SHORT NOTES

Non-breeding reed warblers *Acrocephalus scirpaceus* (Hermann, 1804) in June in southern Europe: local or still migrating birds?

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KEY WORDS: Bird breeding season, floaters, flight morphology, population structure, Txingudi.

Accurate estimations of population structures for breeding birds are essential for assessing population-specific parameters, such as adult survival rates, breeding site fidelity or productivity (1-3). However, not all adult birds observed in a certain breeding area should be considered as breeders: non-breeding local birds and, in migrant species, individuals that are still migrating could also be present. Taking the proportions of birds in these categories into account is crucial for estimating unbiased population-specific parameters (4; 5).

In migrant bird species with large distribution areas, the overlap between local breeding birds and still-migrating ones is frequent, particularly at low latitudes (6-8). Compared to non-migrants (e.g., breeding birds), migrants normally show higher mean fuel loadings, i.e., higher energy stores that are used during the migratory flights (9). Birds tend to have longer and more pointed wings as well as shorter tails related to body size with increasing migration distances (10; 11) as is confirmed in several species of Holarctic passerines (12-15). Therefore, both a higher mean fuel load and different morphologies more resembling the long-distance-type in non-breeders may indicate that these birds are not local but still migrating birds.

Floaters present the non-territorial fraction of a territorial population (16) and are often older, less-experienced or handicapped birds (17), that would normally not breed. Because of their transient behaviour, they are less likely to be recaptured (4).The reed warbler *Acrocephalus scirpaceus* (Hermann, 1804) is a widespread breeding songbird in western Europe that passes the winter in tropical Africa (7). In spring, reed warblers reach southern Europe by late-March or April (7). Thus, most (if not all) adults should have reached their breeding areas by June, at least in southern Europe (18). The question whether some northern European birds that are still migrating could be found in southern European breeding areas has rarely been investigated. Our aim here was to determine whether non-breeding reed warblers captured in June in southern Europe were local or migrating birds, by considering traits such as fuel load, flight-associated morphology and recaptures.

Reed warblers were captured in Jaizubia (43º21'N, 01º49'W, Fuenterrabía, N Iberia), a 38.1ha small tidal river area located in the Txingudi marshlands. Birds were captured with mist nets (240 linear m) placed across reed beds and opened for four hours starting at dawn, during 10 consecutive days in June (05.06–14.06), July (10.07-19.07), and August (07.08-16.08) 2006. Once captured, reed warblers were ringed (or the ring was read) and their age was determined as adults (second-year birds or older, EURING code 4) or juveniles (first-year birds, EURING code 3). The following variables were also recorded: wing length (method III, ±0.5mm; 19), tail length (±0.5mm), length of primary feathers P2 to P9 (from outermost to innermost, ±0.5mm; P1 is vestigial), body mass (TANITA digital balance, ±0.1g) and fat score (scaled from 0 to 8; 20). Finally, we checked whether birds had brood patches (females; the brood patch is used for incubating the eggs, has no feathers and is highly vascularized) or cloacal protuberances (males, scaled from 0 to 9 (21)). We only investigated adult birds because our aim was to analyse the characteristics of non-breeding birds in a breeding population.

Flight-associated morphology (wing length, wing morphology, tail length/wing length) and fuel load (body mass/wing length and fat score; here, wing length is used as a proxy of body size; 22) were compared between breeding and non-breeding adult reed warblers captured in June. A bird was considered as breeder if it showed apparent breeding signs in June, July, or August. Because data on flight-associated morphology and body mass/wing length fitted the normal distribution (K-S test, $P>0.05$), *t*-tests were used for statistical comparisons. In contrast, fat score was not normally distributed (K-S test: $Z=2.466$, $P<0.001$), which is why a *U* test was applied. In order to avoid pseudo-replication, each individual was considered only once.

Wing morphology was assessed by the C_2 index which expresses wing pointedness (23). Positive values of the index are associated with rounded wings, while negative values are associated with more pointed wings.

Of the 77 adults captured in June, 47 (61.0%) showed signs of breeding (either in June or later, in July or August), and were considered to be breeders. This value is similar to that found in some Nearctic passerines (4) and reinforces the idea that a significant fraction of adult birds in a certain local population consists of non-breeders during the breeding season (24).

Breeding and non-breeding reed warblers captured in June had the same flight-associated morphology but differed in relation to their fuel load (Table 1). This supports

the hypothesis that non-breeders may be either local birds or non-local birds from populations breeding in areas relatively close to Txingudi, because if these were birds from more northern areas, we would expect more pronounced long-distance morphology (13). A higher fuel load in non-breeders may indicate that they are still migrating birds breeding in areas close to Txingudi. Alternatively, these individuals could be local, either birds arriving later in their breeding areas (with some remaining fuel accumulated for the spring migration period, from Africa to Europe) or birds starting to gain the fuel required for the migration beginning in summer (from Europe to Africa).

None of the non-breeding birds captured in June was recaptured afterwards, whereas 40.4% of breeders at Txingudi were recaptured in July or August ($x^2_1 = 16.101$, P-exact<0.001; Table 2). This confirms that the recapture probability was relatively high throughout the season and suggests that non-breeders did not remain at Txingudi for a long time. This result is consistent with the idea that non-breeders could either still be migration birds or local transient birds (floaters), unable to defend a territory (25; 4).

The presence of non-breeders can be very important at a local level, and in our opinion, this should be considered in studies dealing with the dynamics of breeding bird populations. This is particularly relevant in programs surveying parameters such as annual survival, population size or productivity (1). All of these parameters are fundamental to our understanding of population trends in particular species and, therefore, are also directly linked to the conservation of biodiversity.

TABLE 1

Differences in flight-associated biometrics and fuel load (mean±SE) between breeding and non-breeding adult reed warblers captured in June in the Txingudi marshlands (northern Iberia).

Variable	Breeding	Non-breeding	Statistics	*P*
Wing length	63.9±0.3 (*N*=47)	63.9±0.4 (*N*=30)	t_{75}=0.011	0.991
Wing morphology (roundness)	0.75±0.02 (*N*=43)	0.73±0.02 (*N*=29)	t_{70}=0.948	0.346
Tail length/ Wing length	0.84±0.01 (*N*=47)	0.84±0.01 (*N*=30)	t_{75}=0.428	0.670
Body mass/ Wing length	0.16±0.01 (*N*=47)	0.17±0.01 (*N*=30)	t_{75}=2.830	0.006
Fat scores	0.7±0.1 (*N*=43)	2.5±0.2 (*N*=29)	*U*=199.0	<0.001

TABLE 2

Number of breeding and non-breeding adult reed warblers captured at Txingudi in June and recaptured at the same site in July or August.

	Captured only in June	Captured in June and July/August
Breeding	28	19
Non-breeding	30	0

ACKNOWLEDGEMENTS

Thanks to all the people who collaborated during the field work, especially to J. I. Jauregi, R. Martín and J. M. Sánchez. The Diputación de Gipuzkoa authorized us to conduct the ringing activities. J. A. was supported by a post-graduate fellowship from the Gobierno Vasco – Eusko Jaurlaritza. The Gobierno Vasco – Eusko Jaurlaritza founded the project. V. Salewski, G. R. Geupel and two anonymous referees provided very valuable comments that improved an earlier version of this work.

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Received: July 8, 2009
Accepted: February 8, 2010
Branch editor: Schön Isa