Impact of hay mowing on the Stonechat *Saxicola torquatus* nestling

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Abstract - The impact of hay mowing on nestling Stonechats *Saxicola torquatus* was describes and quantified through the feeding activity of adults. Three breeding pairs (6 broods) were monitored. Occurrence of invertebrate taxa in the diet of nestling Stonechats was reported. The feeding frequency differs immediately after hay mowing (reduction up to 73%) to go back up after a few days even hunting different prey. The reduction of the feeding frequency does not appear to have affected reproductive success for the breeding pairs at least when the hay mowing takes place in limited and protected areas. The diet composition change with increasing nestling age, spiders and ants increase during the first days.

Key words: diet, hay mowing, *Saxicola torquatus*, Stonechat.

Riassunto - Impatto degli sfalci del fieno sulla nidificazione del saltimpalo *Saxicola torquatus*.

Viene riportato l'impatto sulla nidificazione del saltimpalo *Saxicola torquatus* esercitato dal taglio precoce del fieno. L'impatto viene documentato attraverso l'andamento della frequenza con cui vengono alimentati i pulli al nido. In particolare, a seguito del taglio del fieno in prossimità dei nidi, è stata accertata una forte riduzione (fino al 73%), del numero di prede portate al nido dai genitori. La riduzione del numero di prede rilevato immediatamente dopo il taglio del fieno non sembra che abbia influenzato il successo riproduttivo della specie probabilmente perché ha coinvolto un'area molto limitata all'interno di una riserva naturale. La composizione della dieta cambia con l'età dei pulli.

Parole chiave: *Saxicola torquatus,* saltimpalo, dieta, taglio fieno.

INTRODUCTION

The breeding success of birds mostly depends by the availability of the suitable nesting habitats and sufficient food supplies for nestlings, therefore the diversity of the diet might be strongly correlated to the habitat differences; for instance, highest prey densities are found in hay meadows, dry grasslands or steppe-like habitats (Dennis *et al*., 2008). Agricultural practices often can drastically change the environmental conditions of some breeding areas and among these practices, the management of hayfields for silage or livestock nutrition represents a problem during nestlings of several species. According to some authors, negative effects of hay mowing on bird populations may: 1) alter vegetation structure such that the habitat is no longer attractive to certain species and colonization will not occur (Owens & Myers, 1973); 2) reduce the reproductive success through the destruction of nests and young (Frawley & Best, 1991; Dale *et al.* 1997). Additionally, hay mowing strongly may reduce the food availability and in particular, insects that represent the diet for some species such as Stonechat *Saxicola torquatus*, a grass-dwelling prey insectivores (Cabello *et al*., 1991; Revaz & Schaub, 2008). Habitually the Stonechat's nests are near the ground (95.2% between 0-30 cm, Fuller & Glue, 1977) and associate with scrub situated along the edges of country roads or ditches (Fuller & Glue 1977; Caffi 2007). Considering that the diversity of diet might be partially correlated to the local habitat differences (Greig-Smith 1982; Greig-Smith & Quicke 1983), the effect of hayfield mowing, in Italy usually done in June, may cause a significant prey loss and, consequently, a change of diet.

The stonechat *Saxicola torquatus* in Italy is migrant, resident breeder and wintering, the population seems to be declining mainly due to both the loss of suitable habitats and severe wintering conditions in terms of heavy snow or hard frost, similarly occurs in Europe (Brichetti & Fracasso, 2008; Magee, 1965). In Italy nesting is mainly between late February and July (Brichetti & Fracasso, 2008) but a tendency to delay the laying of the first brood was observed (Caffi, 2007). In this paper, the impact of hay mowing on nestling Stonechats was describes and quantified through the feeding activity of adults, information on the breeding biology and occurrence of invertebrate taxa in the diet of nestling Stonechats were also reported.

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MATERIALS AND METHODS

The study was carried out during the 2022 breeding season at Monterano Natural Park (Northern of Rome, Italy. Altitude 300-400 m a.s.l., 42°14'N, 12°07'E) and in particular three Stonechat pairs, totally 6 clutches, were monitored. The breeding pairs were monitored (in the early morning and in the afternoon each 2-3 days) from April 7th to August 4th covering almost all breeding season. Totally 75 hours of observation were performed. Nests were located during nest building (parent birds with nest material) or nestling feeding. The breeding areas measured approximately 10 ha each and have similar matrices; they are characterized by the presence of country roads and ditches bordered with grassy vegetation isolated tree (*Pyrus pyraster, Ulmus minor*), bushes and shrubs (*Prunus spinosa, Crataegus monogyna*), the wildflower fields are encircled from hedges (mainly *Rosa canina* and *Rubus ulmifolius*). The herbaceous vegetation is growing on clays and is dominated by *Centaurea calcitrapa, Ranunculus velutinus, Trifolium resupinatum* and *Trifolium nigrescens* (Fanelli & Menegoni, 1997).

To determine nestling diets of Stonechat feeding, both parents were observed and photographed, often in exposed perches close to the nest; data regarding the frequency of prey collected by both male and female were recorded; the diet was calculated as a proportion of the feeding samples, categorized by the appropriate taxon. To avoid disturbance, failure or desertion, the hatching and laying data for each brood were determined to within 5 days considering the feeding starting by parents and the incubation period of 13-14 days (Cramp, 1988).

We recorded a total of 1,046 prey items and totally we identified 405 prey items corresponding to 38.71% of the total. The large fraction of unidentified prey is due mainly to the small size of prey.

During the first week of June about 80% of the surface of the wildflower fields, within 2 breeding territories were mowed.

To assess dietary differences between different pairs and time we compared the data regarding the taxonomic groups using the Mann-Whitney U-test. All analyses were carried out with PAST free statistical software version 4.

RESULTS AND DISCUSSION

The time interval (calculated considering starting feeding) and the distance between the first and second clutches of the same pair of Stonechat was 25.33 ± 0.58 days (range 25-26 days, n=3) and 115.67 ± 56.89 m (range 72-180 m, n=3) respectively.

The average distance from country roads was 9.45± 8.11 m (range 0.7-22 m, n=6), probably the proximity to a road favors the prey catch (often parents observed on the road surface). The first brood is laid in the range 20-25 March, according to the breeding biology of the species in Lombardia (Northern part of Italy) (Caffi, 2007). During the nestling both parents of each pair brought prey with an average frequency value of 21.73 ± 2.84 prey items per hour, higher than 17.8 prey/h reported by van Oosten (2016) for Dutch dune grasslands. Considering the quantity of prey transported to the nest by each parent, females brought 11.50 ± 4.60 prey/hour while males brought 9.50 ± 1.72 prey/hour.

In Fig. 1 the feeding frequency, in terms of number of pray per hour transported by both parents, is showed. It can be observed the drastic reduction (up to 73%) of the values occurred during the second brood for two nestling pairs (1 and 2 in Fig.1). The decline in prey occurrence in the diet can be related principally to a strong change in the availability of prey occurs after the hay mowing. In contrast, the feeding frequency observed in the breeding site of uncutted hayfields remains constant (pair 3 in Fig. 1).

A specimen of Honey buzzard *Pernis apivorus* that daily hunted insects in one of the sites frequented by the Stonechat (Fig. 2) it was no longer observed in the same field, probably as consequence of the hay mowing.

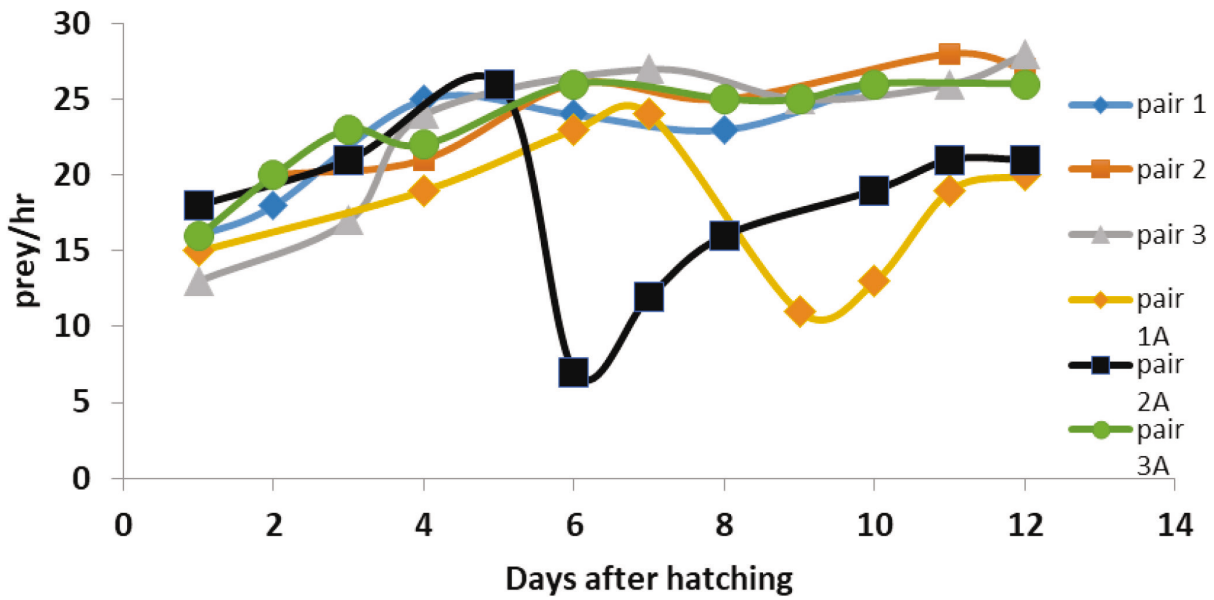

Fig. 1 - Feeding frequency during the nestling period. / Frequenza di alimentazione dei piccoli nel nido.

According to data reported in Tab. 1, the average number of fledging per pair substantially did not differ between the 1st and 2nd clutch (1st brood= 3.6/pair, 2nd brood=3.3/pair). The reduction in frequency apparently does not appear to have affected reproductive success, although the sample is too small to establish the true impact of hay cutting on reproductive success. The increase in frequency after the sharp decline, occurred for pairs 1 and 2, is probably due to the ability to catch alternative prey or to catch prey at greater distances from the nest than before hay was cut.

Fig. 2 - The Honey buzzard *Pernis apivorus* that usually frequented the Stonechat's nesting site. / Il falco pecchiaiolo *Pernis apivorus* che di solito frequenta il sito di nidificazione del saltimpalo.

An evaluation of the diet of nestling Stonechats shows a varied composition: Odonata, Orthoptera, Coleoptera, Lepidoptera, Hymenoptera, larvae and Arachnida were found in the diet of Stonechat (Tab. 1).

The composition of diets of second broods differs from early nest due to phenology of the prey and to hay meadows (U=39.5, p<005, Mann-Whitney U-test) while the Shannon biodiversity index partly differs (H_1=2.122; H_2=2.023) confirming the richness of species present in springtime during Stonechat nesting. The composition diet change also with increasing nestling age, for instance spiders and small white larvae (abundant Diptera larvae have been found in the dung of grazing cows in areas not far from nesting sites) are fed to young nestling such as often was observed for other insectivore passerine birds (Orłowski *et al*., 2015; Torok, 1986; Krupa, 2004) (composition of prey items days 1-5 vs days 6-14: U=35; p<0.05, Mann-Whitney U-test; Shannon index H_1=1.806, H_2= 2.138).

CONCLUSIONS

Although the sample analyzed is small and concerning an area with low anthropic impact, the data confirm that the hay cutting carried out during the reproductive period can determine effects on the feeding frequency and therefore on the reproductive success of the Stonechat and many other species especially if the hay cutting takes place in very large and unprotected areas. Naturally, the hay cutting determines the destruction of the nests and young of ground nesting species, but another consequence is the strong reduction of the prey available to the species that are raising the young before fledging.

Tab. 1 - Stonechat reproductive success (fledging/brood) and diet composition (%) during nestling (3 pairs, 6 broods). / Successo riproduttivo del saltimpalo (involati/covata) e composizione della dieta (%) durante la nidificazione (3 coppie, 6 covate).

Broods	**A**	**B**	**C**	**A1**	**B1**	**C1**
Fledging	3	4	4	4	3	3
Dragonfly (Odonata)	1.22	3.68	-	-	-	-
Horthoptera	3.05	3.07	5.62	5.47	3.82	9.09
Hemiptera	1.22	0.61	0.56	5.04	4.58	2.27
Coleoptera	-	-	-	-	0.76	-
- Carabidae	1.83	0.61	1.12	0.72	1.53	-
Diptera	4.88	6.13	5.56	2.16	-	1.52
Lepidoptera	6.10	5.52	4.49	4.32	5.11	13.64
Hymenoptera	2.44	5.32	4.49	0.72	1.53	6.06
Spiders (Araneae)	6.71	7.36	7.87	10.51	9.92	5.30
Ants (Formicidae)	6.71	6.75	5.06	7.63	10.45	6.06
Larvae	10.98	9.20	10.67	3.72	4.29	6.82
Other (unclassified)	54.88	51.53	54.49	59.71	58.02	50.00

To safe habitats capable of providing an adequate number of preys that make up the stonechat's diet it might be suggested to reduce the hay mowing by leaving patches of hay or by cutting late (July) to allow seeding and flowering. In this way the effects should not have a detrimental effect on breeding birds.

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