Yellow Wagtail
Motacilla flava

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Range

The Yellow Wagtail is a polytypic species that breeds throughout almost the entire Palearctic, although only patchily in N Africa and SW Europe (Cramp, 1988; Hagemeijer & Blair, 1997). The nominate race *flava* occurs in most of Europe, while *iberiae* breeds in the western Mediterranean (SW France, Iberia and the Balearic Islands, and NW Africa). These are the two most numerous races found on migration in the study area, followed by *flavissima* (UK and NW Europe) and *thunbergi* (N Europe, from Norway eastwards). The other races are present in very low numbers (Aymí & Martinez, 1990). This wagtail is a long-distance migrant, although populations in N Africa and possibly S Spain overwinter in part on their breeding grounds (Cramp, 1988; Telleria et al., 1999; Thévenot et al., 2003). Wintering areas are to be found in the Afrotropics (European populations), India and SE Asia (Cramp, 1998).

Although this wagtail breeds in some of the wetlands in Catalonia and the wet Balearics, migrants form the bulk of captures even at these sites (the exception being Els Aiguamolls de l'Emporda, where late in the season local birds dominate).

Migratory route

Recoveries indicate that birds cross the study area following a rather variable axis of movement (fig. 1): the majority move in a SW-NE direction, although some move more due N or even towards the NW. Only two direct recoveries are available: one bird was captured in coastal E Spain at the beginning of May and then recovered two months later in Sweden, 3.000 km further NNE, while another bird was ringed at the end of May in Cadiz (S Spain) and then recovered in November in Senegal. In spring Yellow Wagtails pass through the study area following a more easterly route than in autumn (Cramp, 1988; Telleria et al., 1999; Wernham et al., 2002; Wood, 2002). This longitudinal shift ensures that western Spain and Portugal, where many birds (particularly British ones) pass through in autumn, are largely devoid of birds in spring; likewise, the species is also relatively more frequent in E Morocco in spring than in the west. Recoveries showing NW movements (fig. 1) exemplify the return route followed by some British birds using this more easterly flyway.

The number and frequency of captures in both the Balearics and on Els Columbrets are similar or even higher than at continental sites in NE Spain, suggesting that the species does not avoid crossing large stretches of the Mediterranean Sea (fig. 2). In fact, passage seems to take place across a broad front in both autumn and spring and also when crossing the Sahara (Cramp, 1988). The number of captures is highest in S Morocco (fig. 2), where the species is very common in spring (Ash, 1969; Cramp, 1988).

Phenology

Spring passage starts at the end of March, reaches a peak in late April and early May and then decreases progressively towards the end of May (fig. 3). It should be taken into account that during the second half of May passage seems more intense than it really is due to the inclusion of a significant number of local breeding birds in Catalonia. This overall pattern of passage is quite similar to that described for S France (Blondel & Isenmann, 1981) and Italy (Spina et al., 1993; Spina & Volponi, 2009), but is somewhat delayed with respect to S Spain and Morocco. Moreover, other observational data from Catalonia (ICO, 2010) indicates that in this area passage occurs, although in low numbers, already from late February and early March. In the S Iberian Peninsula migration takes place somewhat earlier than shown here, starting as early as February and with the main passage period occurring in April (Telleria et al., 1999; Finlayson, 1992). In Morocco, passage is also clearly more advanced, with some birds passing through already in early February and peaking between late March and late April (Thévenot et al., 2003). Some migrants are known to still be actively migrating through the W Mediterranean even in late June (Cramp, 1988; Telleria et al., 1999; Thévenot et al., 2003).

Males pass earlier than females (median date four days earlier; fig. 3) and adults earlier than second-year birds (median dates 27 April and 5 May respectively). This delay in female passage is very similar to that reported in Italy during spring migration (Rubolini et al., 2004), but much less obvious than the delay in arrival at breeding grounds (females *c.* 1-2 weeks later; Cramp, 1988). These differences probably reflect the misleading effects caused by the passage of several subspecies through stopover sites. In Nigeria, spring pre-migratory fattening of males occurs *c.* 10 days earlier than in females (Wood, 1992).

Recoveries from the study area show that the later the birds pass through the W Mediterranean the further north they migrate. This finding agrees with the later passage observed for more northern races (*e.g. thunbergi*; Cramp, 1998) and seems to be caused by a leap-frog migration pattern, whereby the northernmost breeding individuals and females tend to winter further south (Cramp, 1988; Wood, 1992).

Biometry and physical condition

Mean values of third primary length range from 59.0 in S Morocco to 61.1 in N Morocco, while mean values of wing length vary from 78.8 in the wet Balearics to 81.0 in N Morocco (table 1). Overall, these values are slightly below those reported in the C Mediterranean (mean third primary length 61.6, n = 141; Spina et al., 1993) and E Mediterranean (Morgan & Shirihai, 1997), but within the range reported in Cramp (1988). The third primary length remains fairly constant throughout the season except in dry Balearics where it tends to decrease significantly (fig. 6). A similar pattern is reported in the Tyrrhenian islands (Spina et al., 1993) and similarly may reflect the early passage of distinctly larger males (Cramp, 1988).

Mean fat scores range between 1.0 on Els Columbrets and 3.5 in N Morocco, although mostly lie between 1 and 2; body mass ranges between 14.5 on Els Columbretes and 18.2 in the wet Balearics (table 1). Fat scores tend to decrease in all areas, although only significantly so in Catalonia (fig. 9); body mass and physical condition do not show any clear temporal patterns (figs. 7-8), just as in the C Mediterranean (Spina et al., 1993). The body mass of birds trapped on islands in the C Mediterranean (mean 13.9, n = 141; Spina et al., 1993) is slightly lower than on Els Columbrets, but distinctly lower (c. 14% lower) than in the dry Balearics. In fact, the maximum values of mean body mass in the C Mediterranean are close to the lowest figures reported here for the W Mediterranean, with the exception of Els Columbrets. These differences show that birds with the highest levels of energetic stress are those that cross the largest geographical barriers; of all birds, those caught on Els Columbrets (the most distant island from N Africa of those in the study area) and those caught on the islands of the C Mediterranean face the longest desert and sea crossings.

Birds captured in Catalonia are distinctly heavier than those from the dry Balearics, while those on Els Columbrets are the lightest (fig. 6). Although the sample is small, birds from the wet Balearics have similar mean body mass to Catalonia, suggesting that on islands with suitable habitat (*e.g.* wetlands) birds can regain some mass lost during sea crossings. The mean body mass in S Morocco is quite high compared with that reported at the tiny nearby oasis of Defilia (mean 14.6, n = 194; Ash, 1969) and Merzouga (mean 15.4, n = 42; Gargallo et al., unpubl.). Mirroring the difference in mass found between the dry and wet Balearics, the lowest values reported in these tiny and less verdant oases (or islands) may reflect poorer habitat suitability and thus fewer possibilities of regaining mass. On the other hand, these apparently poorer stopover areas may attract a higher proportion of birds in poor physical condition that are more likely to stop at the first available site. In any case, the range of mean body mass recorded in S Morocco is *c.* 8-18% lower than in the north of the country (table 1), suggesting that the species regains some mass in Morocco prior to moving on towards Europe. Although the sample size from N Morocco is too small to be conclusive, these findings agree with other published data suggesting that the species uses NW Africa to stopover and regain mass (Wood, 1992; Wernham et al., 2002).

Body mass in birds captured in spring in the Netherlands (mean 16.4, n = 26; Cramp, 1988) and W Germany (mean 16.2, n = 22; Cramp, 1988) is somewhat lower than in Catalonia and N Morocco, suggesting a progressive and slight depletion of reserves after leaving the Mediterranean Basin. These movements through continental Europe seem to coincide with a slowed progress of spring migration (Wood, 1992).

Stopover

Few retraps have been made (fig. 5, table 2). Moreover, in the case of Catalonia the presence of local breeding birds increases unrealistically the mean stopover length. The overall low percentage of retraps suggest that birds do not tend to stay more than one day at the study sites, although this may also reflect the low recapturability rate of this species due to its preference for open habitats where mist-nets are less effective. Birds retrapped in Catalonia –some of them undoubtedly local birds– do not show any significant change in mass, while those from the dry Balearics, where habitat is less suitable for feeding, have negative fuel deposition rates (table 2).

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

	n	Wing	Third primary	Body mass	Fat score
Catalonia	218	79.6 ± 2.7 (73.5-87.0)	60.9 ± 2.4 (54.5-66.5)	17.1 ± 1.5 (11.4-24.0)	1.8 ± 1.3 (0-5)
Columbrets	119	80.2 ± 2.9 (72.0-87.0)	60.0 ± 2.6 (51.0-66.0)	14.5 ± 2.1 (10.7-19.8)	1.0 ± 1.0 (0-4)
Balearics (dry)	207	79.7 ± 2.8 (73.0-88.0)	60.3 ± 2.5 (53.5-66.5)	15.9 ± 2.0 (10.5-22.3)	2.2 ± 1.4 (0-6)
Balearics (wet)	6	78.8 ± 2.5 (74.5-81.5)	60.3 ± 1.9 (56.5-62.0)	18.2 ± 0.9 (17.1-19.6)	1.2 ± 1.5 (0-4)
Chafarinas	0				
N Morocco	4	81.0 ± 2.2 (79.0-84.0)	61.1 ± 2.4 (58.5-64.0)	17.9 ± 3.2 (14.6-22.1)	3.5 ± 0.6 (3-4)
S Morocco	59	79.0 ± 3.3 (73.0-85.0)	59.0 ± 3.5 (50.0-64.0)	16.5 ± 1.3 (14.5-19.3)	1.5 ± 0.6 (1-3)

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	-0.08 ± 0.29 (10)		-0.70 ± 0.60 (5)			
Retraps >1 day	-0.10 ± 0.32 (9)					

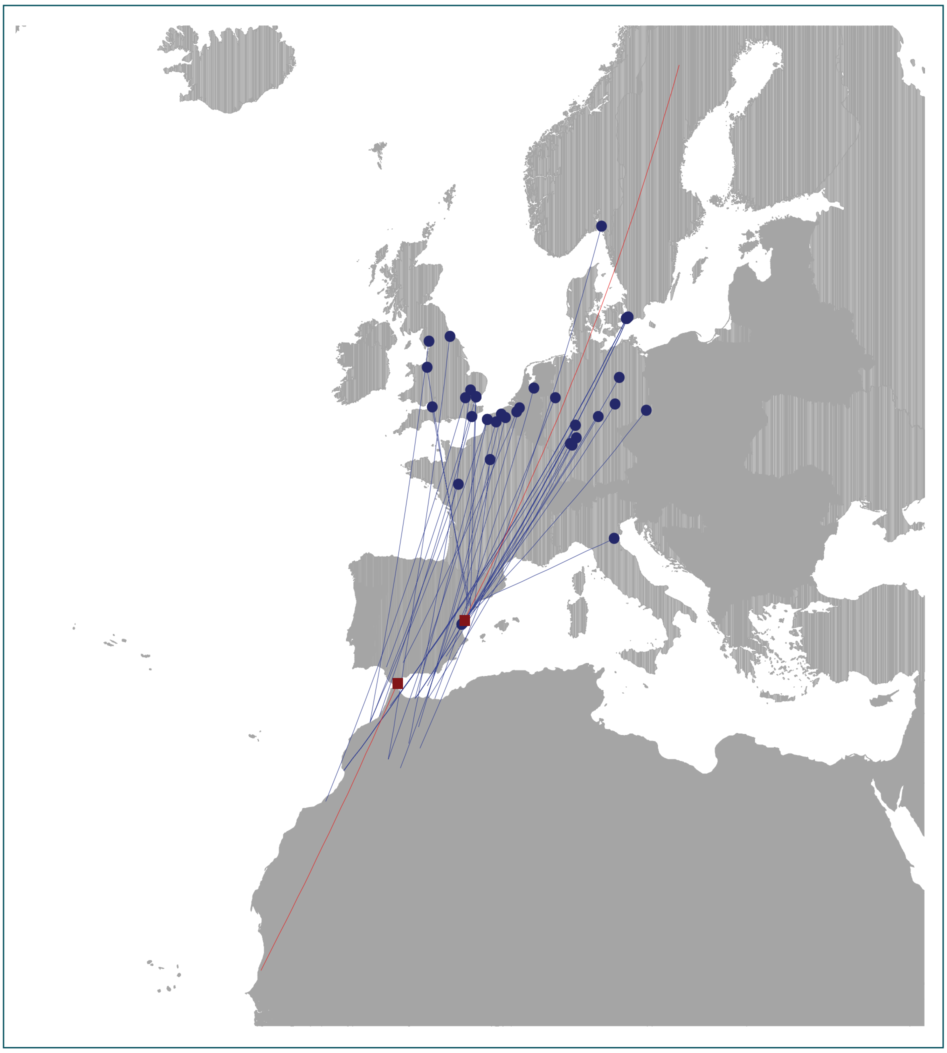


Figure 1. Map of recoveries of birds captured in the study area during the study period (March to May).

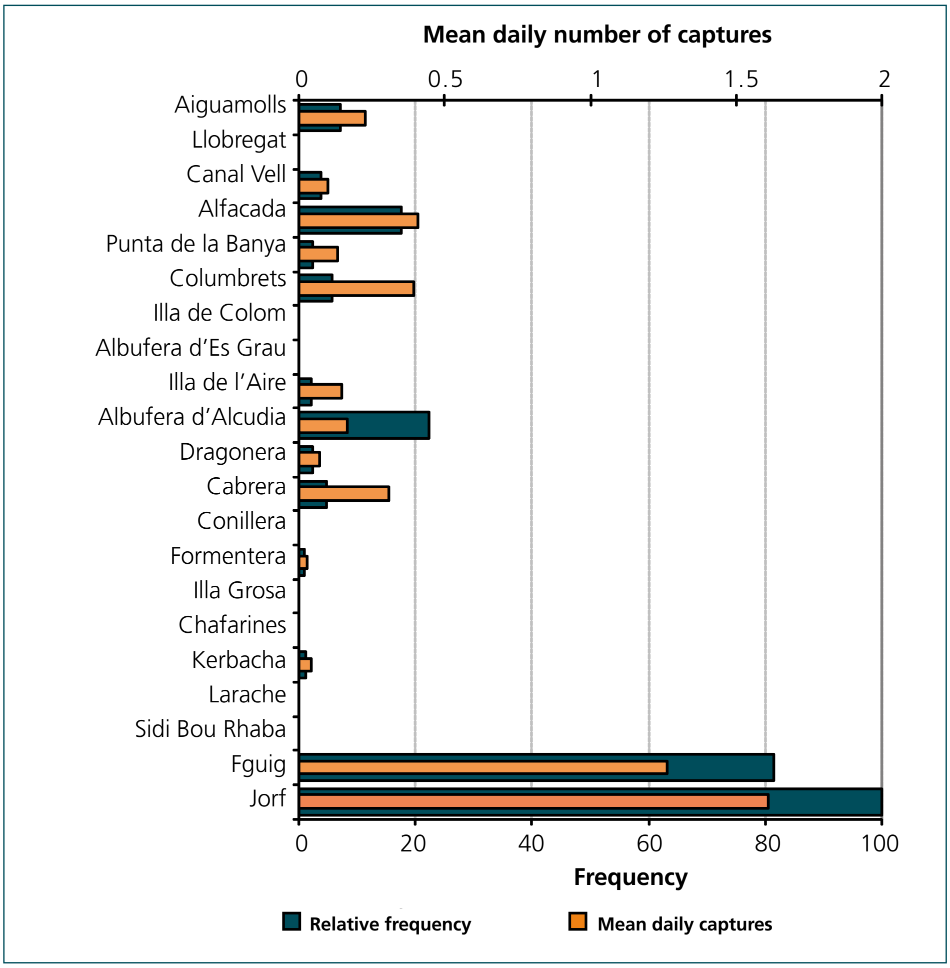


Figure 2. Relative frequency of captures and mean daily numbers according to site during the standard period (16 April to 15 May).

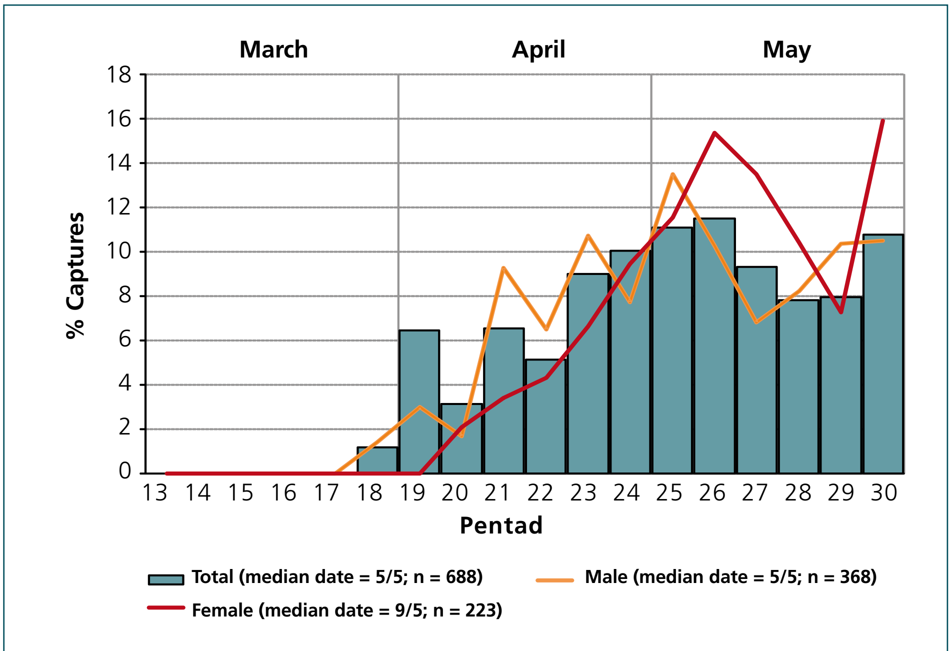


Figure 3. Frequency of captures during the study period.

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

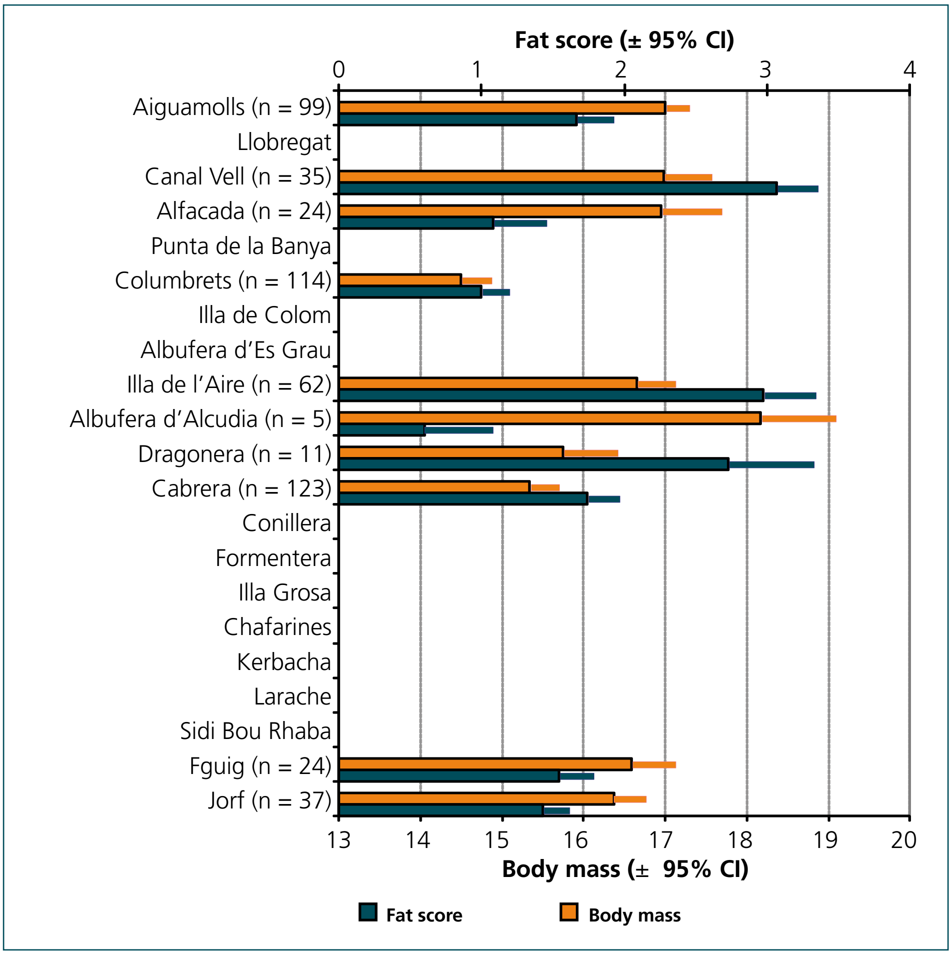
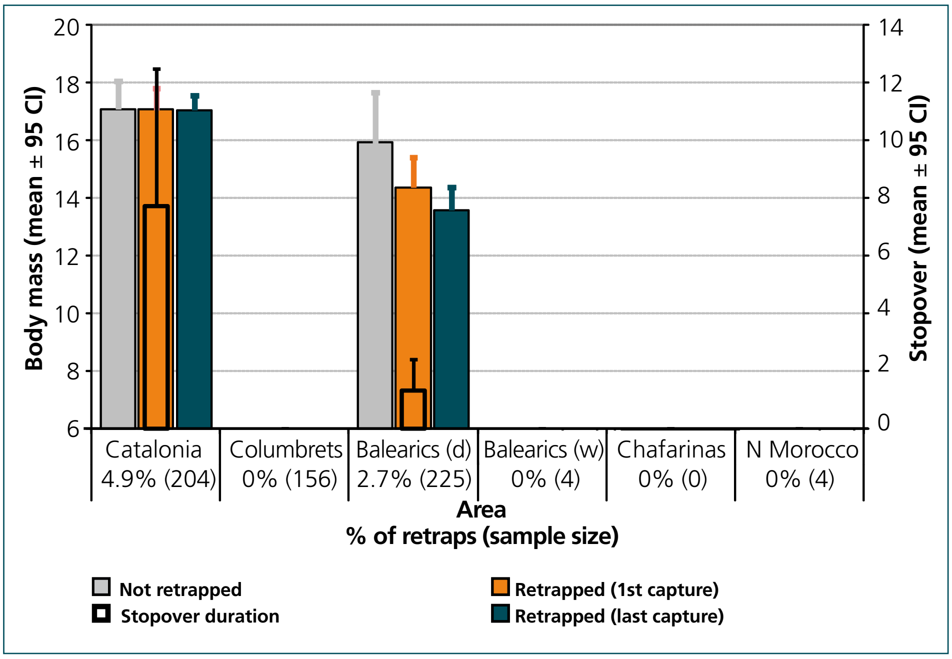


Figure 5. Variation in body mass by trapping status, minimum stopover length and frequency of retraps according to area.



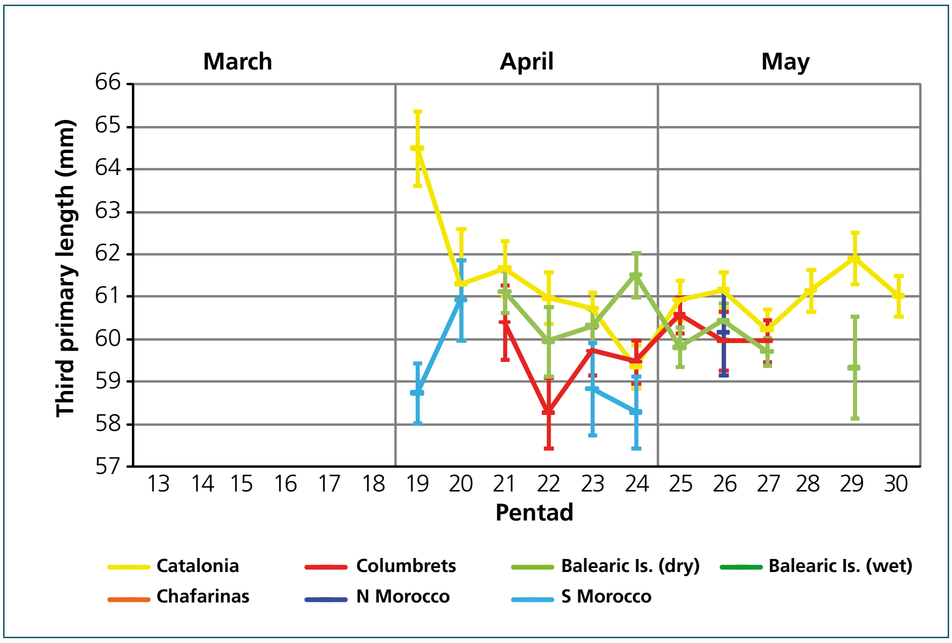


Figure 6. Temporal variation of third primary length according to area.

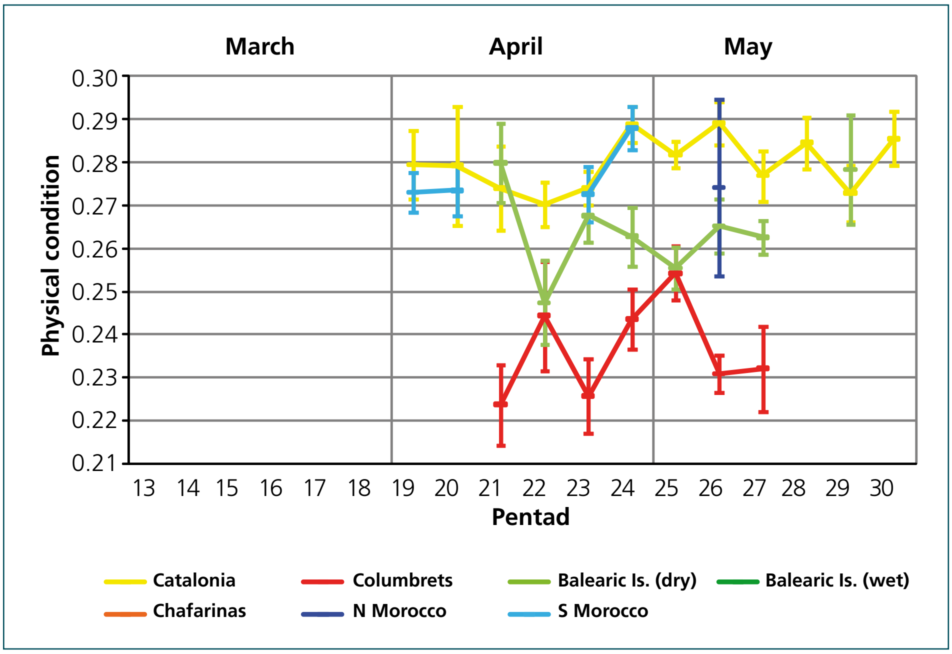


Figure 7. Temporal variation of physical condition according to area.

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

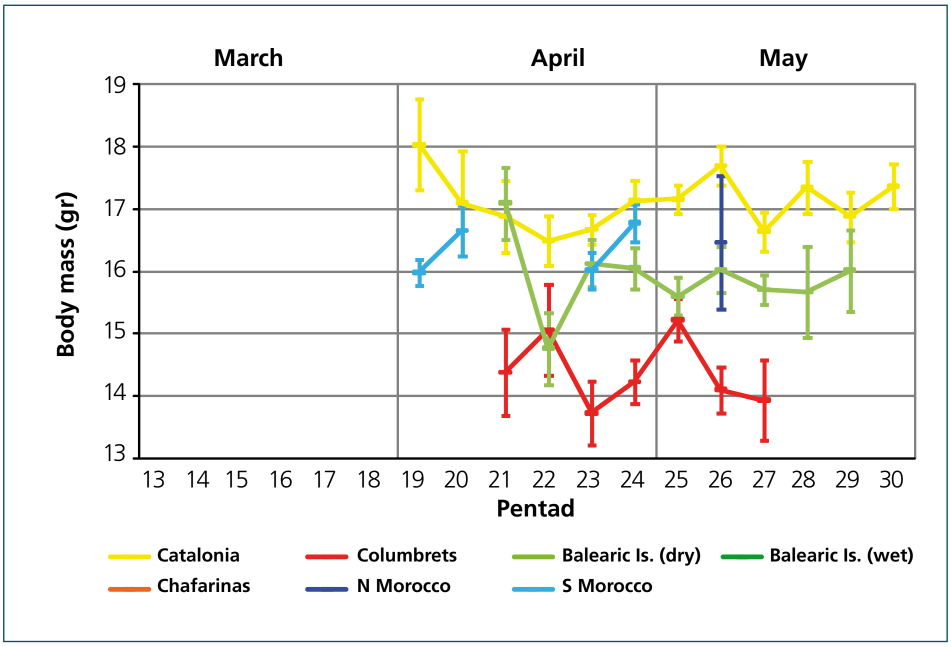


Figure 9. Temporal variation in fat score according to area.