The Portuguese Atlas of Winter and Migratory Birds 2011–2013: a synopsis

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Abstract. The first Portuguese Atlas of Winter and Migratory Birds will be published in 2017 and was innovative in including the post-nuptial migratory period and data from ringing stations. The standard methodology was identical in both seasons and based on counting birds during a 30 min walk in each of six non-adjacent tetrads (2×2 km) within a 10×10 km UTM square. Additional records were also included as well as data from 26 ringing stations working only during the migratory season. It was possible to cover around 60% of the territory during the migration period and ca. 80% in winter. Despite some limitations of the project like short time for field work (only 2 consecutive winters and migratory seasons), results are very positive and set up a milestone for future initiatives.

Introduction

Bird Atlases are important tools to assess bird distributions and can provide a singular resource for studying wildlife (Gibbons et al. 2007). Moreover, they can perform as instruments to foster environmental public policies at regional and national levels and have become a popular form of citizen science (Greenwood 2006). Traditionally, most Atlases are focused on the distribution of breeding birds due to the importance of this phenological period in population recruitment. Moreover, the spatial stability of most species during the breeding season minimizes constrains derived from the high mobility of birds.

Not surprisingly, the number of atlases in Europe dealing with the distribution of bird species in winter is less common (for a review see Heldbjerg et al. 2016). The first winter atlas was carried out in the UK in the 1980'ies (Lack 1986), as a result from a partnership between the British Trust for Ornithology (BTO) and Irish Wildbird Conservancy (IWC). The first "overall-year" atlas, with distribution maps covering all seasons and for every month (also the post-nuptial migratory period) was published in The Netherlands (SOVON, 1987).

In the Iberian Peninsula, despite its utmost importance as winter area for many bird species breeding in Central and North Europe, only regional projects were undertaken until recently (Portugal — Bolton 1987, Elias et al. 1998; Spain — Del Moral 2002, Gaizarain 2006, Herrando et al. 2011). The first atlas with a national coverage

was published for Spain in 2012 (SEO/BirdLife 2012).

In Portugal, the idea of developing a national atlas for winter birds came into form in 2010 when a partnership headed by SPEA (Portuguese Society for the Study of Birds) and including the University of Évora (LabOr-Laboratory of Ornithology), applied for the EDP (Electricidade de Portugal) Biodiversity Fund with an Atlas project on winter and migratory birds to be conducted in 2011–2013. The proposal was pioneering for Portugal in including the post-nuptial migratory period, based on the importance of the country as a stopover site for long-distance migrants on their way towards Africa.

Before the kick-off of the Atlas, the partnership was reinforced with ICNF (the governmental body for nature conservation), regional government agencies in Azores and Madeira and APAA (the national association for bird ringers). The role of APAA was important for a novelty of the project which was the inclusion of data from ringing stations operating in the autumn migration period. With this task we aimed to get information about less detectable migrant species, and to understand if birds that migrate through our mainland territory do it preferentially near the coast or if they also use the interior of the country.

The Portuguese Atlas of Winter and Migratory Birds 2011–2013 (hereafter PAWMB) aimed at producing distribution and relative abundance maps for all species of winter and post-nuptial migratory birds in mainland Portugal and archipelagos of Azores and Madeira. The project was very challenging because it was scheduled for only two years of field work (imposed by the application rules of the EDP Biodiversity Fund call) to be conducted outside the usual breeding period. As an extra challenge the initiative was conceived to be greatly based in volunteer work managed by regional coordinators and the project coordination.

In this paper we will present the methodology used in PAWMB and a brief outlook of results, somehow anticipating the publication of the book which is expected to occur in 2017.

Methodology

Sampling periods, field methods and data management

The project last for 30 months, allowing the establishment of two sampling periods for each season (migratory: 2011 and 2012; winter: 2011/2012 and 2012/2013). In mainland Portugal and Madeira, surveys in the migratory period occurred between 1st of August and 15th of October and winter surveys between 15th of November and 15th of February of the following year. In the Azores both sampling periods were adjusted through a 15 days delay (Equipa Atlas in litt.).

The standard methodology was identical in both sampling periods and based on species' relative abundance obtained by counting birds in a set of six non-adjacent tetrads (2×2 km) within a 10×10 km UTM square. Each tetrad was censused during a 30 min walk. Observers were asked to select transects that cover as many habitats as possible, considering their representativeness in each square. Censuses were carried out during the 4 hours after sunrise or before sunset avoiding adverse weather conditions (extreme temperatures, strong winds, heavy rain and fog). All observations collected during standard visits outside the 30 min transects could be submitted as 'Additional Records', provided they occurred within the sampling periods established.

In order to include also data from mainland ringing stations the country was divided in 14 areas seeking the most possible regular coverage of the territory. Twenty-six ringing stations located within 24 UTM 10×10 km squares were used in this project, 16 along the coastal part of the country (hereafter referred as coast) and 8 in the interior of mainland Portugal (Figure 1). Ringing sessions were carried out only during the migratory season of 2011 with at least one sampling station in each of the 14 areas. In each sampling station two ringing sessions were conducted in the following periods: 28th August – 4th September and 25th September – 2nd October. In order to optimize captures the number of mist-nets per station was not standardized but a minimum of 100 m mist-netting per sampling period was established and results were expressed as number of birds caught per square meter. Mist-nets were open 30–45 min before sunrise and each session last for five consecutive hours.

All observations (systematic and additional) were uploaded by observers in the former national web portal for bird data (worldbirds/PortugalAves) where a special module was created for PAWMB.

Data from other sources were included also as additional records, namely those derived from monitoring schemes coordinated by SPEA (NOC-

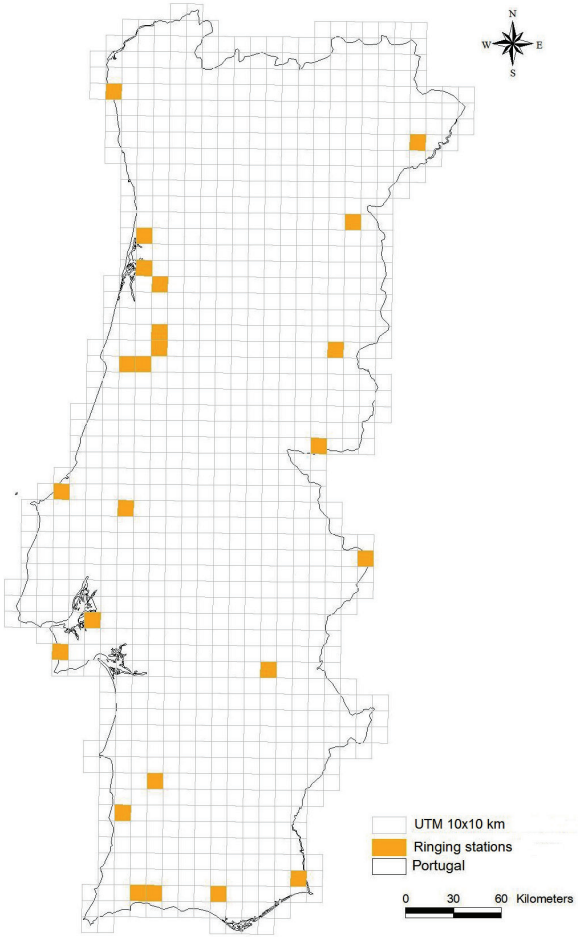

Figure 1. Location of the 24 UTM 10×10 km squares with ringing stations (16 along the coastal part and 8 in the interior of mainland Portugal). Source: Equipa Atlas in litt.

TUA-PT, ARENARIA, CANAN, RAM) and ICNF (the national monitoring programme for winter aquatic birds). An important set of data for Common quail *Coturnix coturnix* and Eurasian woodcock *Scolopax rusticola* in Azores was provided by DRRF (the regional body for forest resources). Similarly, the ANCG (national association for woodcock hunters) supply most of the records for Eurasian woodcock in mainland Portugal. Records available at online platforms like eBird (www.ebird.org) and Biodiversity4all (ww.biodiversity4all.org) were also used.

Analytical methods

Distribution maps were produced using all the records (systematic and additional). Data from systematic surveys allowed relative abundance maps (number of birds per hour) with four categories of abundance by species. These categories were based on the natural grouping of data, which means that classes were set in order to minimize the variance of data in each class.

When the number of 10×10 km squares was sufficient, we did a simple geographical interpolation to estimate the presence in unknown areas. This procedure was possible for several species. Major constrains were related with the lack of full coverage at country level, and with the unbalanced distribution of the surveyed squares.

We decided to use the number of birds per hour instead of the frequency of occurrence (expressed in the number of tetrads in which a species was recorded against the sampled tetrads) since the use of the latter would likely tend to normalize records, not reflecting the importance of certain sites for some species.

Results: a brief outlook

Sampling effort and species richness

Less than 300 volunteers conducted systematic visits along with 17 regional coordinators and 25 accredited bird ringers. In all, it was possible to cover around 60% of the national territory during the migration period and ca. 80% in winter. Although these results are below the initial expectation of more than 400 volunteers and a territorial coverage around 90%, they should be considered positive taking into account the constrains imposed by the short project period, which proved to be too small to sample all the territory.

In all, 415 species were recorded and in Figures 2 and 3 we show the species richness for mainland Portugal respectively in winter and migratory seasons. These maps include overall data (systematic visits and additional records), so a direct comparison between squares should be taken with caution due to the unevenness of effort involved (Equipa Atlas in litt.). Nevertheless, the highest number of species within a 10×10 km square was 158 in winter and 187 during autumn migration.

In winter, bird richness was higher in coastal zones close to major wetlands areas (estuaries and coastal lagoons). Largest numbers of species were detected on coastal Algarve, on the West coast between Sines and Peniche and further north between the Aveiro lagoon and Minho estuary. During migration, the number of species recorded per square was generally higher than in winter although the pattern of variation of species rich-

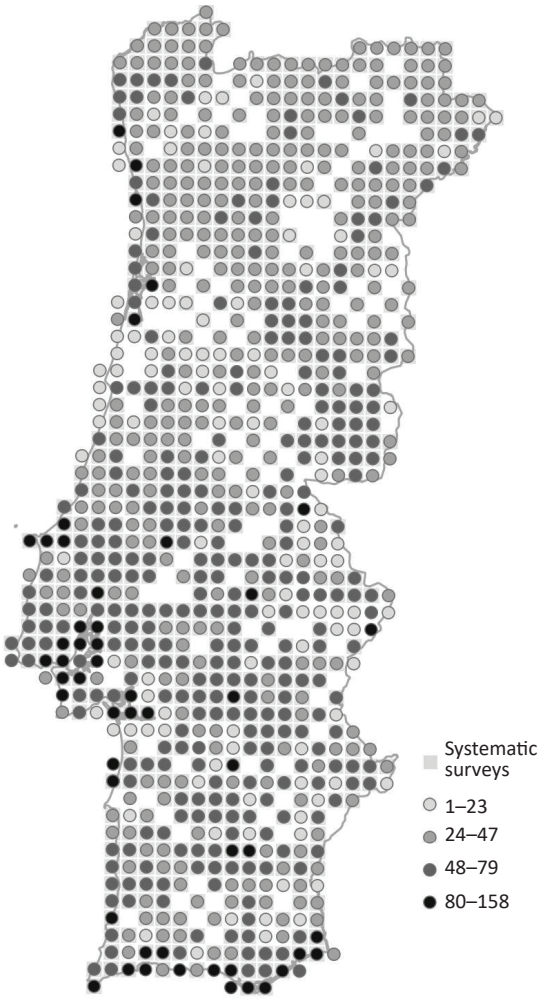

Figure 2. Map of bird richness in mainland Portugal for the winter based on data from two seasons of systematic visits plus additional records. Circles: number of species. Source: Equipa Atlas in litt.

Figure 3. Map of bird richness in mainland Portugal for the migration period based on data from two seasons of systematic visits plus additional records. Circles: number of species. Source: Equipa Atlas in litt.

Table 1. Numbers (N) and proportions (%) of birds caught in ringing sessions carried out during the autumn migration in coastal (Coast) and interior (Interior) sampling stations of mainland Portugal.

Species	Coast (N)	Interior (N)	Total (N)	% Coast	% Interior
Sylvia hortensis	–	6	6	–	100
Sylvia cantillans	14	270	284	5	95
Phylloscopus ibericus	2	20	22	9	91
Luscinia svecica	60	1	61	98	2
Acrocephalus schoenobaenus	48	2	50	96	4
Acrocephalus scirpaceus	346	33	379	91	9
Phoenicurus phoenicurus	4	13	17	27	76
Phylloscopus trochilus	232	128	360	64	36
Ficedula hypoleuca	64	41	105	61	39
Sylvia borin	83	126	209	40	60
Sylvia atricapilla	174	222	396	44	56
Sylvia communis	41	52	93	44	56

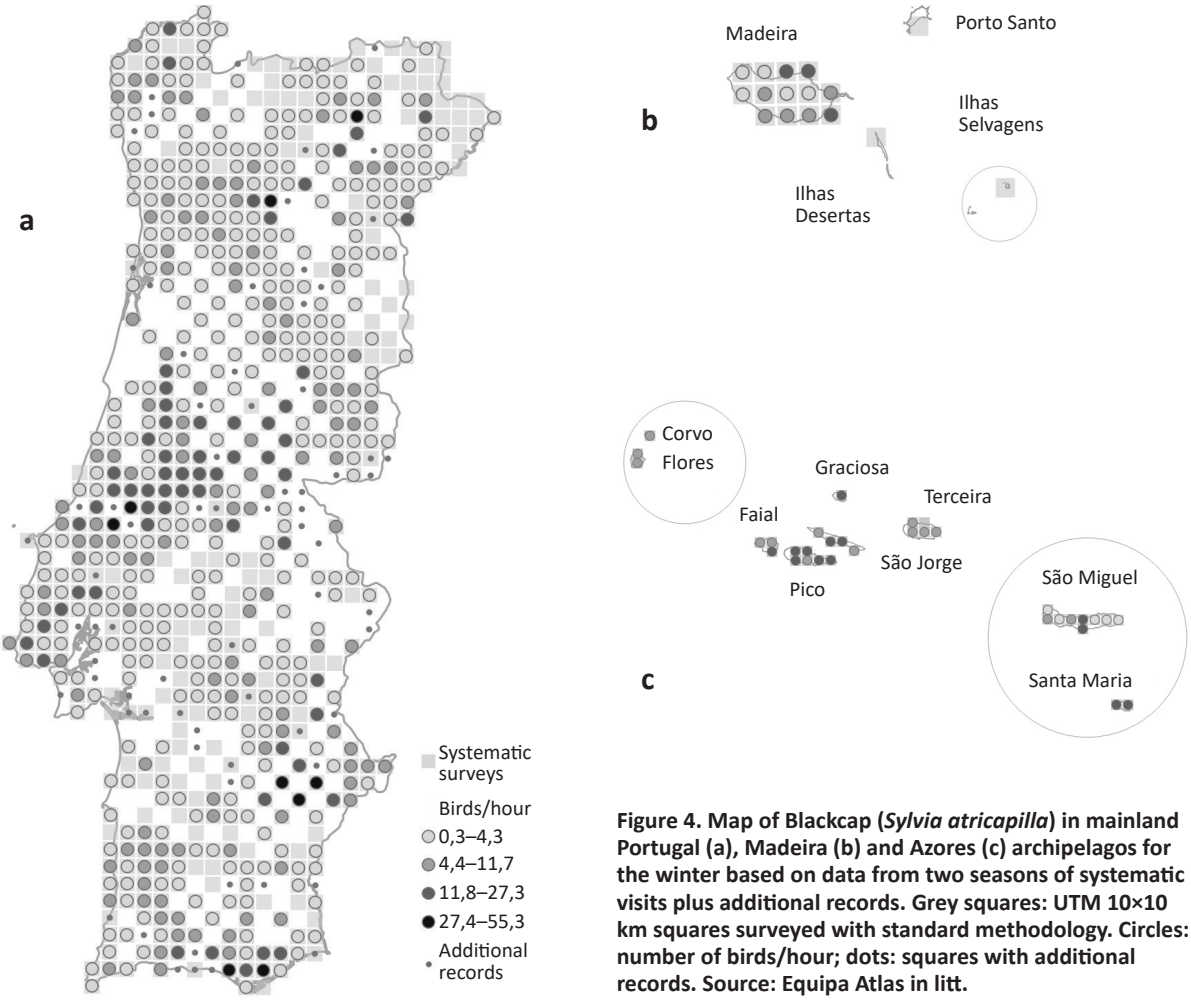

Figure 4. Map of Blackcap (*Sylvia atricapilla*) in mainland Portugal (a), Madeira (b) and Azores (c) archipelagos for the winter based on data from two seasons of systematic visits plus additional records. Grey squares: UTM 10×10 km squares surveyed with standard methodology. Circles: number of birds/hour; dots: squares with additional records. Source: Equipa Atlas in litt.

ness along the coast, Tagus and Sado valleys was similar. In the interior, however, the number of squares with high values of richness seems to be lower compared to winter, although this pattern may be real or otherwise masked by the reduced sampling effort in some of these areas.

As expected from their geographic location, the archipelagos of Azores and Madeira have richness values much lower than the mainland. In Azores there were no relevant differences in the number of species detected per square between the two periods (winter and autumn migration). On the other hand, in the archipelago of Madeira the number of species during the migration period is much higher than in winter because those islands (specially the Selvagens) are an alternative stopover site for some migratory birds between Europe and Africa (e.g. Hartog et al. 1984, Folmer & Ortvad 1992).

In what ringing sessions are concerned, the results highlight (1) the predominance of migrant species in captures and (2) the importance of the interior of mainland Portugal as a migratory passageway for long-distance migrants such as Orphean warbler *Sylvia hortensis*, Subalpine warbler *S. cantillans*, Garden warbler *S. borin* and Common redstart *Phoenicurus phoenicurus* (Table 1). Additionally, ringing sessions were useful in providing information for species with a lower detectability in systematic visits such as Garden warbler, Bluethroat *Luscinia svecica*, Sedge warbler *Acrocephalus shoenobaenus*, Eurasian reed warbler *A. scirpaceus* and Common grasshopper-warbler *Locustella naevia*.

Weather conditions during the Atlas period

The analysis of meteorological data (Instituto de Meteorologia 2012, Instituto Português do Mar e da Atmosfera 2013, Meteo France 2012, 2013, Met-Office 2012, 2013, KNMI 2012), showed that the winters of 2011/2012 and 2012/2013 were mild and to some extent favourable to a permanence of birds in Northwest Europe until

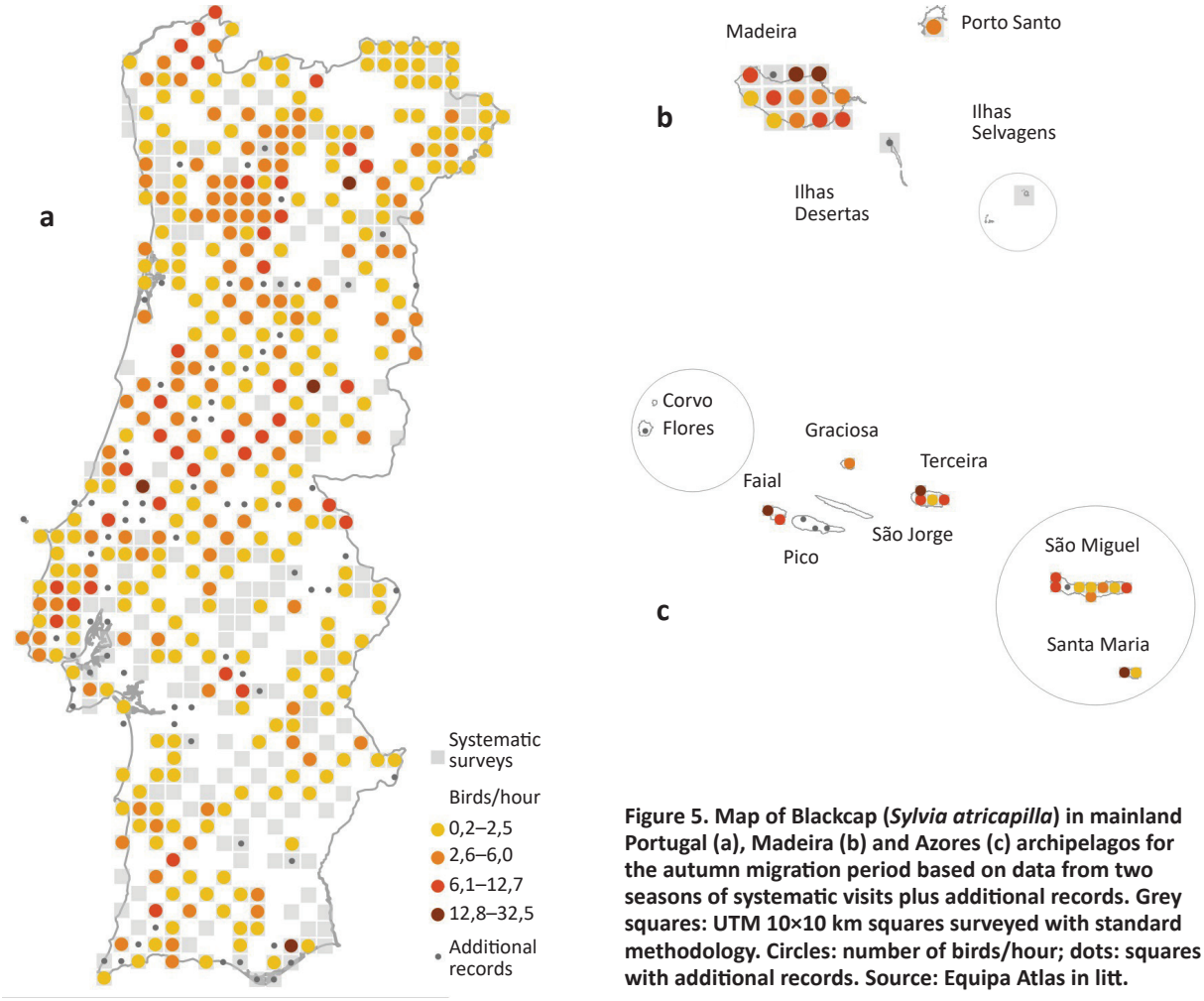

Figure 5. Map of Blackcap (*Sylvia atricapilla*) in mainland Portugal (a), Madeira (b) and Azores (c) archipelagos for the autumn migration period based on data from two seasons of systematic visits plus additional records. Grey squares: UTM 10×10 km squares surveyed with standard methodology. Circles: number of birds/hour; dots: squares with additional records. Source: Equipa Atlas in litt.

the end of January. In 2011/2012, the drought circumstances that occurred from January onwards in mainland Portugal, may have limited the occurrence of wintering birds in our territory (see Leitão & Peris 2003) eventually fostering their concentration in more favourable areas. In 2012/2013, better conditions of soil moisture and temperature throughout the territory might have lead to a greater dispersion of wintering birds. In this context, numbers of wintering birds during the two winters covered by PAWMB could be lower than in previous winters at least in agricultural zones (e.g. Leitão 2012, 2013), but possibly in other habitats as well.

A species example: the Blackcap

The Blackcap *Sylvia atricapilla* is a resident species in mainland Portugal, Azores and Madeira but in winter numbers increased in our continental area with the arrival of birds from North and Central Europe (Catry et al. 2010). Results presented in Figure 4 show that Blackcaps are widespread along mainland Portugal especially in winter where they can be locally abundant. During the migratory period (Figure 5) the distribution pattern in mainland is similar but with lower abundances, suggesting that the major influx of wintering birds to our territory will most likely occur later. In Azores the species was detected on all islands during winter but not during migration probably due to an insufficient coverage of the territory. In the Madeira archipelago the distribution of Blackcaps was similar in both seasons (Equipa Atlas in litt.).

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