Nota Curta / *Short Note*

Only females! An unexpected sex-bias in a population of Water Rails *Rallus aquaticus* wintering in a tidal marsh in northern Spain

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Knowledge of population structure is fundamental when analysing the spatial distribution of and habitat selection in sex classes. The aim of this work was to describe the structure in terms of its sex ratio of a population of Water Rail *Rallus aquaticus* wintering in a tidal reed bed in Urdaibai (N Spain). Sampling was carried out during winter 2012–2013. Overall, 20 Water Rails were captured and the sex was molecularly determined in 19. Apart from one male, all the Water Rails (94.7%) were females. Assuming that males are the dominant sex and thus have priority access to optimal habit, one plausible explanation for this unusual pattern is that tidal reed beds could be a suboptimal habitat occupied by the subordinate sex (females). Alternatively, tidal reed beds may be sufficiently good-quality habitat but males may maintain their breeding territories elsewhere. Capture-associated biases were excluded. When considering biometrics, it seems unlikely that our Water Rails are winter visitors from northern regions.

Key words: Water Rail, *Rallus aquaticus*, DNA analyses, winter, sex-ratio, habitat use, Urdaibai.

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Knowledge of population structures is crucial when analysing individual variability in the spatial distribution of a species. For instance, the analysis of sex ratios in populations over large areas is used to determine differential migration (Cristol *et al.* 1999), since one sex often spends the winter further south than the other (Catry *et al.* 2005, Arizaga *et al.* 2011). Additionally, at a local-scale level, each sex may occupy different habitats (Catry *et al.* 2004, 2007). Mechanisms explaining such differences are still poorly known and vary from competition (the dominant sex occupies the geographical region or preferred habitat of the species) (Moore *et al.* 2003) to the fact that one sex (often males) tends to overwinter as close as possible to its breeding quarters, whilst the other sex moves to more profitable sites in winter to maximize its survival possibilities (Lundberg & Alerstam 1986, Holmgren & Lundberg 1993). The latter is potentially more likely in more southerly areas with better climatic conditions.

The Water Rail *Rallus aquaticus* is widely distributed throughout the Palaearctic (except for the circum-Arctic region and the driest parts of Asia) (Cramp & Simmons 1980). It is mostly associated with reed beds (*Phragmites* spp.) or other types of macrophytes (Jenkins & Ormerod

2002, Brambilla & Rubolini 2004). They are known to be very territorial both as breeders and during the winter (Cramp & Simmons 1980). This territoriality, especially during the non-breeding period, could give rise to strong competition between sexes sharing often limited and, in addition, patchily distributed habitat (Cramp & Simmons 1980). Population segregation in relation to sex is thus possible among Water Rails, a question that until now has never been addressed.

Water Rails occupy both tidal and non-tidal reed beds (Galarza & Domínguez 1989) at the mouth of the river Urdaibai (N Spain), which is home to one of the main populations of this species in the Basque Country (Franco 1995). Although the most recent census gave a breeding population of around 100 adult pairs (Ihobe 2011), its winter population size is unknown. As a monogamous bird, during breeding each territory is expected to be occupied by a single pair (Cramp & Simmons 1980) and so a 1:1 adult sex ratio is likely during this period (except wherever sex-biased floaters occur in the population).

Little is known about population structuring in winter. In this period, dispersal processes and individual re-distribution may occur and lead to a sex bias (Catry *et al.* 2004, 2007). Suboptimal breeding habitats could become attractive as alternative foraging and/or roosting places (Jenkins & Ormerod 2002). If during this period one sex prefers one habitat to the others, then sex-associated segregation is expected. This phenomenon is well documented in species such as the European Robin *Erithacus rubecula* (Catry *et al.* 2004) and the Common Chiffchaff *Phylloscopus collybita* (Catry *et al.* 2007). Tidal reed beds suffer periodic flooding and thus are heterogeneous both spatially and temporally and as such may represent suboptimal breeding habitat for Water Rails (Jenkins & Ormerod 2002). However, at low tide these reed beds are rich in food since the mud flats around them and the mud of the substrate of the reed bed provide huge amounts of invertebrates for Water Rails to feed on (Cramp & Simmons 1980). Notably, in Urdaibai communal foraging often takes place in or near tidal reed beds when the tide is out (Galarza & Hidalgo 2006).

The aim of this work was to describe the population structure of Water Rails in tidal reed beds during the non-breeding period.

Material and Methods

We sampled three tidal reed beds at Urdaibai: (1) Forua, covering 18 ha (30T, UTM 526778 – 4798116), (2) S. Cristóbal, 3 ha (UTM 525201 – 4801992), and (3) Axpe, <1 ha (UTM 524930 – 4803097).

To determine population structure, Water Rails were captured from November 2012 to March 2013. We used two main methods, clap-nets baited with mealworm *Tenebrio mollitor* or *Paranereis* spp. and mist nets (19 mm mesh). We also sometimes used a tape lure (a male breeding call) in order to attract birds towards the trap/net. Capture sessions were carried out throughout the whole day. Once caught, each bird was ringed and its age (adult/first-year bird) was determined on the basis of the color and design of the wing feathers (Baker 1993). We also measured wing length (method III by Svensson 1996) to an accuracy of 0.5 mm. To identify the sex, we took a blood sample from the brachial vein. Samples were stored on FTA cards (Gutiérrez-Corchero *et al.* 2002) until analysis in the laboratory at the Vogelwarte Hiddensee (Germany). Sex was then determined following Eilers *et al.* (2012).

Results

Of a total of 20 captured Water Rails, 18 were identified as females, one as a male, and one remained unknown. A chi-square test showed that this female-biased proportion (94.7%) differed from a 1:1 sex ratio ($\chi^2 = 15.211$, $P < 0.001$). The wing length of our females was shorter than in other populations according to the literature (Table 1).

Discussion

Some considerations are necessary to rule out potential methodological artefacts. First, potential errors in the DNA analyses can be excluded. Second, the use of a tape lure may bias captures because one sex could be more (or less) attracted to the trap than the other (Borrás & Senar 1986). However, we did not use the tape lure in all cases and the method used here has also been employed in other studies in which

Table 1. Comparison of wing lengths of female Water Rails captured at Urdaibai and in other European countries. A one-sample *t*-test was used to compare each population with Urdaibai.
Comparació biomètrica de les femelles que es van capturar en canyissars a Urdaibai amb poblacions de referència d'altres zones d'Europa i Espanya. El t-test compara la mitjana d'Urdaibai amb cadascuna de les poblacions de referència.

Population ***Població***	**Mean** ***Mitjana***	**SD** ***DE***	**n**	**t**	**P**	**Source** ***Font***
Urdaibai	110.3	5.7	18	–	–	This study
Holland	116.0	2.8	124	4.28	<0.001	(Cramp & Simmons 1980)
Iceland	117.0	3.1	6	4.99	<0.001	(Cramp & Simmons 1980)
Germany	117.2	2.9	35	5.15	<0.001	(Eilers *et al*. 2012)
Spain (León)	117.0	4.5	12	4.99	<0.001	(Fuertes *et al*. 2010)

the proportion of males was found to be higher (Fuertes *et al*. 2002). Therefore, even if a certain female-bias existed in the sampling technique, it would be insufficient to explain our result.

The overwhelming proportion of females at these tidal reed beds suggests probable habitat segregation between sexes. Without more information on habitat use and its benefits (e.g. in terms of fitness), we are only able to enumerate a number of plausible hypotheses to explain our results. (1) Assuming that they are the dominant sex (Cramp & Simmons 1980, Moore *et al*. 2003), male Water Rails will occupy optimal habitats. Our result is compatible with the hypothesis that tidal reed beds are suboptimal and so the subordinate sex (i.e. females) occupies these sites. (2) Even if reed-beds are optimal habitats, males may prefer to remain in their breeding sites (territories) due to the benefits (e.g. less investment in territory acquisition during the spring) they derive from this behavior (Kokko 1999). Finally, (3) southern Europe is reported to host a (unknown) number of northern European Water Rails in winter that could be chiefly females (Cramp & Simmons 1980, Snow & Perrins 1998). This is possible for Urdaibai but, given that our females had shorter wings than those from more northerly regions (even within Spain), this hypothesis should be treated very cautiously. Biometry may not be a good indicator of migrants' origins, especially if they come from relatively nearby. This third hypothesis does not exclude the other two. Future, detailed research on sex-related habitat use by Water Rails during the breeding and non-breeding period, both in tidal marshes and non-tidal reed beds, will be essential to help resolve the issues posed by these hypotheses.

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Resum

Només femelles! Inesperada alta proporció de femelles en Rasclons *Rallus aquaticus* hivernants en canyissars intermareals al nord d'Espanya

El coneixement de l'estructura demogràfica o poblacional és essencial per a la comprensió de molts aspectes de la biologia i ecologia animal, utilitzant sovint el sexe com a criteri de classificació. L'anàlisi de l'estructura poblacional és fonamental per determinar els factors que delimiten la distribució espacial i l'ús diferencial de l'hàbitat segons sexes. L'objectiu d'aquest article és descriure l'estructura de la població de Rascló *Rallus aquaticus* en canyissars de caràcter intermareal a Urdaibai, durant el període no reproductor. Per això, es va mostrejar l'espècie durant l'hivern 2012–2013. Es van capturar 20 individus, dels quals se'n va poder determinar el sexe en 19, mitjançant tècniques moleculars. Excepte un mascle, la resta (94,7%) van ser femelles. Tot i que cal dur a terme nous estudis en el futur per determinar les causes que expliquen aquest patró, avancem les següents hipòtesis: (1) els mascles, dominants, no ocupen hàbitats subòptims, que queden així disponibles per a les femelles, o (2) podria ser que els canyissars mareals siguin hàbitats favorables, almenys a l'hivern, però que els mascles ocupin els territoris que utilitzen en època de cria, a causa dels avantatges que això comporta des d'un punt de vista reproductiu. Per biometria, sembla poc probable que els exemplars d'Urdaibai provinguin de poblacions migratòries hivernants.

Resumen

¡Sólo hembras! Inesperada alta proporción de hembras en Rascones *Rallus aquaticus* invernantes en carrizales intermareales en el norte de España

El conocimiento de la estructura demográfica o poblacional es esencial para la comprensión de muchos aspectos de la biología y ecología animal, utilizándose a menudo el sexo como criterio de clasificación. El análisis de la estructura poblacional es fundamental para determinar los factores que delimitan la distribución espacial y uso diferencial del hábitat según sexos. El objetivo de este artículo es describir la estructura de la población de Rascón *Rallus aquaticus* en carrizales de carácter intermareal en Urdaibai, durante el periodo no reproductor. Para ello se muestreó la especie durante el invierno 2012–2013. Se capturaron 20 individuos, de los que se pudo determinar el sexo de 19, mediante técnicas moleculares. Excepto un macho, los demás individuos (94,7% de la población) fueron hembras. Siendo obligado llevar a cabo nuevos estudios en el futuro para determinar las causas que explican este patrón, avanzamos las siguientes hipótesis: (1) los machos, dominantes, no ocupan hábitats subóptimos, que quedan así disponibles para las hembras, o (2) alternativamente, podría ser que los carrizales mareales sean hábitats favorables, al menos en invierno, pero que los machos ocupen los territorios que son utilizados en época de cría, debido a las ventajas que esto conlleva desde un punto de vista reproductivo. Por biometría, parece poco probable que las aves de Urdaibai procedieran de poblaciones migratorias invernantes.

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