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Winter sympatry of two Reed bunting (*Emberiza schoeniclus*) subspecies in the Venetian lagoon

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Abstract - Morphometric data were taken on 403 specimens of Reed bunting, mist-netted during a 7 year period on the northern border of the Venetian lagoon. Two morphs could be clearly identified on the basis of bill depht and wing lenght. The large-billed, short-winged morph (*E. schoeniclus intermedia*) was caught year round, while the other (*E. schoeniclus schoeniclus*) was caught only from October to March. The distributions of bill depth of the two morphs showed some overlap that may suggest hybridization: birds of intermediate bill size, however, were never caught in summer months and their wing lenght was that of *E. s. schoeniclus*.

Introduction

The Reed bunting, *Emberiza schoeniclus*, occupies a very wide paleartic range, with three groups of subspecies differing in dimensions, coloration, but mainly in the size and shape of the bill. The extreme bill size polymorphism of this species is uncommon among passerines. The *schoeniclus* group extends (breeds) over the northern part of the range and is largely migratory, whereas the *intermedia* and *pyrruloides* groups are mostly resident or nomadic in the southern areas of the range. In Italy, *E. s. schoeniclus* is a regular migrant and wintering species, while several isolated resident populations of *E. s. intermedia* are found in some of the wetland areas still present in the country. Formerly (Arrigoni 1929), the large bill individuals were tentatively considered a different species (*E. palustris*), but, at the same time, it was claimed that the range of bill size of *schoeniclus* showed continuity with that of *palustris*, a statement unsupported by quantitative data. More recent surveys (Brichetti and Cova 1976, Meschini and Frugis 1993) indicate that *schoeniclus* breeds sporadically and locally in the western Po valley and by some of its northern tributaries, while *intermedia* breeds regularly in the eastern part of northern Italy, bordering the Adriatic sea. Some isolated populations still breed also in the italian peninsula. Individuals of intermediate bill size (hybrids?) are reported for the intermediate region (lake Garda, lake of Mantua, etc.), where the two forms could cohexist. Again, no quantitative biometric data are given.

To define whether a clear distinction could be made between the forms of *E. schoeniclus* found in nortern Italy, we started a systematic study of specimens caught by the northern border of the Venetian lagoon, where both the aformentioned forms are frequent. The large-billed form (*intermedia*) is present year round and reproduces locally. The small-billed form (*schoeniclus*) is frequent during the autumn and spring migrations, is present in winter with variable numbers of individuals, which share the same territories with the local *intermedia* population, but has never been observed to breed.

Methods

Birds were captured with 12 x 2.5 m mist nets, set in several locations of an approximately 200 ha area on the northern border of the venetian lagoon, in the course of a different study (Brocchieri *et al.* 1992). The area includes a few buildings (factories) but consists mainly of uncultivated grassland and dry flats with few trees (mainly *Salix*) and several ponds of fresh water, bordered by reedbeds, mainly *Phragmites* and *Typha*. The same number of nets (10) was set at least once per month for a period of 7 years (1987-93). A total of 407 birds were netted. For most of these, total body weight was taken with a 100 g Pesola balance to the nearest 0.1 g; subcutaneous fat deposits were estimated according to Busse and Kania (1970); wing lenght (maximum chord) and tarsus lenght were measured to the nearest 0.5 mm. Bill lenght was

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Table 1. Morphometric characteristics of the large-billed Reed buntings (*E. schoeniclus intermedia*) breeding in the Venetian lagoon. Males are significantly larger than females for all the characters considered, except for bill length (Analysis of Variance).

	males			females				
	mean ± SD	range	*n*	mean ± SD	range	*n*	F	*p*
wing length	80.57±2.51	76-86	31	74.89±1.85	71.5-79	32	74.9	<0.001
bill length	13.06±0.47	12-14	28	12.86±0.32	12.5-13.5	21	0.05	ns
bill depth	6.77±0.29	6.1-7.4	31	6.40±0.27	6-6.9	32	15.6	<0.001
bill width	5.24±0.35	4.5-5.9	31	5.02±0.38	4.4-5.7	30	9.47	0.004
body mass	21.25±1.65	17.7-24	30	18.44±1.10	16.5-20.6	31	66.3	<0.001

measured from tip to skull with calipers to the nearest 0.5 mm; bill depth at nostrils and bill width at base were taken with a dial caliper to the nearest 0.1 mm. Birds were sexed according to Svensson (1992), ringed with numbered aluminium rings and promptly released.

Results

Table 1 gives some biometric data for all birds netted during the breeding season (April-September), when only the intermedia form is present. Figure 1 shows

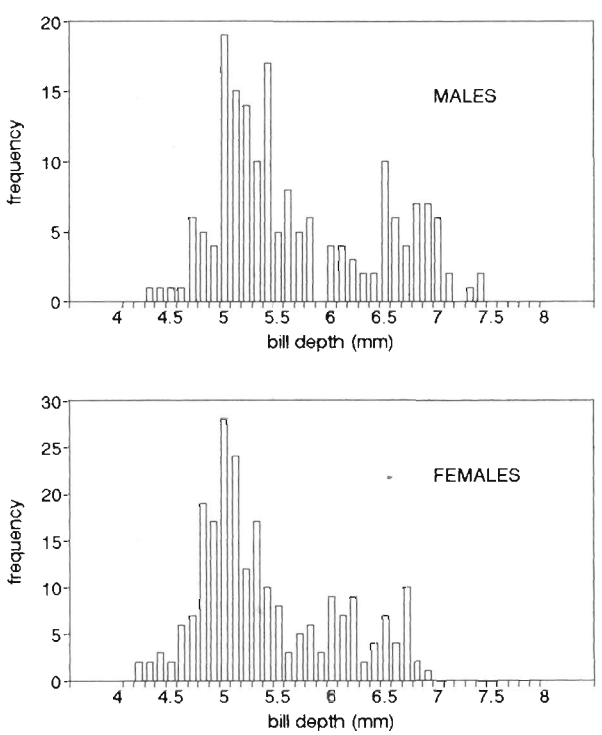

Figure 1. Frequency of bill depth in male and female Reed buntings captured year round in the Venetian lagoon.

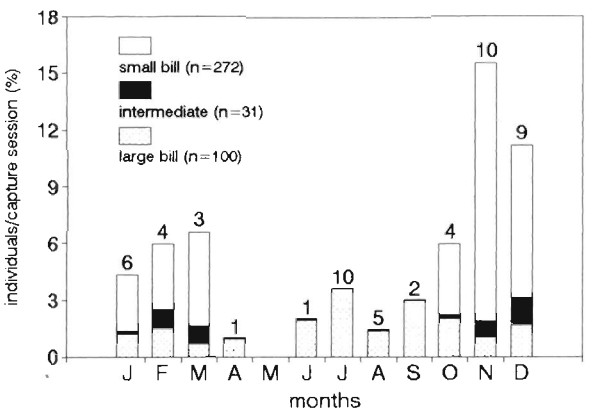

Figure 2. Frequencies of capture (standardized as number of individuals captured per netting session) of large-billed (bill depth >6.0 mm for males and >5.9mm for females), small-billed (bill depth <5.8 mm for males and <5.7 mm for females), and intermediate-billed Reed buntings in different period of the year. Numbers indicate netting sessions in which at least one specimen of Reed bunting was captured.

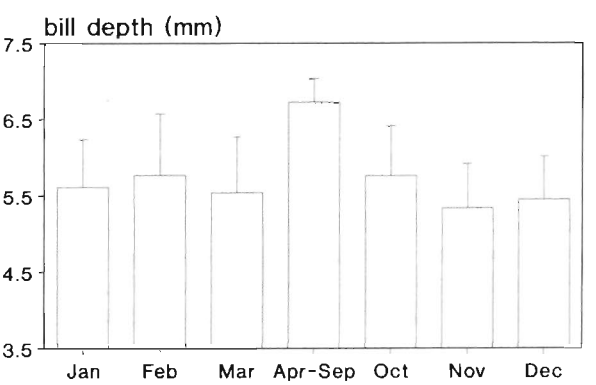

Figure 3. Variation of mean bill depth of male Reed buntings captured in different periods of the year (bars indicate SD). In April-September mean bill depth is significantly larger than in the rest of the year (ANOVA, $F_{6,171}=25.7$; $P<0.0001$). The same pattern was also observed for females ($F_{6,222}=31.9$; $P<0.0001$). Note the smaller standard deviation observed during the breeding season, when only E. s. intermedia was captured.

Table 2. Analysis of variance of the morphometric characteristics of Reed buntings captured in the Venetian lagoon, subdivided in three groups on the basis of their bill depth (large, small, and intermediate bill size)

Males	Large-billed (bill depth>6 mm)		Small-billed (bill depth <5.8 mm)		Intermediate			
	mean ± SD	n	mean ± SD	n	mean ± SD	n		
bill depth	6.68 ± 0.32	56	5.17 ± 0.29	112	5.88 ± 0.10	10		
bill length	12.86 ± 0.54a	51	12.32 ± 0.46b	108	12.72 ± 0.44a	9	F=22.4	p=0.001
bill width	5.21 ± 0.41a	56	4.24 ± 0.44c	112	4.71 ± 0.31b	10	F=95.9	p=0.001
wing length	80.82 ± 2.71b	55	81.83 ± 2.31a	95	81.95 ± 2.55a	10	F=3.1	p=0.048
body mass	21.50 ± 1.50	54	20.92 ± 1.80	101	21.13 ± 1.55	10	F=1.97	ns
Females	(bill depth >5.9 mm)		(bill depth <5.7 mm)		Intermediate			
bill depth	6.37 ± 0.28	55	5.02 ± 0.29	160	5.79 ± 0.08	14		
bill length	12.56 ± 0.43a	42	12.18 ± 0.41b	154	12.25 ± 0.43b	13	F=13.8	p<0.001
bill width	4.98 ± 0.36a	53	4.09 ± 0.38c	160	4.71 ± 0.31b	14	F=116	p<0.001
wing length	74.57 ± 2.09c	54	76.75 ± 1.46b	136	77.79 ± 1.64a	12	F=13.5	p<0.001
body mass	19.34 ± 1.61	54	18.97 ± 1.34	150	19.76 ± 0.71	14	F=3.05	p<0.05

Different indices (a, b, c) above the means refer to significant differences between groups of data (according to a least significant difference range test)

the distribution of bill depth in males and females of birds caught throughout the year. The distributions are very wide, hinting bimodality. From the data in Table 1 we considered 6.0 mm (males) and 5.9 mm (females) as the minimum values for bill depth characterizing the *intermedia* form. If we take 5.8 mm (males) and 5.7 mm (females) as the maximum values for bill depth for the *schoeniclus* form (Svensson 1992), some of the individuals caught show intermediate values. In Table 2 the same biometric data given in Table 1 for the birds caught in summer, are reported for all three classes (large, small, and intermediate bill) and Figure 2 shows their frequency distribution in catches year round. It can be seen from Table 2 that small-billed birds (*schoeniclus*) are somewhat lighter but have significantly longer wings than the large-billed individuals (*intermedia*), as expected from their migratory habits. In the two forms bills differ mainly in depth, less in width and hardly in lenght. The bill's upper profile also differs: straight in *schoeniclus* and slightly curved in *intermedia*. Figure 3 shows the mean bill depth of birds caught in different periods of the year. Birds with bills of intermediate depth have the same wing lenght as the small-billed individuals, and are caught only when these are also caught. It is thus likely that they belong to the migrant group.

It should be noted that our morphometric data do not agree entirely with those of Dementiev and Gladkow (1954), reported by Blümel (1982), which, to our knowledge, are the only other published with some detail for this species.

Discussion

Biometric data of Reed buntings caught in the study area allow a distinction to be made between the *intermedia* form and the *schoeniclus* form, mainly on the basis of bill depth and body weight values, which are higher in *intermedia*, and wing lenght values, which are higher in *schoeniclus*. Some individuals have intermediate bill size but long wings, which suggests that they belong to the *schoeniclus* group, as confirmed by their being caught only when *schoeniclus* individuals are also caught (non- summer months). The continuity in the distribution of bill sizes suggests that the two forms are not genetically isolated: if the intermediate individuals are hybrids, however, it suggests that the migratory habit and its associated long-wing trait are dominant, while bill size's genetic determination is likely to be quantitative (Boag and van Noordwijk 1987).

The bill size polymorphism of this species is rather unique. Other extreme cases of bill size polymorphism in passerines are the well known Darwin's finches of the Galapagos (*Geospiza*) (Grant 1986) and the

African finch *Pyrenestes ostrinus* of Cameroon (Smith 1987). In the latter the trait's variation was shown to be genetically determined, possibly by one or a small number of genes (Smith 1993), and related to diet: large-billed birds feed on harder sedge seeds than small-billed individuals (Smith 1990). The two forms of *Pyrenestes* are sympatric, and may thus represent a case of disruptive selection leading to the occupancy of a new trophic niche (Smith 1993). In the case of *E. schoeniclus* it has been claimed (Stegmann 1956) that large-billed forms (*pyrrhuloides*) have the ability to crack the stems of *Phragmites* and feed on insects hiding in them (mainly dipteran larvae), a food source not available to *schoeniclus*. If this observation is confirmed it would show a case where a heavier bill in a passerine leads to a more insectivorous diet, rather than to the exploitation of harder seeds, as in *Geospiza* (Grant 1986) and *Pyrenestes* (Smith 1987). It cannot be said, however, that one form is more narrowly specialized in its diet than the other: quantitative data are simply not available. The only indirect suggestion for trophic specialization is the fact that the habitat of *intermedia* is more strictly dependent on *Phragmites* reedbeds than is that of *schoeniclus* (Witherby *et al.* 1943, Vaurie 1959). Since *schoeniclus*' bill size and shape are closer to that of most other paleartic species of the genus *Emberiza*, it is likely to be the ancestral morph. It is puzzling that large billed forms of Reed bunting are prevalently sedentary or nomadic and occupy the southernmost areas of its vast range, while most paleartic species of genus *Emberiza* tend to be migratory, and breed mostly in the northern part of the paleartic region (Blümel 1982).

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Riassunto - Sono stati raccolti dati morfometrici su 403 esemplari di Migliarino di palude (*Emberiza schoeniclus*), catturati con mist-nets durante un periodo di 7 anni lungo il margine Nord della Laguna di Venezia. Si sono potute identificare chiaramente due forme sulla base dell'altezza del becco e della lunghezza dell'ala. La forma a becco grosso ed ala più corta (*E. s. intermedia*) è risultata presente tutto l'anno, mentre l'altra (*E. s. schoeniclus*) veniva catturata solo da ottobre a marzo. Le distribuzioni dell'altezza del becco delle due forme mostrano una sovrapposizione molto limitata che potrebbe suggerire l'occorrenza di ibridazione: tuttavia esemplari con becco di altezza intermedia non sono stati mai catturati nei mesi estivi e inoltre presentavano una lunghezza dell'ala simile a quella di *E. s. schoeniclus*.

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