih gnezdišč in s pomočjo štetja vrste vzdolž cest, da bi ugotovili položaj zlatovrankinih glavnih prehranjevališč. Od sredine osemdesetih let je bila velikost njene populacije med 7 in 15 gnezdečimi pari (gp). Od konca populacijskega upada v sredini osemdesetih, pa se je zaradi manjšega števila neuspešnih gnezditvenih poskusov letni gnezditveni uspeh povečal na 1,3 – 3,3 mladiča / gp na leto. Vsa trenutno aktivna gnezdišča ležijo v spodnjem delu doline reke Sulzbach in sicer <400 m od rečnega toka. Na območju predstavljajo 40,5 do 44,9% kmetijskih površin kultivirana travišča, na katerih se zlatovranka hrani. Večje število lovečih zlatovrank je bilo zabeleženih na kmetijskih površinah med aprilom in majem, medtem ko so se med junijem in sredino septembra pogosteje prehranjevale na sveže preoranih poljih, traviščih in više ležečih predelih vzdolž doline reke Sulzbach. Analiza logistične regresije 32 habitatnih parametrov, izmerjenih na površinah za radijem 50 m okrog zlatovrankinih lovišč in na površinah, ki mejijo nanje, a se v njih zlatovranka ne hranijo, je pokazala, da zlatovrankam bolj ustrezajo območja z večjo skupno dolžino telegrafskih žic in mejne površine med polji, pa tudi območja z visokim številom potencialnih počivališč in precejšnjim deležem travišč in neobdelane zemlje za hranjenje. Glede na zlatovrankino neznatno populacijo je pričakovati, da bo ta v veliki meri nagnjena k parjenju

v sorodstvu in stohastičnim populacijskim nihanjem. Da bi ublažili možnosti zlatovrankinega izumrtja, avtorji priporočajo, da se podaljša trenutni areal vrste v sosednja kmetijska območja na obeh straneh avstrijsko-slovenske meje z uveljavljanjem ustreznega kmetovanja in upravljanja travišč.

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