

SPRING STOPOVER OF THE GLOBALLY THREATENED AQUATIC WARBLER *ACROCEPHALUS PALUDICOLA* IN MEDITERRANEAN FRANCE

MIGRACIÓN PRENUPCIAL DE UNA ESPECIE GLOBALMENTE AMENAZADA, EL CARRICERÍN CEJUDO *ACROCEPHALUS PALUDICOLA*, EN EL SUR DE FRANCIA

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SUMMARY.—Mist netting with playback was conducted in five marshes in the Camargue (France) in April-May 2009 to document the use of a Mediterranean route by aquatic warblers during spring migration. Six individuals were captured or observed at three sites. Habitat characteristics corresponded to grazed stands dominated by reed *Phragmites australis* or to stands within reeds dominated by *Juncus*, *Cladium* or *Schoenoplectus* spp., with 7 - 27 cm water levels and a denser vegetation stratum in the first 55 - 80 cm. Mediterranean studies are needed to identify and promote wetland management compatible with the ecology of this globally threatened species.

RESUMEN.—Se realizaron capturas con grabaciones de cantos en cinco localidades de La Camarga (Francia) en abril y mayo de 2009 para documentar el uso de una ruta mediterránea por el carricerín cejudo durante la migración prenupcial. Seis individuos fueron capturados u observados en tres localidades correspondientes a dos tipos de hábitat: carrizales pastoreados dominados por *Phragmites australis* o carrizales dominados por *Juncus*, *Cladium* o *Schoenoplectus* con nivel de agua de 7 - 27 cm y una cobertura más densa de vegetación en los primeros 55 - 80 cm. Son necesarios más estudios en el Mediterráneo para identificar lugares potenciales de paso prenupcial y promover una gestión de las marismas compatible con la ecología de esta especie mundialmente amenazada.

The aquatic warbler *Acrocephalus paludicola* is the only passerine species in continental Europe listed as globally threatened (BirdLife International, 2000). Belarus, Poland and Ukraine contain 92 % of the breeding population currently estimated at 12,500 singing males (Flade, 2008). Habitat lost to

agriculture and drainage is the major cause of the decline of this reed specialist which is mostly restricted to flooded sedge and *Cladium* fen mires (Aquatic Warbler Conservation Team, 1999). Location and characteristics of breeding sites are relatively well-known (Kloskowski and Krogulec, 1999;

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Kozulin *et al.*, 2004; Vergeichik and Kozulin, 2006; Tanneberger *et al.*, 2008), but several gaps remain in our knowledge of the migration and wintering strategies (Pain *et al.*, 2004; Julliard *et al.*, 2006; Schaffer *et al.*, 2006; Walther *et al.*, 2007).

During autumn migration, the northern and Atlantic coasts of France receive the largest numbers of aquatic warblers in Europe, with the Mediterranean area considered as playing a minor role (Julliard *et al.*, 2006). Spring migration is less documented, but two major routes have been proposed from the African wintering quarters, one along the Spanish and French Mediterranean coast up to the Rhône Valley, the other across the Mediterranean Sea from Morocco through Sardinia and the Italian Peninsula (Atienza *et al.*, 2001; Flade 2008). Scattered records are known from Mediterranean France during both migrations, including five observations and one capture from the Camargue between 11 and 24 April since 1968 (Hafner 1970; Réserve Nationale Camargue 1987; Boutin *et al.*, 1991; Thibault *et al.*, 1997; Kayser *et al.*, 2003; 2008). In France, 60 % of the records in spring are from the Mediterranean area (Le Nevé *et al.*, 2009). The aim of this study was to survey and characterise potential stopover sites in the Camargue during spring to orient and stimulate future research on aquatic warbler migration along the Mediterranean coast.

The Camargue or Rhône Delta encloses 9,200 ha of reedbeds (Davranche *et al.*, 2009). In accordance with habitat requirements reported during migration (de By, 1990), we selected five flooded marshes covered with common reeds *Phragmites australis* mixed with either *Juncus*, *Schoenoplectus*, *Schoenentum* or *Cladium*, and of which the management practices (short hydroperiods or bull grazing) favoured a low reed height. All sites comprised small open-water areas and were generally located nearby large water bodies. The Sanglier and Verdier are owned by the Tour du Valat (Natural Reserve), Pèbre and

Canisson are owned by the Conservatoire du Littoral, being managed respectively by the Parc Naturel Régional de Camargue and the Marais du Vigueirat, whereas Sollac is an industrial site of 1,650 ha comprising over 800 ha of natural habitats owned by the Group Arcelor-Mittal Méditerranée.

Birds were captured using from two to six sections of three consecutive mist nets (12-m long, 16 x 16 mm mesh) spaced between 75 m and 250 m according to the availability of structurally suitable habitat. Most sites were surveyed three times between 13 April and 8 May 2009 from 30 min before sunrise to 12:00 h when meteorological conditions (wind) permitted. Each net section was equipped with a MP3 key linked to an Altec Lansing in Motion Orbit MP3 speaker repeatedly playing the aquatic warbler songs in wave format during one minute followed by a 5 second pause. Because we observed that aquatic warblers were attracted by playback but remained still and were unlikely to be caught in the net, from the second week of sampling we used a 40-m long rope settled between two observers walking slowly towards the net line, starting at 30 m from the latter to increase capture probability. Nets were visited every 45 min and captured birds were ringed, weighed, examined for moult and fat with the length of head, beak, wing and tarsus measured according to the ACROLA (ACROcephalus paludicoLA) sampling scheme (Provost *et al.*, 2008). Habitat measures recommended by the ACROLA scheme were taken in a 50 x 50 quadrat located at 60 cm from the center of each mist net. These included water level, thickness of litter layer, density of dry and green reeds, reed height, presence of other plant species and their overall percent cover, along with type of vegetation management (reed harvesting or cattle grazing).

Aquatic warblers were captured and/or observed at three of the five study sites between 14 and 24 April (table 1). We captured two

aquatic warblers out of a sample of 78 birds during 1,074 net-hours. The passerine assemblage was dominated by resident species such as the moustached warbler *Acrocephalus melanopogon* (49 %), the bearded tit *Panurus biarmicus* (25 %) and the reed bunting *Emberiza schoeniclus witherbyi* (8 %). Few migrant *Acrocephalus* warblers were captured, with three individuals of great reed warbler *A. arundinaceus*, one sedge warbler *A. schoenobaenus* and one reed warbler *A. scirpaceus*. High fat scores were observed in aquatic warblers (body weight of 16 g), as well as once in three other species (garden warbler *Sylvia borin*, great reed warbler and bearded tit). The two aquatic warblers captured had been 'pushed' to the nets or would not have been captured otherwise. Four additional individuals attracted by playback were observed or heard next to the net lines. Habitat characteristics where aquatic warblers were captured or observed correspond to reed-dominated stands where grazing occurs or to *Juncus*-, *Cladium*- or *Schoenoplectus*- dominated stands with 7 - 27 cm water levels and a denser vegetation stratum in the first 55 - 80 cm above ground (table 2). Overall, reed height and density were low compared to the mean values obtained from a study on Eurasian bitterns *Botaurus stellaris* (Poulin *et al.*, 2005), where non-harvested reedbeds in the Camargue showed a reed density of 325 stems per square meter (vs. 112 stems in this study) and a dry reed height of 168 cm (vs. 115 cm) on average.

The aquatic warbler is a secretive bird outside the breeding season and to the best of our knowledge no study conducted in the Camargue had ever targeted this species. With aquatic warblers present at three of the five sites sampled, a proportion of birds captured exceeding 2 %, and a number of observations equalling those cumulated over the past 50 years, our preliminary data confirm the use of a spring migratory route through the Camargue. In addition, aquatic warblers were previously observed at the two sites lacking

the species, on 4 April 1997 at Canisson and 15 April 2006 at Verdier (Kayser *et al.*, 2003; 2008). Finally, three more observations of birds attracted by playback were made in a former agricultural land colonized by common reeds at the Marais du Vigueirat, 2 km from Canisson on 18 - 19 April 2009 during 44 net-hours of ACROLA mist-netting protocol (G. Massez, pers. comm.).

While playback facilitates the detection of individuals by attracting them and stimulating their song/call behaviour, it appears that mist-netting is less efficient than observation for estimating aquatic warbler presence in spring. We believe that the use of point counts with playback would be a more efficient method for prospecting potential stopover sites over large areas during spring migration. Playback is rarely used during prenuptial migration, and it could be worth testing experimentally the effect of a predominance of calls over songs and the use of speakers located one each side of the net line to foster bird movement. Mediterranean spring surveys should also start earlier than this study and cover the full month of April (Atienza *et al.*, 2001).

Although the ecological requirements of the aquatic warblers are marginal relative to the typical, large reed-dominated marshes covering the Camargue, the combination of a Mediterranean dry climate with brackish conditions and grazing as a common management practice are likely to provide, here and there, favourable stopover habitats, although most of these will be of relative small size and fragmented within a larger wetland mosaic. Nevertheless, the ecological requirements of the aquatic warbler are relatively close to those of the moustached warbler and the reed bunting, which are particularly common in reedbeds colonised by either *Carex* spp. or *Cladium mariscus* in the Camargue (Poulin *et al.*, 2002). The relatively low capture rates in this study are potentially related to the fact that the upper part of the nets was often visible above the vegetation, increasing the pro-

TABLE 1

Size and location of the five study sites with sampling dates and effort, and number of aquatic warblers either captured, observed or responding to playback during netting activities.

[*Tamaño y situación de cinco localidades de estudio con fechas de muestreo, esfuerzo y número de carricerines cejudos capturados y observados que respondieron al playback durante las actividades de captura.*]

Site (reedbed size)	Location	Date	Netting effort Net * hours	Number of individuals captured	Number of species captured	Number of aquatic warblers	
						Captured	Heard
Canisson (40 ha)	43° 29' 45" N, 4° 48' 43" E	04 / 13 / 09	90	21	2	0	0
		04 / 20 / 09	90	21	4	0	0
		04 / 30 / 09	75	10	4	0	0
Sollac (135 ha)	43° 27' 08" N, 4° 52' 15" E	04 / 18 / 09	108	10	2	0	1
		04 / 27 / 09	81	2	1	0	0
		05 / 08 / 09	72	1	1	0	0
Sanglier (16 ha)	43° 31' 22" N, 4° 40' 38" E	04 / 17 / 09	72	0	0	0	1
		04 / 24 / 09	72	3	3	1	0
		05 / 01 / 09	72	1	1	0	0
Verdier (120 ha)	43° 31' 40" N, 4° 41' 48" E	04 / 17 / 09	36	1	1	0	0
		04 / 24 / 09	36	0	0	0	0
Pèbre (9 ha)	43° 26' 58" N, 4° 37' 38" E	04 / 14 / 09	72	3	3	1	1
		04 / 21 / 09	90	4	2	0	1
		05 / 07 / 09	108	3	2	0	0

TABLE 2

Habitat characteristics for each net line (means from three quadrats) where aquatic warblers were captured (1), observed (2) or heard (3) according to the ACROLA (ACROcephalus paludicola) vegetation sampling scheme.
 [Características del hábitat de cada línea (medias para cada tres cuadrículas) donde los carricines cejudos fueron capturados (1), observados (2) o escuchados (3), según el esquema de vegetación muestreado por ACROLA.]

Habitat characteristics	Site (type of contact)				
	Pèbre (1, 2)	Pèbre (2)	Sanglier (1)	Sanglier (2)	Sollac (3)
Water level (cm)	17	11	27	26	7
Litter thickness (cm)	8	7	15	31	11
Dry reed density per m ²	103	30	65	85	24
Green reed density per m ²	159	35	37	13	10
Mean height of dry reed	120	101	99	100	157
Maximum height of dry reed	192	127	150	137	197
Mean height of green reed	107	82	112	102	103
Other plant species	<i>Juncus</i> , <i>Schoenoplectus</i>	<i>Schoenoplectus</i> , <i>Juncus</i>	<i>Juncus</i> , <i>Schoenoplectus</i>	<i>Juncus</i> , <i>Schoenoplectus</i>	<i>Cladium</i> , <i>Juncus</i> , <i>Schoenetum</i>
% Cover by other plants	5	45	48	60	62
Height of low stratum	55	65	73	80	75
Management practice	grazing	grazing	short hydroperiod	short hydroperiod	short hydroperiod

bability of net avoidance by flying birds. Spring 2009 was exceptionally wet and the presence of water could be a more limiting factor than vegetation structure in the Camargue in most years. This has yet to be confirmed, as the species has been shown to breed also in dry fen mires in Hungary and Belarus (Kovács and Végvári 1999; Kozulin and Flade, 1999). More investigations are needed to quantify the amplitude of the spring migration through the Mediterranean coast and identify the ecological needs of the species at its stopover sites. This also applies to the autumn migration with the Mediterranean route being potentially more important than previously thought, as shown by Atienza *et al.*, (2001). Historical records from the Tour du Valat ringing station revealed 12 aquatic warblers captured between 1958 and 1972 (8 August - 11 November), with three additional captures at the Marais du Vigueirat between August 1994 and 1999 (Thibault *et al.*, 1997; Kayser *et al.*, 2003; G. Massez, pers. comm.). These numbers are high considering that the nets were not located in aquatic warbler habitat and that no playback was used. More studies are warranted to quantify the role of the Mediterranean area within the migration strategy of this globally threatened species.

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