# 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 depth 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

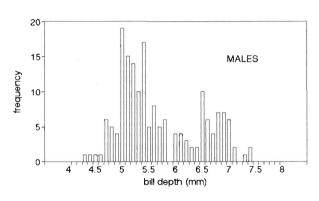
Table 1. Morphometric characteristics of the large-billed Reed buntings (E. schoeniclus intermedia) breeding in the	Venetian
lagoon. Males are significantly larger than females for all the characters considered, except for bill length (An	alvsis of
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	males			fen				
	mean ± SD	range	n	mean ± SD	range	п	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	$12.86 \pm 0.32$	12.5-13.5	21	0.05	ns
bill depth	6.77±0.29	6.1-7.4	31	$6.40\pm0.27$	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	$21.25 \pm 1.65$	17.7-24	30	$18.44 \pm 1.10$	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 I gives some biometric data for all birds netted during the breeding season (April-September), when only the intermedia form is present. Figure 1 shows



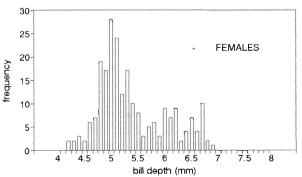


Figure 1. Frequency of bill depth in male and female Reed buntings captured year round in the Venetian lagoon.

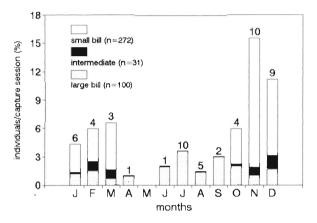


Figure 2. Frequencies of capture (standardized as number of individuals captured per netting session) of large-billed (bill depth >6.0 mm for males and >5.9mm for females), small-billed (bill depth <5.8 mm for males and <5.7 mm for females), and intermediate-billed Reed buntings in different period of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

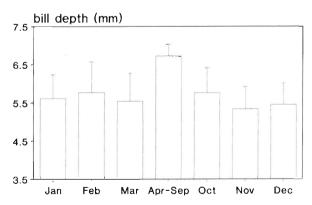


Figure 3. Variation of mean bill depth of male Reed buntings captured in different periods of the year (bars indicate SD). In April-September mean bill depth is significantly larger than in the rest of the year (ANOVA, F6,171=25.7; P<0.0001). The same pattern was also observed for females (F6,222=31.9; 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)

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Males	Large-billed (bill depth>6 mm)		Small-billed (bill depth <5.8 mm)		Intermediate			
	$mean \pm SD$ n		mean $\pm$ SD n		mean $\pm$ SD	n		
bill depth	$6.68 \pm 0.32$	56	$5.17 \pm 0.29$	112	$5.88 \pm 0.10$	10		
bill length	$12.86 \pm 0.54a$	51	$\text{J}2.32\pm0.46\text{b}$	108	$12.72 \pm 0.44a$	9	F=22.4	p=0.001
bill width	$5.21\pm0.41a$	56	$4.24 \pm 0.44 c$	112	$4.71 \pm 0.31b$	10	F=95.9	p=0.001
wing length	$80.82 \pm 2.71b$	55	$81.83 \pm 2.3  \text{la}$	95	$81.95 \pm 2.55a$	10	F=3.J	p=0.048
body mass	$21.50\pm1.50$	54	$20.92 \pm 1.80$	101	$21.13 \pm 1.55$	10	F=1.97	ns
Females	(bill depth ·5.9 mm)		(bill depth < 5.7 mm)		Intermediate			
bill depth	$6.37 \pm 0.28$	55	$5.02\pm0.29$	160	$5.79 \pm 0.08$	14		
bill length	$12.56 \pm 0.43a$	42	$12.18 \pm 0.41$ b	154	$12.25 \pm 0.43b$	13	F=13.8	p<0.001
bill width	$4.98 \pm 0.36 a$	53	$4.09 \pm 0.38c$	160	$4.71 \pm 0.31b$	J 4	F = 116	p<0.001
wing length	$74.57 \pm 2.09c$	54	$76.75 \pm 1.46b$	136	$77.79 \pm 1.64a$	12	F=13.5	p<0.001
body mass	$\lfloor 9.34 \pm J.6 \rfloor$	54	$18.97 \pm 1.34$	150	$19.76 \pm 0.71$	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.

### References

Arrigoni degli Oddi E. 1929. Ornitologia Italiana. Hoepli, Milano.

Boag P.T. and van Noordwijk A.J. 1987. Quantitative genetics. In: (Cook F. and Buckley P.A., Edits.) Avian Genetics: A Population and Ecological Approach. Academic Press, New York.

Brichetti P. and Cova C. 1976. La situazione nidificatoria del Migliarino di palude in Valpadana. Uccelli d'Italia 1: 28-31

Brocchieri L., Matessi C. and Marin G. 1992. Inference of pair bonds from capture data based on low variation of the sex ratio among catches. Amer. Nat. 140: 492-508.

Busse P. and Kania W. 1970. Operation Baltic 1961-1967 working methods. Acta Orn. 12: 231-267.

Blumel H. 1982. Die Rohrammer. A. Ziemsen Verlag, Wittenber Lutherstadt.

Dementjew G.P. and Gladkow N.A. 1954. Die Vogel der Sowjet Union. Bd.5, Moskau.

Grant P.R. 1986. Ecology and Evolution of Darwin's Finches. Princeton University Press, Princeton.

Meschini E. and Frugis S. (Eds.) 1993. Atlante degli uccelli nidificanti in Italia. Suppl. Ric. Biol. Selvaggina 20: 1-344.

Smith T.B. 1987. Bill size polymorphism and intraspecific niche utilization in an African finch. Nature 329: 717-719.

Smith T.B. 1990. Resource use by bill morphs of an African finch: evidence for intraspecific competition. Ecology 71: 1246-1257.

Smith T.B. 1993. Disruptive selection and the genetic basis of bill size polymorphism in the African finch *Pyrenestes*. Nature 363: 618-620.

Stegmann B. 1956. Über die funktionelle Bedeutung der Subspezies-Charaktere bei Emberiza schoeniclus L. J. Orn. 97: 236.

Svensson L. 1992. Identification guide to European Passerines (4th ed.). BTO Guide, Tring.

Vaurie C. 1959. The birds of western paleartic fauna. Witherby, London.

Witherby H.F., Jourdain F.C.R., Ticehurst N.F. and Tucker B.W. 1943. The handbook of british birds, Vol. 1. Witherby, London.