Foraging ecology of two declining bird species in NE Slovenia

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Introduction

Hoopoe *Upupa epops* and Scops owl *Otus scops* declined by 75% in the last 15 years at Natura 2000 site Goričko, NE Slovenia. The most probable cause for decline was agricultural intensification: decline of meadows (more than 800 ha from 2004 to 2012), commassations with hedge removal (carried out on 9.5% of surface since 2003), increase of large fields, and degradation and reduction of traditional orchards. The aim of our study was to identify foraging habitat of the two study species and their diet. This information will be used to draw-up conservation measures for them.

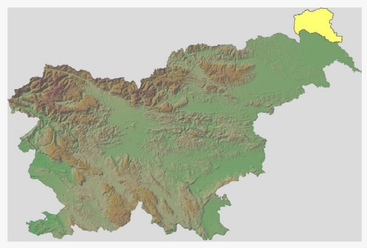

Fig. 1: Goričko is situated in NE Slovenia.

Study area

Goričko (490 km^2) is a hilly region in NE Slovenia, bordering Austria and Hungary (Fig. 1). It receives the least precipitation in Slovenia (ca. 800 mm) and has hot summers and cold winters. Several forest complexes are interspersed within the prevailing mosaical agricultural landscape (Fig. 2). It is designated as IBA and Natura 2000 site (both SPA and pSCI).

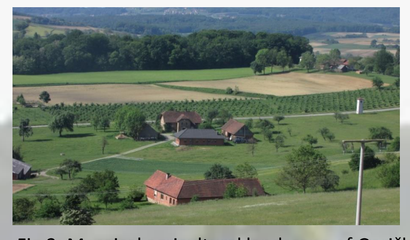

Fig.2: Mosaical agricultural landscape of Goričko.

Methods

In 2012 and 2013, we conducted a research on foraging ecology of both species, using high resolution Reconyx cameras mounted close to nest entrance (Fig. 3), VHF telemetry (for Scops owl) (Fig. 4) and direct observations of foraging activity (for Hoopoe). Hoopoes' foraging polygons were plotted on digital ortophotos and digitalized using ArcGIS 9.2 (n=5 nests). Six Scops owl males and two females were equiped with 2.4 g VHF transmitters (five mounted as backpacks and one glued). Triangulation was used to determine Scops owl positions (simultaneous recording from three positions, bisection method). Locations were read every 5 minutes.

Fig. 3: Reconyx camera on Hoopoe's nest.

Fig. 4: VHF telemetry was used to study foraging habitat of Scops owl.

Results

Diet and foraging habitat of Hoopoe

Useful camera data was obtained from five Hoopoe nests. Preliminary results show that the main prey was molecricket *Gryllotalpa gryllotalpa* representing 50-80% of prey by frequency and biomass (depending on the nest; Fig. 5). Other prey species included mainly field cricket *Gryllus campestris* (Fig. 6) and lepidopteran, dipteran and beetle larvae (Fig. 7-9) , whereas spiders, adult beetles and grasshoppers were eaten exceptionally (Fig. 10-12). One pair exploited hoverfly larvae crawling out of a cesspit to pupate. Hoopoes foraged up to 700 m from the nest (Fig. 13), on cut meadows (fig. 14), cart tracks, road verges (fig. 15), grassy farmyards, plantations (vineyards, orchards, elder, Fig. 16) and pastures.

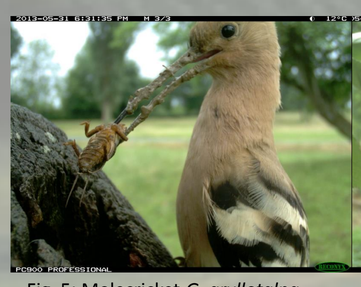

Fig. 5: Molecricket *G. gryllotalpa*

Fig. 6: Field cricket *G. campestris*

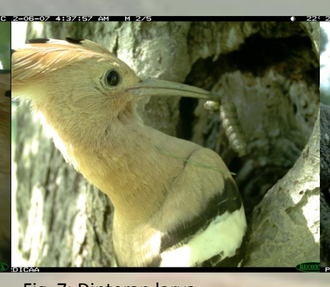

Fig. 7: Dipteran larva

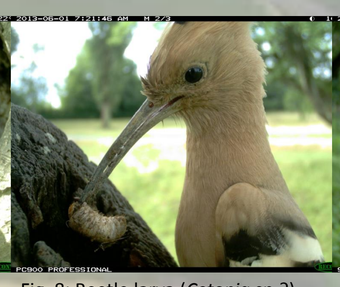

Fig. 8: Beetle larva (*Cetonia* sp.?)

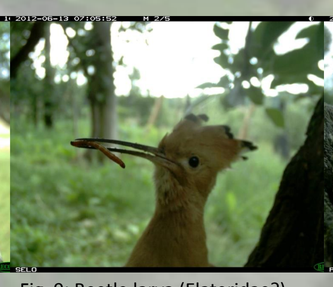

Fig. 9: Beetle larva (Elateridae?)

Fig. 10: Spider

Fig. 11: Adult beetle

Fig. 12: Grasshopper

Fig. 13: Foraging polygons of Hoopoe plotted in ArcGIS.

Fig. 14: Cut meadows

Fig. 15: Two Hoopoes feeding on a road verge

Fig. 16: Elder plantation

Diet and foraging habitat of Scops owl

Useful camera data was obtained from five Scops owl nests. Preliminary results show that the main prey were different grasshopper species (Fig. 17-21), followed by molecricket *Gryllotalpa gryllotalpa* (Fig. 22) and Field cricket *Gryllus campestris* (Fig. 23). Only rarely did parents bring different larvae (Fig. 24), spiders (Fig. 25), earwigs *Forficula* sp. (Fig. 26) or moths. In 2012, a large proportion of rodents was brought to one nest, probably due to an outbreak of rodents in that year (Fig. 27). Analysable telemetry results were obtained for two Scops Owl females and three males. They foraged in treelines and shrubs, on meadows, in plantations (orchards, elder). One female hunted for grasshoppers on a potato ad pumpkin field. They foraged a few 100 m from the nest. Detailed analysis of telemetry data has yet to be done.

In suitable breeding and feeding conditions Scops owl can form loose colonies. In one village, five nests were found (all in nestboxes), spaced 300-700 m apart, whereas in another village two nestboxes were occupied only 190 m apart (both pairs successfully fledged their young). Therefore, we assume that foraging habitats of neighbouring pairs overlap to a certain degree.

Fig. 17: Grasshopper

Fig. 18: Grasshopper (*Ephippiger* sp.?)

Fig. 19: Grasshopper (*Tettigonia* sp.?)

Fig. 20: Grasshopper (*Tettigonia* sp.?)

Fig. 21: Grasshopper

Fig. 22: Molecricket *G. gryllotalpa*

Fig. 23: Field cricket *G. campestris*

Fig. 24: Lepidopteran larva

Fig. 25: Spider

Fig. 26: Earwig *Forficula* sp.

Fig. 27: Small rodent

Conservation measures

Several conservation measures can be drawn from this study which are beneficial both for the focus species as well as other endangered birds (e.g. Roller *Coracias garrulus*, Little owl *Athene noctua*, Black Redstart *Phoenicurus phoenicurus*, Wryneck *Jynx torquilla*, etc.):

- Conservation of mosaical agricultural landscape and its elements (vertically and horizontally structured treelines, groups of trees and bushes, overgrown surfaces, small-sized fields with low cultures, e.g. potato and oil pumpkins, traditional orchards, meadows, pastures); no conversion of extensively managed meadows into fields or intensive meadows
- Planting of new high-stem orchards, especially apples, and maintenance of old ones (removal of Mistletoe *Viscum album*); trees should not be planted too close together (every 10-30 m is optimal) or too close to houses (> 10 m); some dead branches should be left on trees as they are used by Hoopoe as singing and pairing posts; natural cavities should not be closed or filled when rejuvenating orchards
- Nature-friendly backyard management (grass instead of pavement, planting of traditional fruit trees instead of low plantation varieties, conservation of barns and large trees close to farmhouses, such as Lime *Tilia* sp., Horse chestnut *Aesculus hippocastanum*, Walnut *Juglans* sp., gardening without the use of pesticides)
- Ecological small-scale agriculture (especially avoidance of poisons for Molecricket such as Mesurol); no commassations allowed
- Gradual grass cuts (small surfaces cut every week); use of bar mower better than rotational mower; blades set at least at 10 cm above ground; leaving uncut grass stripes at least 3 m wide every 30-50 m; cutting from the centre of the parcel towards the edge or from one edge to the other (all these measures promote invertebrate density and diversity)

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