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Habitat selection and hatching success of the Common Sandpiper *Actitis hypoleucos* in Italy

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Abstract - Data were collected on the breeding biology of Common Sandpipers (*Actitis hypoleucos*) nesting in the middle course of Brenta River (NE Italy) in 1997. Birds occupied the territories from the end of March and laying mainly occurred in the second and third decade of April. Nests were found on sandy gravel beds, in the immediate vicinity of running water. Hatching success was low (58%), mostly due to predation by mammals. Human disturbance by sun-bathers dramatically restricts the areas suitable for breeding and therefore requires protection measures.

Key words: *Actitis hypoleucos*, breeding, riverine habitat.

Riassunto - Selezione dell'habitat e successo di schiusa del piro piro piccolo *Actitis hypoleucos* in Italia.

Si descrivono alcuni aspetti della biologia riproduttiva del piro piro piccolo nidificante lungo il medio corso del fiume Brenta (Veneto). Le coppie hanno occupato i territori verso la fine di marzo e la deposizione è avvenuta principalmente nella seconda e terza decade di aprile. I nidi sono stati trovati su banchi sabbiosi di ghiaia, nelle immediate vicinanze dell'acqua corrente. Il successo di schiusa è stato basso, pari al 58%, soprattutto a causa della predazione da parte di mammiferi. Il disturbo umano da parte di bagnanti limitava drasticamente le aree adatte alla riproduzione e richiede pertanto misure di protezione.

Parole chiave: *Actitis hypoleucos*, biologia riproduttiva, habitat ripariali.

INTRODUCTION

The Common Sandpiper *Actitis hypoleucos* is a small-sized wader mainly breeding in pebbly, sandy or rocky areas of fast-flowing rivers and to a lesser extent in a spectrum of different habitats (freshwater lakes, sea beaches, estuaries), occurring from sea level up to 4,000 m above the sea level (Snow & Perrins, 1998). This species has a very large distribution across Eurasia with a huge population of 2.600.000-3.200.000 individuals. Between 794.000 and 1.460.000 pairs breed in Europe, where the species is still categorised as "Least Concern", though a decline in population size has been reported (BirdLife International, 2024). In Italy, 500-1000 pairs have been estimated (EIONET, 2024), 200-300 of which are scattered along the rivers of the Veneto Region (Mezzavilla *et al.*, 2016).

The breeding biology of this species has been thoroughly studied in its breeding quartiers in northern Europe as regards many aspects (Holland *et al.,* 1982; Holland & Yalden, 1991; Yalden, 1992; Schödl, 2006; Hammer *et al*., 2013; Holland, 2018), but very few data are available for the Mediterranean populations, despite their abundance and wide distribution (Diez & Peris, 2001; D'Amico, 2002). In particular, data are lacking for the breeding biology of the Italian population, only synthetic reports being available (Valle, 1999; Bonato & Farronato, 2012).

Knowledge of the status of the species, of its habitat selection and breeding parameters is a prerequisite for any conservation initiative. The description of the nesting habitat at different levels allows the identification of critical features for future successful restoration work, while the identification of the causes of breeding failure allows their correction (Kissling *et al*., 2007; Duca *et al*., 2009).

This note describes the breeding biology of a small population of Common Sandpipers, breeding in the Veneto Region (north-eastern Italy) in 1997 with particular emphasis on habitat selection and hatching success.

STUDY AREA AND METHODS

The study was conducted during the breeding season 1997, in a 3.4-km stretch of the middle course of the Brenta river, in north-eastern Italy (45°37'47.35"N 11°44'13.63"E - 45°36'25.01"N 11°45'04.99"E, Fig. 1), within the SCI/SPA IT3260018 "Grave e zone umide della Brenta"). The Brenta river begins in Trentino Region, emerging at an elevation of 450 m above the sea from Lake Caldonazzo. Its course spans 174 km before reaching its end on the Adriatic Sea (Caravello & Pivotto, 2007). The area features a riverine landscape complete with riverbanks, river steppes, riparian willow groves, and vast, well-preserved hygrophilous forests. The impact of human involvement has been significant in the al-

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luvial regions along this portion of the river. These areas are now characterized by multiple quarry lakes and heaps of debris from gravel sifting, predominantly consisting of large pebbles (Mozzi, 2003). Nevertheless, the river bank contains vast untouched stretches, adorned with natural flora such as softwood forests, shrubs, sedge meadows, and sparsely vegetated gravel and sand banks (hereafter sandy gravel banks). In the study area, the Brenta river has a bed scattered with unstable shingle islets and is still fast flowing (Bonato & Farronato, 2012), representing the zone of the river which provides optimal habitat for Common Sandpipers (Roché & Frochot, 1993). The area hosted a number of both avian (Hooded Crows *Corvus cornix*, Magpies *Pica pica*) and mammalian predators (mustelids *Mustela sp. pl.*, Hedgehogs *Erinaceus europaeus*, feral cats *Felis catus* and dogs *Canis lupus familiaris*) (Bon *et al*., 1996; Bonato & Farronato, 2012). The western part of the study area (Fig. 1) was easily accessible from nearby roads, thus being subject by a severe disturb by high numbers of sun bathers during week-ends, whereas fishermen caused a lesser (but daily) degree of disturbance due to their small numbers.

Field data were gathered systematically searching for nests on suitable areas of river banks, in particular observing flushing adults. Though I believed that all nests were found during the egg-laying stage or during the first few days of incubation, I continued searching for nests throughout the breeding season. Only nests with at least one egg and/or eggshells with yolk (indicating avian predation) were counted (Traylor *et al*., 2004). Incubation stage was checked by a water test of egg flotation to estimate laying date. All nests were monitored until all eggs were lost or all eggs hatched. I visited nests at 7-day intervals or as frequently as weather conditions permitted, to determine fate. During each inspection, the status of clutches was recorded. Nests were ascribed to one of the following categories: 1) successful (presence of egg membranes or hatchlings, 2) predated (by birds if beak marks or yolk were found on shell or by mammals in presence of teeth marks and absence of yolk on shell), 3) flooded (eggs found wet or out of the cup), 4) deserted (eggs found cold), 5) unknown (otherwise) (Traylor *et al*., 2004). Nest fate was ascertained for 12 clutches out of 16.

Habitat selection was studied superimposing a grid of 100 x 100-m quadrats using QGIS (release 3.12.1; www.qgis.org) on aerial pictures (www.idt2.regioneveneto.it/idt/webgis) of the whole study area. I classified each quadrat for the presence-absence and number of nests of Common Sandpiper and other breeding species: Little-ringed Plovers *Charadrius dubius* and White Wagtail *Motacilla alba*, which have been reported to be associated with Common Sandpipers (Roché & Frochot, 1993). In addition, each quadrat was characterized for the following biotic and abiotic parameters: 1-3) % cover of vegetation (visually estimated in two categories: <2 m and >2 m), water and sandy gravel banks; 4) location, classified as "central" (the quadrat was separated from the river embankment and then from the mainland by at least another quadrat) or "peripheral" (the quadrat was at the river embankment); 5) anthropic disturbance (presence of fisherman/sunbathers).

Categorical data are presented as numbers (percent) and continuous data as means + 1 SD. Variables not normally distributed were square-root or arc-sin-square-root transformed as necessary to meet assumptions of normality for parametric tests. All tests were two-tailed and $P < 0.05$ was considered significant. Difference in count data were tested by means of a $\chi 2$ test. Differences in means were analysed using unpaired *t*-tests. I investigated the relationships of the biotic and abiotic variables of quadrats with Common Sandpiper presence-absence by means of logistic regression (Sokal & Rohlf, 1981). I conducted correlation analyses (Spearman's test) to reduce collinearity and the number of variables used in multivariate analyses (Green, 1979). Then, I retained the variable perceived as more biologically important among two or more of strongly inter-correlated variables ($r > 0.60$), since they may be considered as estimates of a single underlying factor. I compared survival functions using Cox proportional hazards model, a semiparametric method (Cox, 1972). Analyses were performed using SPSS software for Mac, release 20.0 (SPSS, Inc., Chicago, IL).

RESULTS

I found 16 clutches of Common Sandpiper, seven of Little-ringed Plovers, and six of White Wagtails, distributed along a 3,3 km stretch (4,8 pairs/km). The linear density, however, varied markedly in relation to the presence of areas occupied by weekend sun-bathers and therefore completely avoided by breeders. In a 2-km stretch free of anthropogenic disturbance, 12 pairs were present (6.0/km). The overall true density was, however, far less and calculable at 2.4/km, when considering a minor parallel course of the river Brenta in the study area largely utilized by Common Sandpipers for nesting. Overall inter-nest distance was 97±57 m. Common Sandpipers occupied 12 quadrats, of which nine hosted one pair, two hosted two pairs and one hosted three pairs (Fig. 1). Common Sandpipers were significantly (and positively) associated to both Little-ringed Plovers (Cramer's $V = 0.631$; $P < 0.001$) and White Wagtail (Cramer's $V = 0.564$; $P < 0.001$). Compared with non-breeding quadrats, those hosting Common Sandpipers contained both more shingle banks and water, but less high vegetation. In addition, occupied quadrats were respectively less frequently located near to the mainland and more frequently free from anthropic disturbance than those discarded by breeders (Fig. 1 and Tab. 1).

DISCUSSION

The present work provides the first data on both habitat selection and breeding biology of the Common Sandpiper in Italy, which was hitherto almost unknown. Three main findings are noteworthy. First, Common Sandpipers breeding in the middle course of the Brenta river are distributed according to the presence of sandy gravel beds, close to running water, thus confirming previous work conducted in England, Hungary, Poland, and Spain (Hammer *et al*., 2013; Holland, 2018; Elas & Meissner, 2019). The area of exposed sandy gravel beds close to running waters is known to be directly correlated with

Tab. 1 - Macro-habitat selection and nesting associated species of Common Sandpiper breeding along the Brenta river (NE Italy) in 1997. Environmental variables were measured at 1-ha quadrats occupied or not by the species. The mean ± SD is shown. a) *t* test carried out on the variable square root or arc-sin square root transformed. b) Difference tested by means of a $\chi 2$ test on the count data. / Selezione del macro-habitat e specie associate al piro piro piccolo nidificante lungo il fiume Brenta (Italia nord-est) nel 1997. Le variabili ambientali sono state misurate in quadrati di 1 ettaro occupati o meno dalla specie. È indicata la media ± SD. a) test *t* effettuato sulla variabile trasformata in radice quadrata o in radice quadrata arcosin. b) differenza testata mediante un test $\chi 2$ sui dati di conteggio.

Parameter	All N = 136	Occupied N = 12	Non occupied N = 124	P
Number of Common Sandpiper nests a	0.1±0.4	1.3±0.7	0±0	<0.001
Sandy gravel banks (%)a	14±17	38±16	12±16	<0.001
Low (<1 m) vegetation (%)a	1±2	0±0	1±3	0.549
High (> 1 m) vegetation (%)a	16±6	32±24	60±29	0.002
Running water (%)a	7±8	31±16	15±18	0.002
Agricultural land (%)a	10±22	0±0	11±23	0.079
Industrial gravel pits (%)a	1±3	0±0	1±3	0.508
Location: peripheral/central (%)b	32/68	8/92	35/65	0.022
Presence of breeding Little ringed Plovers (%)b	5	50	1	<0.001
Presence of breeding White Wagtail (%)b	4	42	1	<0.001
Anthropic disturbance (%)b	31	0	34	0.015

breeding density (Jones, 1983; Holland, 2018), since it represents the foraging habitat for both adult and chicks (Yalden, 1986; Holland, 2018). Along the Brenta river, sandy gravel beds influenced linear density, which resulted in average values reported in the literature for the species in other European populations: 0.13 - 12.0 pairs/km (Vickery, 1991; Dougal *et al*., 2004; Хохлова, 2021; Hammer *et al*., 2013; Holland, 2018). I found a significant avoidance of Common Sandpipers for wooded areas (Tab. 1). Though Common Sandpipers are known to prefer open areas, avoiding wooded ones (Buckton & Ormerod, 1997, Hammer *et al*., 2013; Holland, 2018), this behaviour is not confirmed by other researchers (Vickery, 1991; Diez & Peris, 2001; Elas & Meissner, 2019). Anyway, birds breeding in wooded areas were reported reaching similar breeding success to those located in open areas (Yalden, 1992).

A second finding from our work is that the Common Sandpiper was subject to significant predation by mammals, which significantly reduced reproductive success. A hatching success of 58% is lower than what reported for northern European congeners: 80% (Cuthbertson *et al.*, 1952) and 89% (Holland *et al.*, 1982). Causes of breeding failure for these populations were different, with predation being reported playing a minor role (Holland *et al.*, 1982), but see Holland (2018). Mammalian predation is a major cause of breeding failure for waders and has been suggested as a possible driver of wader population declines. On the contrary, nest survival has been improved through exclusion or reduction in numbers of predators (see McDonald & Bolton, 2008 for a review). This latter action would probably have little impact in my study area. I was unable to identify the species of mammals responsible of predation, but mustelids, which were highly suspected, are not proposable for reduction measures. On the contrary, slay dogs or cats, which could be restricted relatively easily, are probably not responsible for predation of Common Sandpipers, since straying is negligible in the Veneto Region and unleashed dogs accompanying sun-bathers usually wander in areas not occupied by breeding Common Sandpipers, as mentioned above.

A third finding is the critical impact of anthropic disturbance on the distribution of the species along the Brenta river. Fishermen and sun-bathers (the latter frequently with dogs) clearly limit the presence of the species, restricting it to areas unfavourable to human leisure activity. The negative impact of anthropogenic disturbance on distribution and reproductive success is known in the literature for the Common Sandpiper (Vickery, 1991; Yalden, 1992; Metzner, 2002; Schödl, 2006; Hammer *et al*., 2013; Holland, 2018; Хохлова, 2021). The control and restriction of unregulated human presence would probably allow an increase in the number of available breeding sites, creating the conditions for a possible numerical expansion of the breeding population. Albeit actions to regulate human presence appear to be not difficult to implement, there is no evidence that any such initiative is in place or in preparation in the middle course of Brenta River or if in place that it is being enforced.

As an aside, we mention that timing of breeding of Common Sandpipers of the Brenta River was clearly anticipated in comparison to the congeners of northern Europe. In my study area, the highest laying frequency was observed in the second and third decade of April, whereas in England the earliest birds arrive on the breeding grounds in mid-to late April and hatching mainly occur between late May and early July (Holland *et al.*, 1982; Dougal *et al*., 1995).

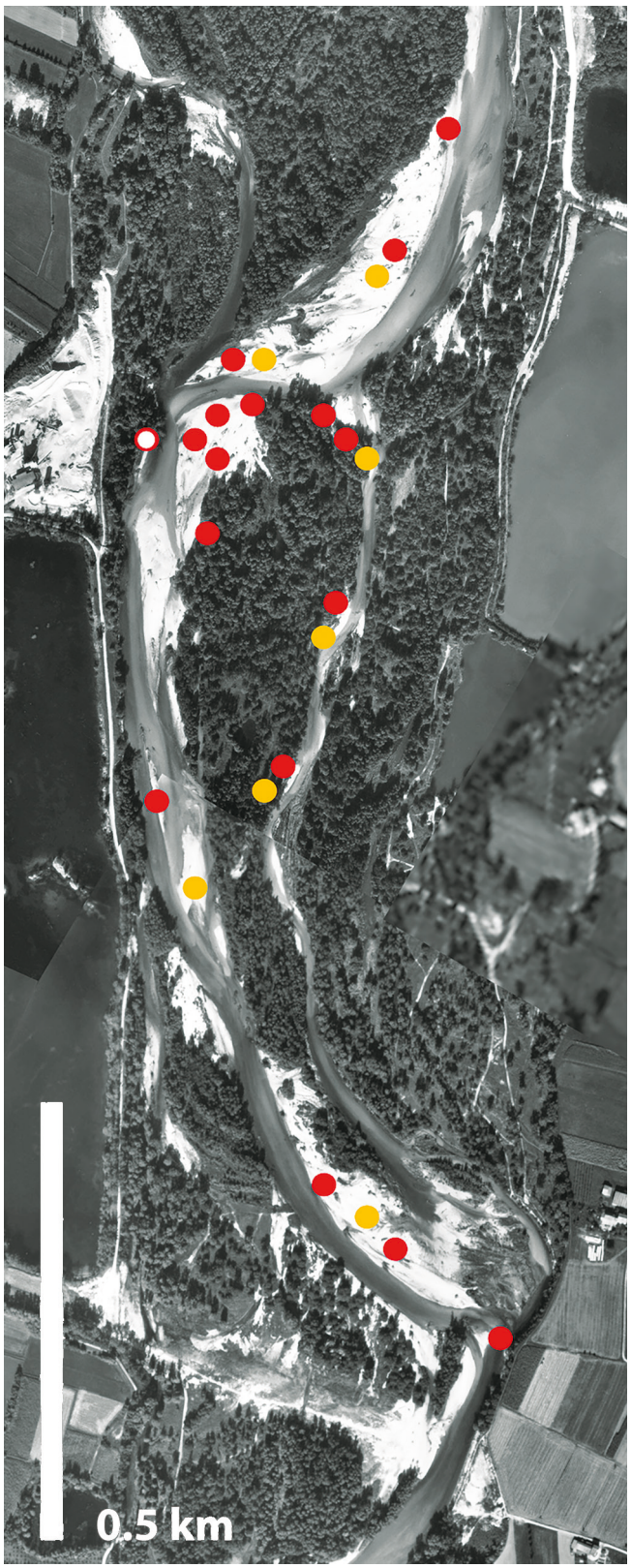

Fig. 1 - Study area: middle course of Brenta river (NE Italy) in late nineties of the past century. Red dots: nests of Common Sandpiper. Red circle: nest of Common Sandpiper, without any laid egg. Golden dots: nests of Little-ringed Plover. / Area di studio: medio corso del fiume Brenta (NE Italia) alla fine degli anni Novanta del secolo scorso. Punti e cerchi rossi: nidi rispettivamente con e senza uova di piro piro piccolo. Punti gialli: nidi di corriere piccolo. (Photo: / Foto: www.idt2.regione.veneto.it).

The major limitations of the present work lie in both the small sample and the limited time interval (one breeding season), which make it impossible both to trace a population trend and to attribute the true long-term weight to the extent of reproductive failure observed. This limits the generalisation of the results and impose confirmatory studies.

In conclusion, the present work demonstrates that Common Sandpipers nesting along the Brenta river select for nesting tracts with gravel/sand beds, close to both running water and wooded areas, according to the literature for other European populations (see Holland, 2018 for a review). Breeding success is low due to factors that are difficult to correct (predation by mammals). Anthropogenic disturbance appears to have a critical impact on the distribution of breeding pairs, preventing the mere presence of the species on heavily disturbed tracts and should be regulated as soon as possible, although no such initiative is evident.

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Fig. 2 - Clutch of Common Sandpiper, middle course of Brenta river, NE Italy, April 1997. / Nido di corriere piccolo, medio corso del Brenta, Italia nord-orientale, aprile 1997. (Photo: / Foto: di Michele Vettorel).

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