Common Redstart

Phoenicurus phoenicurus

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Range

The Common Redstart's breeding range extends throughout much of Europe, and eastwards to central Siberia and Mongolia (Cramp, 1988). It is a long-distance migrant, the vast majority of birds wintering in the Afrotropics; a few birds winter in Arabia or very occasionally north of the Sahara (Moreau, 1972; Cramp, 1988). In W Africa it is largely confined to the Sahel *c.* 10-17ºN, but in E Africa extends further southwards to northern Congo and Uganda (Moreau, 1972; Cramp, 1988; Zwarts et al., 2009). It does not breed at any of the study sites.

Migratory route

This species migrates through the study area on a main SW-NE axis (fig. 1), although some birds seem to move more in a due N or even NW direction (to the British Isles). Other birds move in an almost easterly direction, as exemplified by a bird ringed on Cabrera (Balearics) and recovered 6 days later in Sardinia (Italy). Interestingly, recoveries involving birds trapped in the Balearics/Els Columbrets show a distinctly more due N axis of movement than those of birds migrating through continental Spain and Catalonia (mean direction 16.38ºNNE and *c.* 38ºNE, respectively). This may indicate that those undertaking longer sea-crossings tend to take a more direct due N route and may involve a higher proportion of delayed birds in a hurry (*cf.* Barriocanal & Robson, 2006). In fact, the average date of capture of recoveries from the Balearics/Els Columbrets is significantly later –*c.* 11-17 days– than in Catalonia and rest of Spain. Some birds seem to cross the Mediterranean by very different routes each spring. This is the case of one bird ringed in NE Spain in one year and recovered the following year in Tunisia (980 km south-west), and of another ringed on the Tyrrhenian islands one spring and recovered in NE Spain the following one (1,066 km west).

Spring migration through SW Europe takes place further east than in autumn since recoveries in spring decrease in SW Iberia but increase in NE Spain and France (Zink, 1981; Cramp, 1988; Bueno, 1992; Wernham et al., 2002). This pattern is exemplified by two recoveries of birds captured in the Balearics/Els Columbrets during spring and retrapped distinctly westwards in central Spain and Portugal in autumn (662 and 861 km away, respectively). Recovery data from Italy corroborates this migratory pattern (Pettersson et al.,1990; Spina & Volponi, 2009) and several birds ringed there in spring have been recaptured in the W Mediterranean in autumn.

This species seems to cross the W Mediterranean across a rather broad front, since captures and relative frequencies are particularly high in the Balearics and on Els Columbrets (fig. 2). These insular figures may be misleading due to a high attraction effect since captures at less exposed sites such as the wet Balearics are distinctly lower, and in Catalonia the highest figures correspond to the quasi-island of La Punta de la Banya. However, captures are common on all islands and passage through the area certainly occurs in good numbers. Figures are rather low in Morocco where this species is thought to be more common in autumn than in spring (Cramp, 1988). Information on the use of NW Africa in spring, however, is contradictory, since some authors report the highest number of recoveries in spring (Zink, 1981; Wernham et al., 2002), but others do so in autumn (Zwarts et al., 2009). According to the latter, 80% of recoveries in NW Africa (excluding winter) from the Atlas or areas to the north take place in autumn and the rest in spring (decreasing to 60% when also considering the Sahara desert). In Morocco only 60% of recoveries occur in autumn and 40% in spring (Moroccan Ringing Centre, unpubl. data). Taking into account the overall reduction in numbers in spring due to mortality, this information suggests that the species is probably rather common and widespread in Morocco in both seasons (*cf.* Thévenot et al., 2003), although numbers trapped at specific sites may vary largely.

Phenology

Passage through the area extends mostly from mid-March to late May, and most birds pass in April and the first half of May with a peak during late April (fig. 3). The pattern is very similar in all three major study areas (Catalonia, Balearics and N Morocco) and to that reported elsewhere for the region. Nevertheless, a few birds do still pass through in early June (outside the study period) and from late February or early March (Cramp, 1988; Finlayson, 1992; Telleria et al., 1999; Thévenot et al., 2003; ICO, 2010). The overall phenological pattern in the C Mediterranean is similar to that described here, although the reported median date of passage on Capri (3 May) suggests some delay with respect to the W Mediterranean (Pettersson et al., 1990; Spina et al., 1993). In S and SE Morocco passage can start in February, although it only really gets underway in early March with a peak in first half of April (Smith, 1968; Thévenot et al., 2003; Gargallo et al., unpubl.).

Males migrate distinctly earlier than females (differences in median dates 11 and 12 days in adults and second-year birds, respectively), although adults do so only slightly earlier than second-year birds (2 and 3 days earlier in males and females, respectively). Large temporal gaps in the passage of the sexes have also been reported from Capri (Pettersson et al., 1990) in accordance with the later arrival of females on breeding grounds (Cramp, 1988). Recoveries show that the further north birds are ringed/recovered, the later they pass through the study area, indicating that northern populations tend to migrate later.

Biometry and physical condition

Mean values for third primary lengths range from 60.8 in N Morocco to 62.0 in the wet Balearics (table 1), similar to the means reported from the islands of the C Mediterranean (mean 61.5, n = 556; Spina et al., 1993). Mean values for wing lengths vary from 78.6 in N Morocco to 80.5 in the wet Balearics, similar to the means reported from other parts of W Europe (Cramp, 1998). There is a steady decrease in the length of the third primary during the migration season in accordance with the later passage of shorter-winged females (see above; fig. 6). The apparent increasing trend observed in some areas (N Morocco and the wet Balearics) is due to a small sample size and is not significant. The lengths of the third primary on Els Columbrets and in the dry Balearics are significantly shorter than in Catalonia.

Fat reserves are clearly lowest in S Morocco and on Els Columbrets and highest in N Morocco, the wet Balearics and Catalonia (fig. 9, table 1). Birds trapped in S Morocco are found to be in the poorest physical condition. Birds trapped on Els Columbrets have distinctly lower average fat reserves than in the dry Balearics and Catalonia, while birds have the best physical condition in the wet Balearics and N Morocco (fig. 7). Fat and physical condition do not show any clear overall temporal trend. Fat decreases significantly on Els Columbrets but increases in Catalonia (fig. 9) and physical condition increases on Els Columbrets and in the dry Balearics (fig. 7). Mean body mass varies from 12.9 in S Morocco to 15.2 in the wet Balearics with no clear overall temporal trend observed (fig. 9). It increases significantly with time in dry Balearics, but remains fairly constant in Catalonia and on Els Columbrets. Averages are distinctly higher in the wet Balearics and N Morocco. In Catalonia, body mass is only marginally higher than in the dry Balearics, but in both areas is clearly greater than on Els Columbrets. Body mass on Els Columbrets and in the dry Balearics is slightly higher than on the Tyrrhenian islands (mean 13.2, n = 557; Spina et al., 1993). The average from N Morocco is very similar to that given for N Tunisia (mean 14.9, n = 39; Waldenström et al., 2004), and in S Morocco is nearly identical to that reported in larger datasets in different years at the nearby sites of Defilia (13.1, n = 110; Ash 1969) and Merzouga (12.9, n = 181; Gargallo et al., unpubl.), suggesting that our figures are very representative of the area as a whole.

According to our data, birds trapped in N Morocco are *c.* 15% heavier than in the south of the country, indicating that they are able to fatten up after crossing the Sahara. Although birds have good energetic reserves in N Morocco, those trapped at continental and insular stopover sites are not in markedly poorer condition (only somewhat so at more isolated and distant islands such as Els Columbrets). Reported spring average mass at Gibraltar (14.0, n = 24; Finlayson, 1981) is very similar to that of Catalonia, but is *c.* 11% higher in Holland and Denmark (mean 15.7, n = 250; Cramp, 1988), suggesting that further north in continental Europe birds can regain reserves and undertake net mass gains.

Stopover

The percentage of retraps and mean stopover length is very low in all areas (fig. 5, table 2). Birds staying on islands are in poorer condition at first capture than those not trapped again, indicating some reluctance for birds in good condition to stay at these sites. On Els Columbrets birds show significant negative fuel deposition rates (when using all the dataset), but in the dry Balearics the tendency is positive (although only significant when considering retraps of more than one day). In continental areas fuel deposition rates are positive (in Catalonia when considering more than one-day retraps), but only significantly so in the very limited sample from N Morocco. As suggested above, these results indicate that birds are able to regain some mass even at apparently less suitable sites (*e.g.* the dry Balearics), probably thanks to their ability to feed efficiently in open terrain (Cramp, 1988). Data from N Morocco also reveals the importance of this area for refuelling, although the sample size is too small to be conclusive.

Table 1. Mean (± SD), range and sample size of main biometric parameters according to area.

	n	Wing	Third primary	Body mass	Fat score
Catalonia	1,156	79.8 ± 2.1 (73.0-86.0)	61.5 ± 1.9 (54.0-68.0)	14.2 ± 1.3 (6.6-18.8)	2.4 ± 1.1 (0-7)
Columbrets	1,412	79.6 ± 2.3 (73.0-88.0)	61.0 ± 1.9 (54.0-67.0)	13.6 ± 1.6 (6.4-22.2)	1.5 ± 1.1 (0-6)
Balearics (dry)	5,789	79.2 ± 2.1 (73.0-88.0)	61.0 ± 2.0 (54.0-68.0)	14.1 ± 1.5 (7.1-20.9)	2.1 ± 1.1 (0-7)
Balearics (wet)	16	80.5 ± 1.8 (77.5-83.5)	62.0 ± 1.8 (58.0-65.5)	15.2 ± 1.5 (12.8-18.7)	2.9 ± 1.1 (1-5)
Chafarinas	11		61.1 ± 2.6 (59.0-67.0)	14.7 ± 2.7 (11.0-19.5)	1.9 ± 1.3 (0-4)
N Morocco	33	78.6 ± 2.2 (73.0-85.0)	60.8 ± 1.9 (56.5-65.0)	14.8 ± 1.9 (11.5-21.2)	2.4 ± 1.4 (0-6)
S Morocco	21	79.8 ± 2.3 (75.5-84.5)	62.0 ± 2.0 (58.5-66.0)	12.9 ± 1.2 (11.3-16.0)	0.9 ± 0.8 (0-2)

Table 2. Variation in fuel deposition rate (g/day) according to area and type of retraps involved (mean ± 95% CI and sample size are given).

	Catalonia	Columbrets	Balearics (dry)	Balearics (wet)	Chafarinas	N Morocco
All retraps	-0.10 ± 0.14 (85)	-0.34 ± 0.26 (27)	0.03 ± 0.06 (301)			0.55 ± 0.10 (2)
Retraps >1 day	0.11 ± 0.15 (46)	-0.02 ± 0.18 (16)	0.12 ± 0.06 (210)			

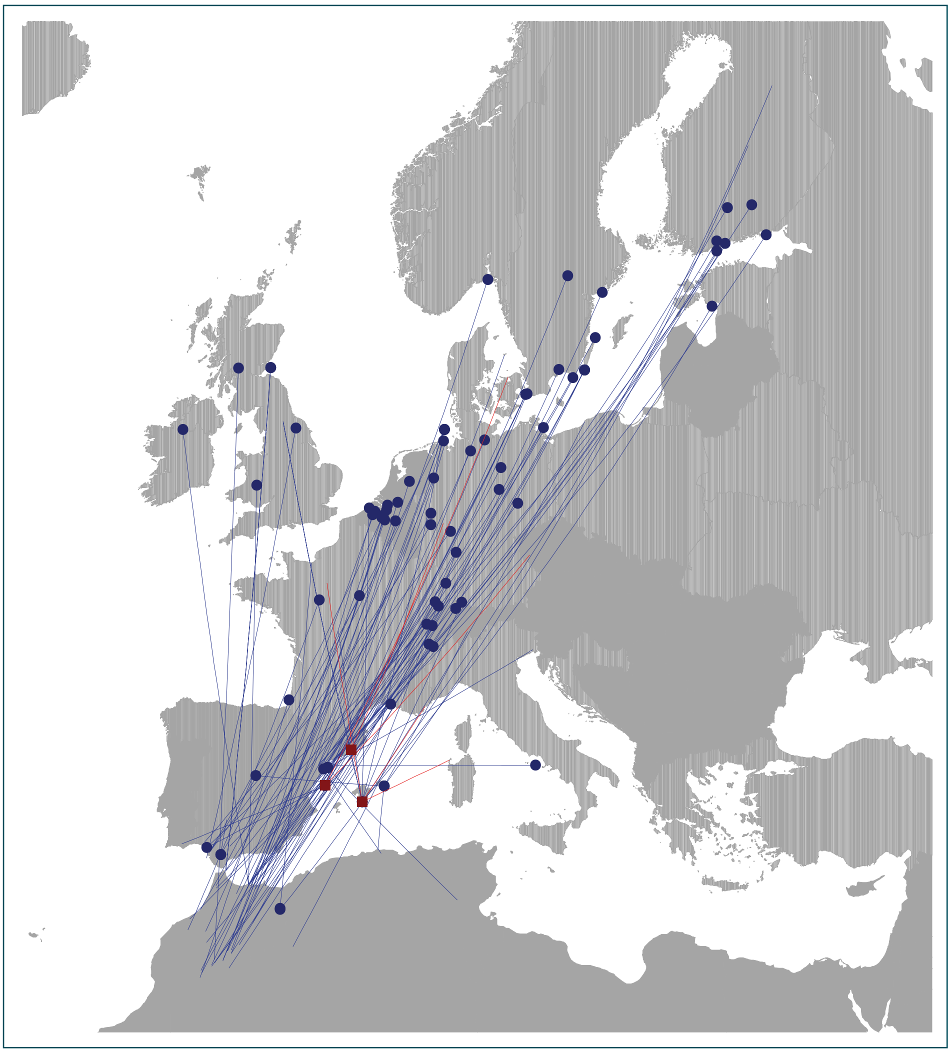

Figure 1. Map of recoveries of birds captured in the study area during the study period (March to May).

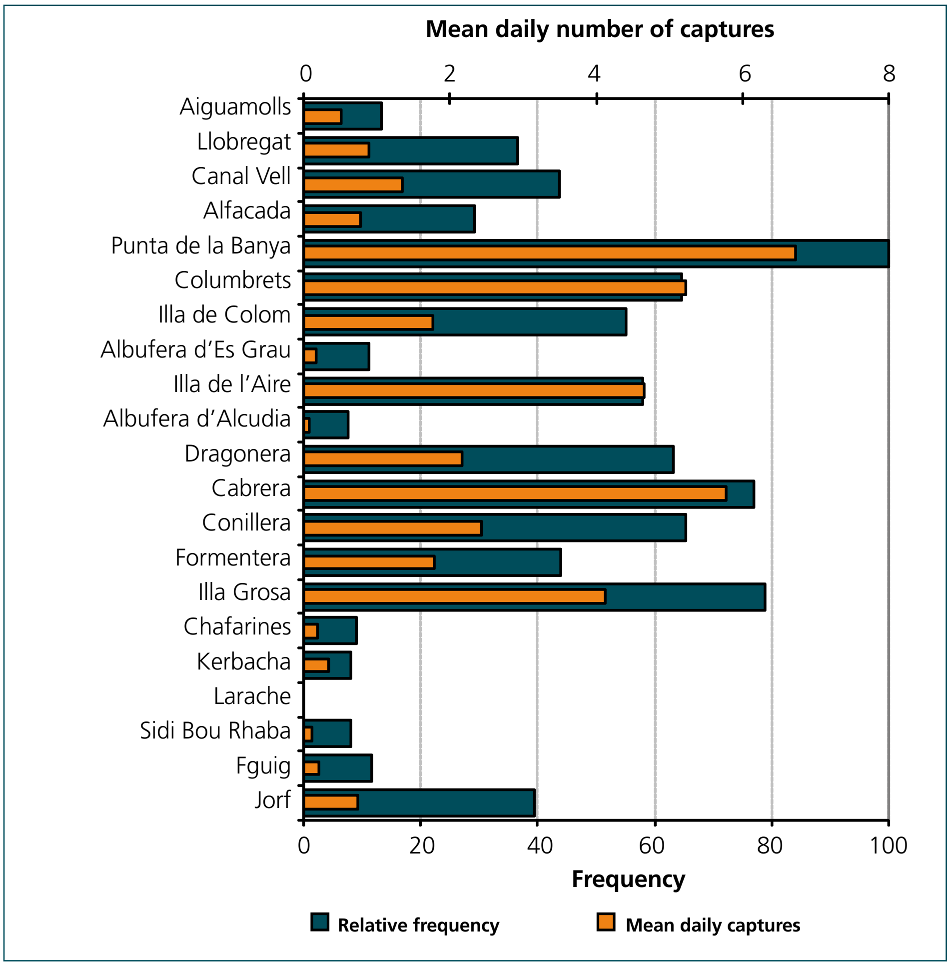

Figure 2. Relative frequency of captures and mean daily numbers according to site during the standard period (16 April to 15 May).

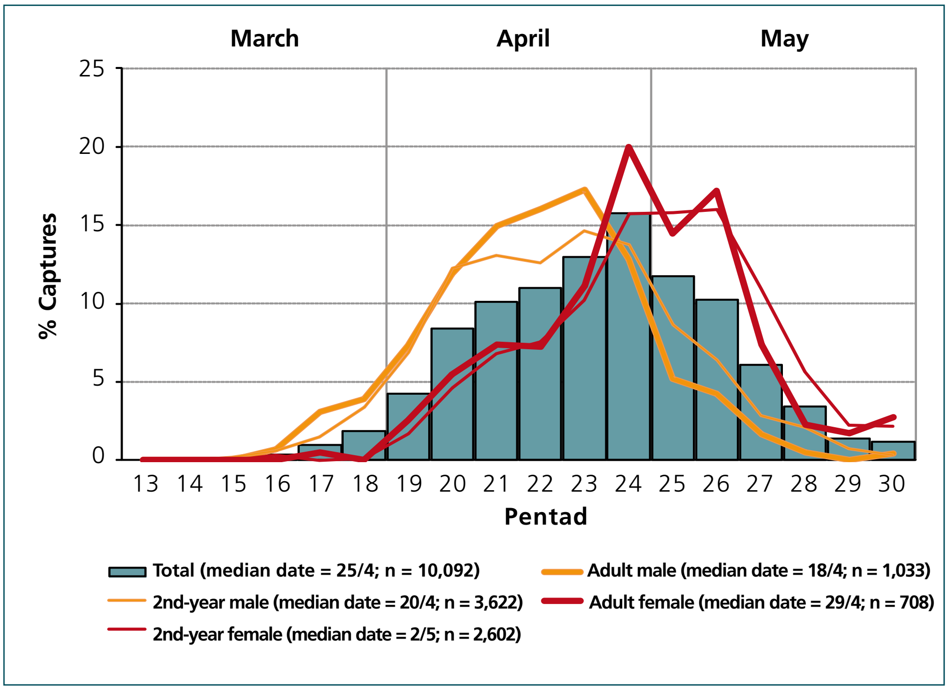

Figure 3. Frequency of captures during the study period.

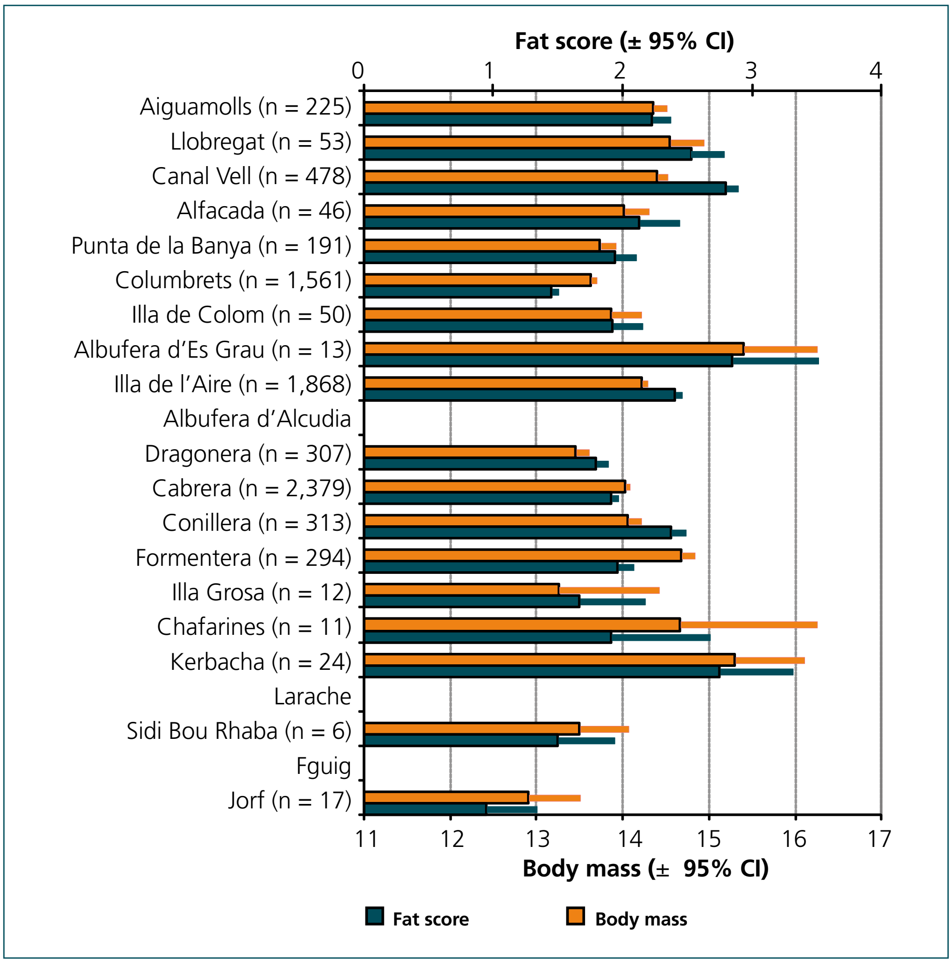

Figure 4. Variation in body mass and fat score according to site during the standard period (16 April to 15 May).

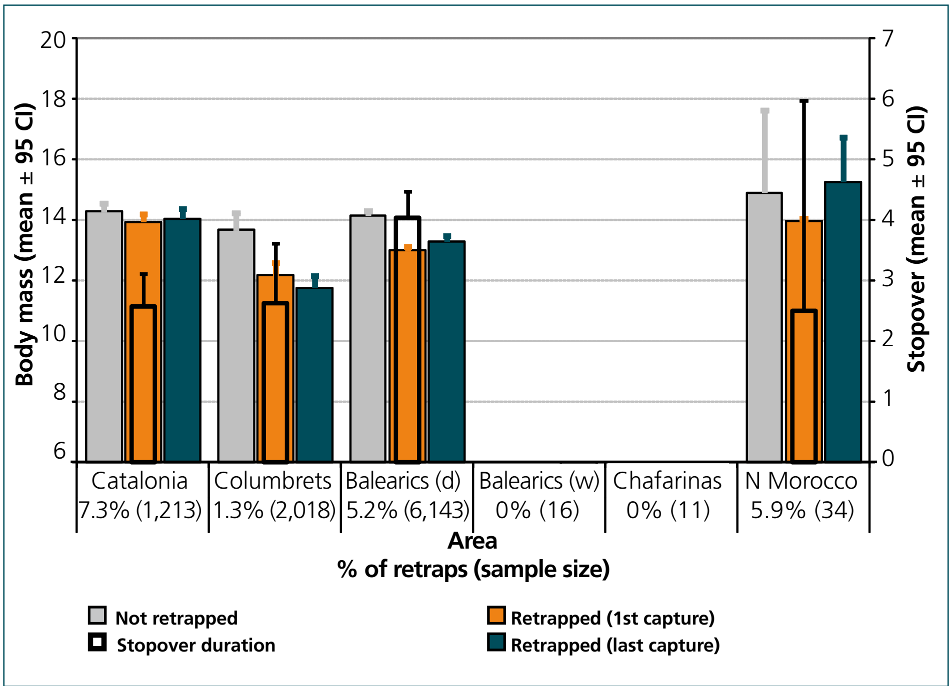

Figure 5. Variation in body mass by trapping status, minimum stopover length and frequency of retraps according to area.

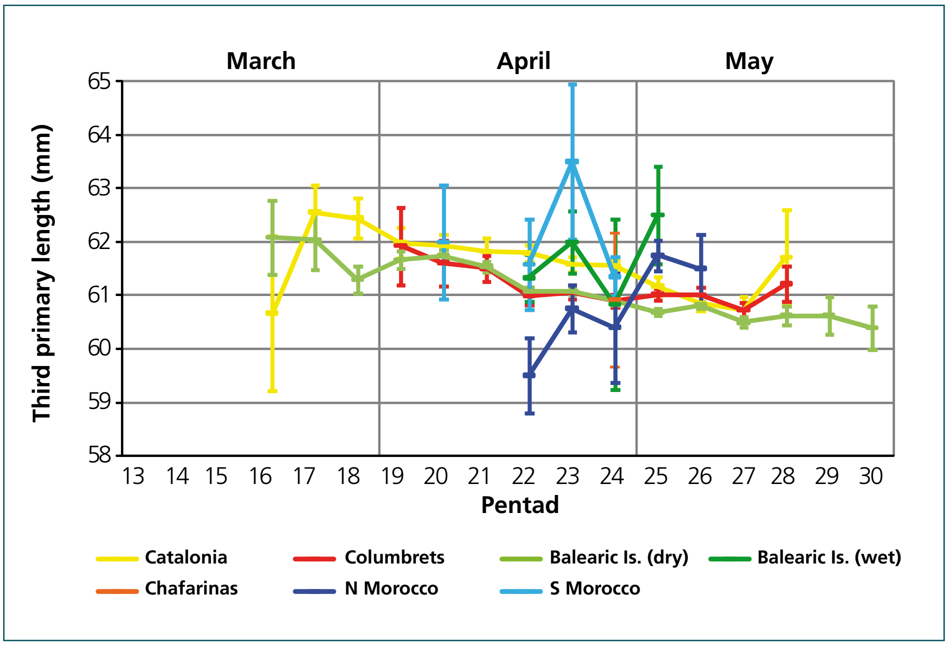

Figure 6. Temporal variation of third primary length according to area.

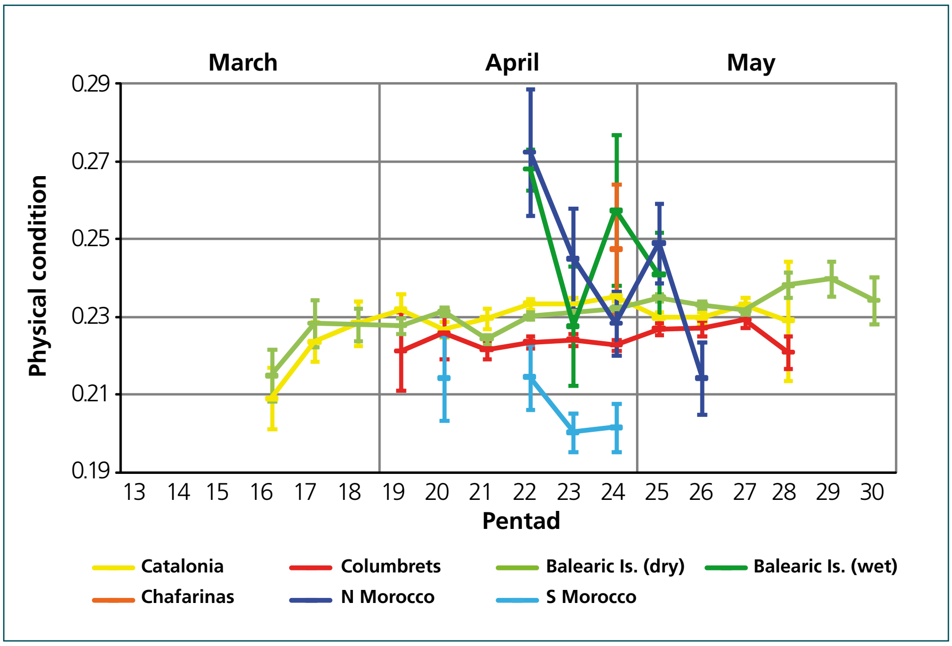

Figure 7. Temporal variation of physical condition according to area.

Figure 8. Temporal variation in body mass according to area.

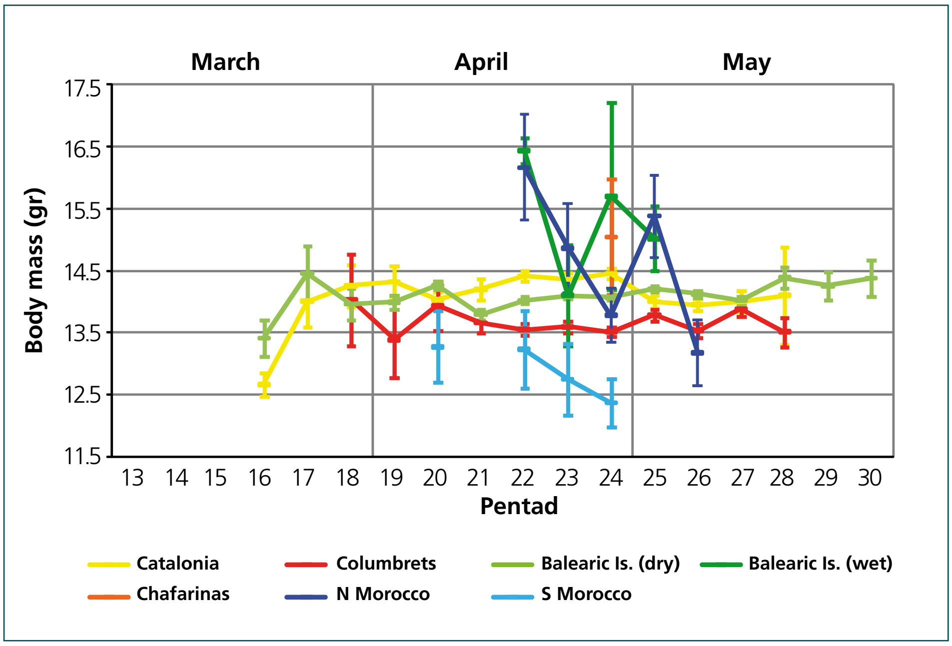

Figure 9. Temporal variation in fat score according to area.