Migration of the Eurasian Scops-owl (*Otus scops*) over the Western Mediterranean

Migração do mocho-d'orelhas no Mediterrâneo ocidental

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ABSTRACT

The Eurasian Scops-owl (*Otus scops*) is the only European Owl that undertakes a long migration south of the Sahara desert. The breeding ecology of the species in southern and eastern Europe is better known but the migration ecology and wintering areas in the Afrotropical region are poorly known. We present data on the passage of Eurasian Scops-owls along the western Mediterranean during spring migration. From the Project Piccole Islands (PPI) we show data about the migration of the species over the Iberian Peninsula and small islands in the western Mediterranean between 1993 and 2011. A total of 537 individual owls were captured and marked during this period. Another project, similar to PPI, started at the north fringe of the Sahara on an oasis located at southern Morocco, and was operated from 2009 to 2013. During these five years a total of 23 individual owls were captured and marked. Data about the phenology and biometry of the captured individuals and inter-annual comparisons are shown. Our results show that there are no differences in arrivals between coastal and island locations suggesting that the Eurasian Scops-owls passing through the western Mediterranean move directly across the sea in spring choosing the shorter, more direct and faster route.

Keywords: Morocco; *Otus scops*; Spain; spring migration; western Mediterranean islands

RESUMO

O mocho-d'orelhas (*Otus scops*) é a única rapina noturna europeia migradora de longa distância, invernando a sul do deserto do Saara. A ecologia reprodutiva desta espécie é bem conhecida no sul e este Europeus, pouco se sabendo sobre a sua migração e localização dos territórios de invernada na região Afrotropical. Neste artigo, apresentamos dados sobre a passagem de mocho-d'orelhas no Mediterrâneo ocidental durante a migração primaveril. Apresentamos ainda dados sobre a migração da espécie na Península Ibérica e em pequenas ilhas no Mediterrâneo ocidental, recolhidos entre 1993 e 2011 no âmbito do Projeto Piccole Islands (PPI). No total foram capturados e marcados 537 mochos-d'orelhas durante este período. Um projeto semelhante ao PPI iniciou-se no extremo norte do Saara, num oásis localizado no sul de Marrocos, tendo decorrido entre 2009 e 2013. Durante estes cinco anos foram capturados e marcados 23 indivíduos. São apresentados dados sobre a fenologia, as biometrias dos indivíduos capturados e comparações interanuais. Os resultados mostram que não existem diferenças nas chegadas entre o continente e as ilhas, o que sugere que a passagem do mocho-d'orelhas através do Mediterrâneo ocidental corresponde a um movimento direto sobre o mar, i.e. à rota mais curta, direta e rápida.

Palavras-chave: Espanha, ilhas Mediterrânicas ocidentais, Marrocos, migração de primavera, *Otus scops*

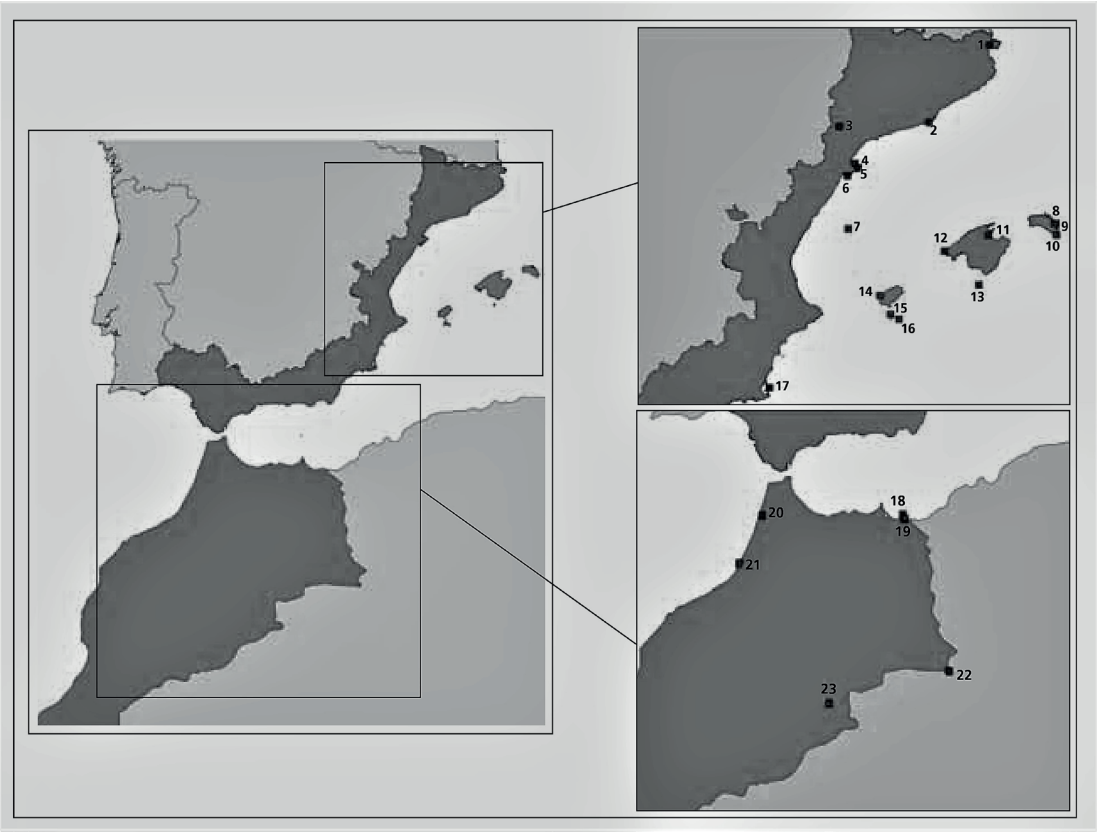
Introduction

The Palearctic-African flyway is a major avian system involving a migratory journey of billions of birds over thousands of kilometers between their breeding and wintering sites. At some point, most of them have to cross several ecological barriers to arrive at their European destinations. Specifically, in the case of the birds migrating through the western Mediterranean flyway, the Sahara desert, the Mediterranean Sea, the Pyrenees and the Alps are major obstacles to overcome. It is known that, when undertaking their migratory flights, landbirds normally avoid crossing such large ecological barriers (Alerstam 1990, Newton 2008). To do so, they often use routes over suitable habitats that allow stopping to rest and refuel, for example by following the edge of continental land masses (Newton 2008). However, in some cases, detours from the shortest route considerably increase travel distance, energy or time, and, therefore, crossing ecological barriers may be beneficial for some species or individuals (Battley et al. 2012). Trans-Sahara migrants arriving at the Mediterranean Sea in spring have two options: either cross the sea near the Gibraltar strait and migrate through the continent, or cross the sea without detour. So far, there are few studies addressing which migratory strategy trans-Saharan migrants use to reach their destination (Pilastro et al. 1998) but studies thus far show that this is a species-specific strategy in which one or both options can be used (Barriocanal & Robson 2007).

The Eurasian Scops-owl (*Otus scops*) is the only European owl that undertakes a long migration, wintering south of the Sahara desert. While the breeding ecology of the species has been studied (e.g. Hagemeijer

Figure 1 - Location of study sites under the Piccole Isle Project, western Mediterranean.

Figura 1 - Localização dos locais de amostragem do Projeto Piccole Islands, Mediterrâneo



& Blair 1997), the migration ecology and winter distribution in the Afrotropical region are poorly known. Here we present data of the northbound spring passage of Eurasian Scops-owl at the northern fringe of the Sahara and the western Mediterranean, to investigate which migration strategy is used by this species to cross the Mediterranean and reach their west-European breeding grounds.

Study Area

The passage time of the Eurasian Scops-owl during their spring migration was studied at 16 ringing sites in the western Mediterranean (Fig. 1) and Morocco. The work was conducted between 1993 and 2011 following standardized protocols within the framework of the Piccole Islands Project (PPI). This project, started in 1988, aimed at understanding the different strategies employed by birds crossing the central Mediterranean during their northbound journeys to Europe (Spina et al. 1993) and was soon expanded to include sites in the western Mediterranean (Gargallo et al. 2011). Eleven of the ringing stations were located on small islands: Columbrets Island 39º 53' N - 00º 40' E, Illa de Colom 39º 57' N - 04º 16' E, Albufera d'Es Grau (Menorca) 39º 57' N - 04º 15' E, Illa de l'Aire 39º 48' N - 04º 17' E, Albufera

d'Alcúdia (Mallorca) 39º 48' N - 03º 06' E, Dragonera 39º 35' N - 02º 20', Cabrera 39º 08' N - 02º 56', Conillera 38º 59' N - 01º 13' E, Formentera (Can Marroig) 38º 44' N - 01º 24' E, Illa Grosa 37º 44' N - 00º 42' W, Chafarines 35º 11' N - 02º 26' W. Four other coastal stations were located in mainland Spain (Aiguamolls 42º 17' N - 03º 07' E, Llobregat 41º 17' N - 02º 04' E, Canal Vell 40º 45' N - 00º 47' E, Alfacada 40º 41' N - 00º 50' E). Further details of the study sites are described elsewhere (Barriocanal & Robson 2006, Gargallo et al. 2011). To the above sites, we also included data from a small station located in the interior of Morocco, along the northern fringe of the Sahara (Yasmina Oasis, 31.21'N - 3.98ºW).

Methods

Data from the PPI is based on continuous and standardized mist-netting (Gargallo et al. 2011). We used data collected from 1993 to 2011 in the western Mediterranean and 2009-2013 at Yasmina. Nets were checked every hr from dawn to dusk, and were closed when meteorological conditions were adverse. For the analysis of arrival data, birds captured on the island stations have been pooled as coming from one group defined as "islands" and in the same way birds captured in the coastal stations have been considered as "continent". We used the mean values of capture date to compare continental and island arrivals. We used the length of the flattened wing (Svensson 1992), measured to the nearest 0.5 mm to analyze if individuals captured in the two areas came from the same breeding population. To compare arrival date between locations, we used non-parametric Mann-Whitney U-tests. To develop analysis of phenology and biometry we have used data of first captures. Date of capture was expressed as Julian date. Capture data was also organized by pentade; a pentade is a 5-day increment of time, reported from the first increment of the calendar year. In order to check for differences in phenology and biometry when comparing islands and continents we used the one-way ANOVA test.

Results

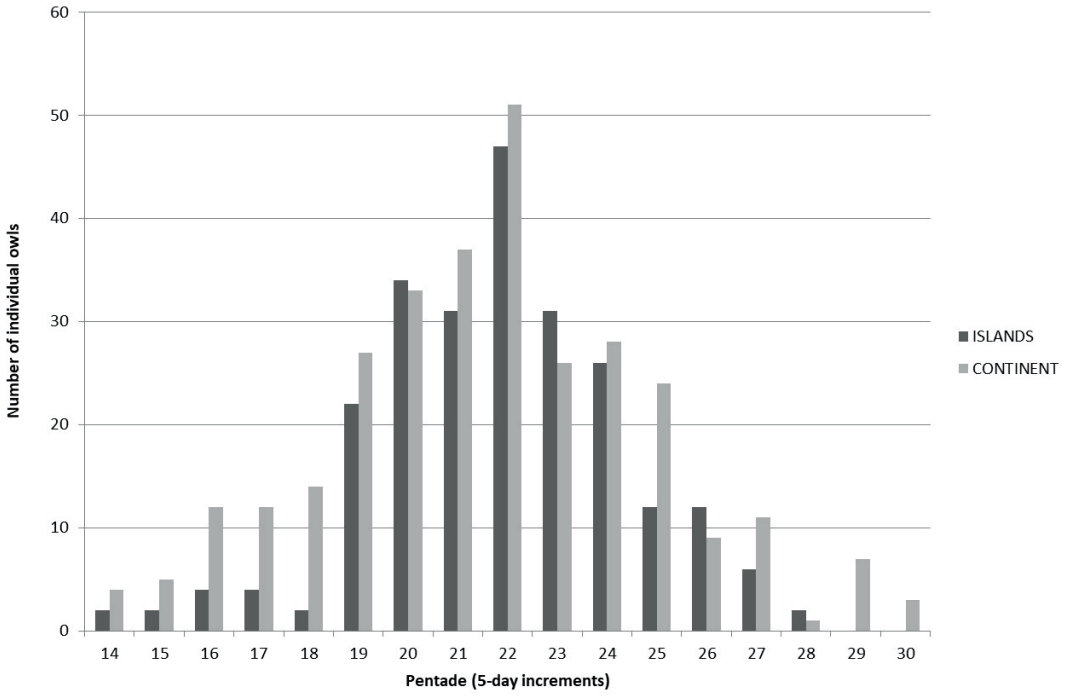
On western Mediterranean sites, during the 19 years of study (1993–2011) a total of 303 Eurasian Scops-owls were captured at the continental stations, ranging from 1 in 1994 to 52 individuals in 2008. On the island stations 234 individuals were captured, from 1 individual in 1993 to 29 individuals in 1997. At the Yasmina Oases (Morocco) we captured a total of 23 individuals between 2009 and 2013.

Phenology

Passage over the western Mediterranean occurred mainly between pentade 20 and 24 (6 -30 April) with a peak during pentade 22 (15-20 April) (Fig. 2). At the continental stations a peak in captures was observed during pentade 22, after which the number of captures diminished, especially after pentade 24. At the island stations the peak in captures also occurred during pentade 22 (Fig. 2). There were no differences in the Julian arrival date of the owls between islands (mean = 83.1, s.d. = 11.4, n = 220) and the mainland (mean = 83.4, s.d.= 8.8, n = 255); ($F = 0.08$, $P = 0.77$), nor when data from Yasmina were compared: Mediterranean (mean = 83.2, s.d.= 10.1, n = 475) and Yasmina (mean = 79.5 , s.d.= 10.9, n = 21); ($F = 2.79$, $P = 0.095$). Arrival dates did not differ significantly between islands (Julian day 107.4) and the mainland (Julian day 106.5) ($P > 0.12$, Mann-Whitney U-test).

Figure 2 - Number of Eurasian Scops-owls captured at island and continental ringing stations by calendar pentade (5-day increment) during northbound migration over the western Mediterranean (1993-2011).

Figura 2 - Número de mochos-d'orelhas capturados nas estações de anilhagem localizadas no continente e ilhas, em intervalos de cinco dias, durante a migração para Norte no Mediterrâneo ocidental (1993-2011).



Wing length

Wing length did not show any increase or decrease during the season (Fig. 3) and there were no differences between the islands (mean = 157.6 mm, s.d. = 5.0, n = 183) and mainland (mean = 157.4 mm, s.d.= 4.6, n = 234); (F = 0.1, P = 0.75), or between the Mediterranean (mean = 157.5 mm, s.d.= 4.8, n = 417) and Yasmina (mean = 156.1 mm, s.d.= 4.8, n = 20; (F = 1.67, P = 0.196) sites.

Body mass

Since there were no differences in wing length between the study sites and along the season we didn't make any effort to correct body mass for body size. No differences in body mass have been found during the season (Fig. 4) or between the islands and continent (islands mean = 83.1 g, s.d. = 11.4, n = 220; mainland mean = 83.4, s.d.= 8.8, n = 255); (F = 0.08, P = 0.77), nor between regions (Mediterranean mean = 83.2 g, s.d. = 10.1, n = 475; Yasmina mean = 79.5 g, s.d.= 10.9, n = 21); (F = 2.79, P = 0.095).

Based on data from 560 Eurasian Scops-owls captured at 16 ringing stations from islands (Balearics) and mainland eastern Spain during 19 years of study, and at the northern fringe of the Sahara desert in southern Morocco during five years of study, our results show slight (but non-significant) differences in the phenology or biometry of northbound-migrating owls.

Figure 3 - Pentade (5-day increment) analysis of flattened wing lengths (mm) of Eurasian Scops-owls during their northbound migration over the western Mediterranean (1993-2011).

Figura 3 - Comprimento da asa com ajuste da curvatura (mm) de mocho-d'orelhas durante a migração para Norte no Mediterrâneo ocidental (1993-2011).

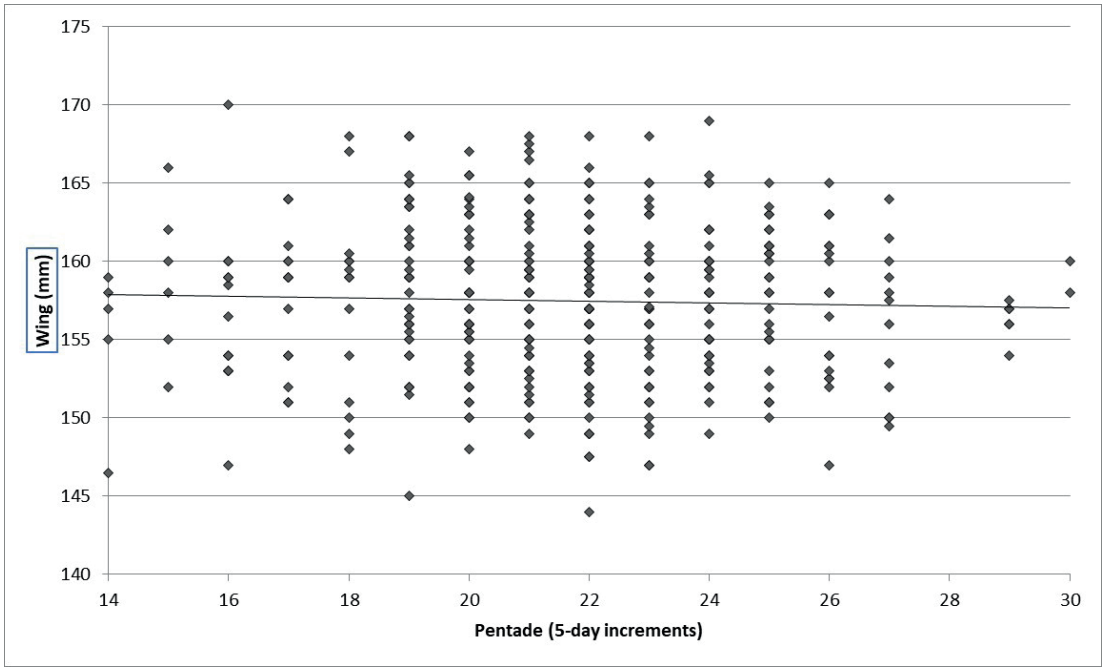
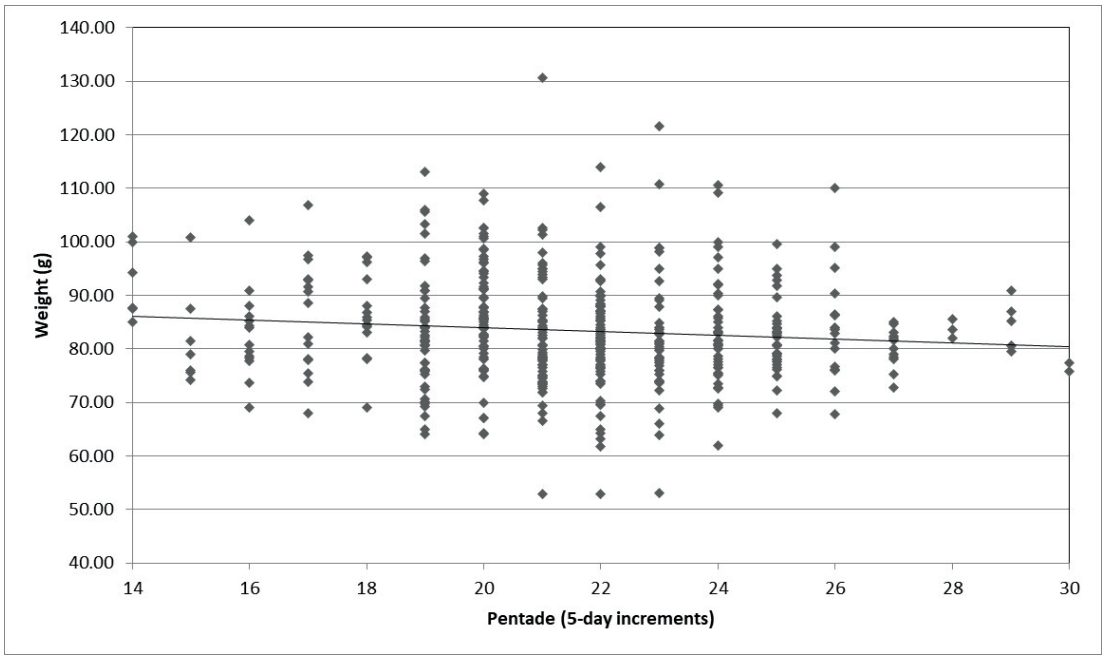


Figure 4 - Pentade (5-day increment) analysis of weight (g) of Eurasian Scops-owls during their northbound migration over the western Mediterranean (1993-2011).

Figura 4 - Peso (g) do mocho-d'orelhas durante a migração para Norte no Mediterrâneo ocidental (1993-2011).



Discussion

During spring migration, an early arrival at the breeding territories presents several selective advantages, especially for males (Møller 1994; Forstmeier 2002; Kokko 1999). Birds migrating through the western Mediterranean are facing one of the last ecological barriers before reaching southern Europe. They have two options to cope with the Mediterranean Sea: follow the coast or cross the sea. Species that select the short route over the sea can arrive earlier on their breeding grounds but may face rapid weather changes and scarcity of landing sites during passage, whereas species that select the continental route (implying a detour) may spend more time in getting at their breeding grounds but have ample opportunities to find adequate stopover sites and face less variable weather (Liechti & Bruderer 1998). This means that birds face a tradeoff between time and safety when choosing the migratory route, which is solved in different, species-specific ways (Spina & Pilastro 1999). We found no evidence of geographic or temporal trends on the timing of passage, suggesting that the migration strategy of this species is passing in a broad front over the Mediterranean without the presence of the sea being an obstacle as seems to happen with other species of birds (Barriocanal & Robson 2006, 2007). While there is a difference in size between sexes - the females and adults being slightly larger - we did not observe differences in the timing of the ages or sexes, which is contrary to the timing found in other species, where male adults have to arrive earlier in order to get the better breeding territories (Morbey & Ydenberg 2001). To conclude, our results show that there are no differences in arrivals between coastal and island locations. Such data supports the position that Eurasian Scops-owls passing through the western Mediterranean in spring move directly across the sea, choosing the shorter, more direct and faster route.

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