

Timing of Song Thrush *Turdus philomelos* on pre-nuptial migration in southern Italy

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Abstract We studied the presence and movements of Song Thrush along the southern Tyrrhenian coast line in the region of Campania, from 2013 to 2016, in order to establish the timing of northward migration. We captured and ringed 150 birds with standardised mist-netting. There was little evidence of migration from the second 10-day period of January, when the trapping began, until the first 10-day period of February. There were no peaks due to the arrival of migrant birds though an increase in captures was recorded during the second 10-day period of February with a very considerable peak during the second 10-day period of March. The mean body mass showed significant increases from the third 10-day period of February, with the highest values recorded in March, also reflected in the accumulation of subcutaneous fat; 91% of subjects with fat scores 3 and 4 were concentrated between the third 10-day period of February and the third 10-day period of March, while the first birds with fat appeared only in the first 10-day period of February. Analysis of several recoveries of thrushes ringed in Campania, in other Italian regions and in other countries, confirms the presence of these birds in Campania in the period between the third 10-day period of January and the third 10-day period of March. The data gathered during the four years of this investigation provide a fairly clear, though not conclusive, picture of the temporal trend of pre-nuptial migration of Song Thrush, which never began before the second 10-day period of February, although it is possible that some birds on migration may be present in the previous 10-day period.

Keywords: Song Thrush *Turdus philomelos*, timing, spring migration, body mass, fat deposition

Összefoglalás Az énekes rigók jelenlétét és vonulását tanulmányoztuk 2013 és 2016 között a Campania régió (Olaszország) Dél-Tirrén partvonala mentén, hogy feltérképezzük az északi vonulás időzítését ennél a fajnál. A madarakat függőháló segítségével fogtuk. A vizsgálati időszakban 150 egyedet fogtunk és gyűrűztünk meg. Január második dekádja – amikor a befogások kezdődtek – és február első dekádja között alig volt vonuló egyed. Kiemelkedő fogási csúcs nem volt a vizsgálati időszakban, azonban február közepétől március végéig emelkedett a befogott madarak száma. Február utolsó harmadától kezdődően jelentős növekedés mutatkozott az átlagos testtömegben, a legnagyobb értékek márciusban voltak, ami a felhalmozott zsír mennyiségének növekedésében is megmutatkozott. A befogott egyedek – melyeknek raktározott zsírmennyisége 3–4 értékű volt – 91%-a ebből az időszakból került ki. Az első olyan madarak, melyeknél már volt raktározott zsír, február első harmadában jelentek meg. Campaniában és Olaszország más régióiban vagy más országokban gyűrűzött énekes rigók visszafogás adatainak elemzése is megerősíti, hogy január utolsó harmadától március végéig jelen vannak az énekes rigók ezen a területen. A vizsgálati időszak négy évében gyűjtött adatok egy tiszta, bár nem teljesen erős képet adnak az énekes rigók tavaszi vonulásának időbeli mintázatáról, amely február közepénél nem kezdődik hamarabb, de néhány korai madár az azt megelőző tíznapos időszakban már megjelenik a területen.

Kulcsszavak: énekes rigó *Turdus philomelos*, időzítés, tavaszi vonulás, testtömeg, zsírtartalékok

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Introduction

The Song Thrush *Turdus philomelos* is a common species in Italy both during migrations and wintering (Andreotti *et al.* 1999). However, the knowledge of the main flyways, of the timing on northward migration and of the different populations migrating in the regions of southern Italy, is rather scarce due to low ringing effort carried out in this area (Andreotti *et al.* 1999). Besides, these regions are probably reached by birds from areas where ringing at the nest is not practiced, especially from central and northern European Russia, from Belarus, Ukraine and the Balkans, and in general from Eastern Europe (Spina & Volponi 2008, La Gioia & Scebba 2009). Birds wintering in countries of the Mediterranean area first appear in October, but continue to arrive throughout the autumn; winter movements, probably related to climatic conditions and searching for food, are common in southern Europe and the Middle East (Andreotti *et al.* 2010).

In the “Key Concepts document on Period of Reproduction and pre-nuptial Migration of huntable bird Species in the EU”, available on the European Union website (http://ec.europa.eu/environment/nature/conservation/wildbirds/hunting/key_concepts_en.htm) and officially adopted by European Commission in 2001, on the basis of the information provided by the Italian Institute for Environmental Protection and Research (ISPRA) (Spina & Serra 2003, Andreotti *et al.* 2004, Spina & Volponi 2008), the pre-nuptial migration of the Song Thrush in Italy starts in the second 10-day period of January.

Macchio *et al.* (1999), based on trapping activity in Italy in the years 1980–1994, stated that spring migration takes place from February, which is also suggested by the trend of the annual index of abundance, calculated in order to correlate the number of captures with the ringing effort; Licheri and Spina (2002) also report that ringing data collected in Italy in the years 1982–1999 show that return migration is from February to April, with some individuals still leaving in early May. Recent studies carried out in Lazio (Scebba *et al.* 2014), Puglia (Scebba *et al.* 2015) and Calabria (Muscianese *et al.* 2012, 2013) put the start date of the pre-nuptial migration not before the end of the third 10-day period of January with significant increases from the second 10-day period of February.

This study was carried out in a representative area of southern Italy, in the region of Campania. Here, the migrations of Song Thrushes are different from those crossing the more northern regions (Andreotti *et al.* 1999, Spina & Volponi 2008, La Gioia & Scebba 2009). The study aims to identify, on the basis of a standardised work program, the 10-day period of the beginning of pre-nuptial migration.

Methods

Study area and trapping

Fieldwork was carried out with a standardised protocol in the southern part of Campania, not far from the southern Tyrrhenian coast line (about 5 km from the Gulf of Salerno) (Figure 1), from 17 January to 26 March during 2013, from 18 January to 16 March

during 2014, from 11 January to 15 March during 2015 and from 14 January to 20 March during 2016. In these four years two catching sites in the province of Salerno were used, approximately 30 km apart: “Il Passo” (40°41'N 14°37'E, 745 m asl) located in a hilly area in the Regional Park of the Lattari Mountains was used only in 2013 while in the other three years was used “Garrezzano” (40°37'N 15°00'E, 290 m asl) in the Regional Park of the Picentini Mountains, situated at a lower level and involved in a more intense migratory flow.

Vegetation at the first trapping site consists of Mediterranean maquis elements

such as *Prunus spinosa*, *Spartium junceum*, *Myrtus communis*, *Ilex aquifolium* and *Ruscus aculeatus*, along with young trees of *Quercus ilex*, *Alnus cordata* and *Fagus sylvatica*, as well as heathers, *Hedera helix*, ferns and *Rubus ulmifolius*, with a large chestnut wood on the edge. The area of the second trapping site has extensive cultivation of olive trees with large tracts of coppiced woodland and garigue scrub and the nets were set in one section of scrubland with abundant *Spartium junceum* and *Rubus ulmifolius* mixed with Mediterranean maquis elements as *Pistacia lentiscus*, *Crataegus monogyna*, *Prunus spinosa*, *Olea europaea*, *Phyllirea latifolia*, *Rosa canina*, *Pyrus communis o pyraster*, *Rhamnus alaternus*, *Cytisus scoparius* and young trees of *Quercus cerris* and *Ostrya carpinifolia*.

In each location a transect of 115 m of nylon mist nets (3 m high, mesh size 28 mm, five shelves) in constant number and size, with a fixed orientation, were operated for five consecutive days for each 10-day period. Nets were checked hourly; birds captured were put in cotton bags individually, processed a short distance away from the net sites, and released immediately after ringing and measurements were completed, usually within 15 minutes.

Biometrics

In all, from 2013 to 2016, 150 Song Thrushes were trapped and ringed, with individual alloy rings fitted to the tarsus and various morphological measurements taken: wing length (maximum chord method, Svensson 1992), using a stopped ruler to the nearest 0.5 mm; third primary length (flattened and straightened, Berthold & Friedrich 1979) (to 0.5 mm); tarsus length (Svensson 1992), using a calliper (0.1 mm). Body mass was measured using a digital balance (0.1 g) and visible fat was scored on a scale from 0 to 8 (Kaiser 1993). Age was determined according to the moult limit between moulted greater coverts (with rounded pale spots on the tips) and juvenile retained coverts (usually with triangular spots on the tips) (Svensson 1992). The data from all years were combined for analysis and fitted into standard “decades”

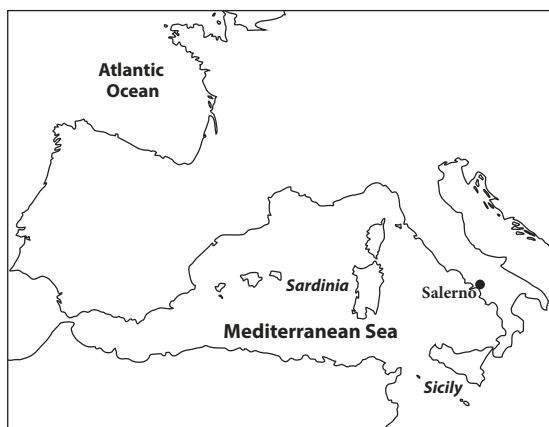


Figure 1. The study area in the southern part of Campania, southern Italy

1. ábra A vizsgálati terület elhelyezkedése a dél-campaniai régióban, Dél-Olaszországban

or ten-day periods, the reference time unit used by the European Union for the application of the Directive on the conservation of wild birds (2009/147/CE); the calendar year was been divided into 36 ten-day periods of 10-11 days each, depending on the months (8-9 days in the case of the third ten-day period of February) (Licheri & Spina 2002).

Daily weather data were downloaded from websites *Il Meteo.it* and *MSN Meteo*. Furthermore, to evaluate the period of time in which the birds remain to winter in Campania, we examined a sample of recovered birds marked in Italy and in other countries (data from archive Gruppo Inanellamento Limicoli).

Results

Trapping patterns

The ringing activities were conducted from the second 10-day period of January to the second 10-day period of March in order to cover the beginning and the main period of pre-nuptial migration. In all, 150 Song Thrushes were captured, including 18 in 2013, 44 in 2014, 40 in 2015 and 48 in 2016.

As the monitoring during 2014–16 was based on continuous and standardised mist netting involving the same catching location and timing of mist netting, it is possible to estimate the trapping patterns during the study period (*Figure 2*) and by calculating the catching-effort index (CI) for these three years (*Figure 3*). Accordingly, all activities carried out

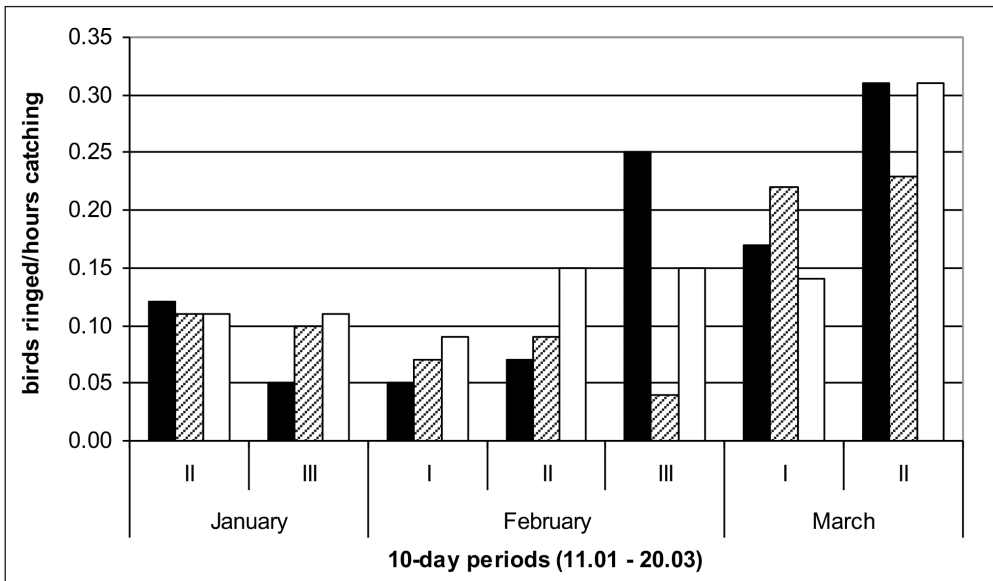


Figure 2. Trapping patterns (birds ringed per hours of catching) by 10-day period, 11 January to 20 March, 2014–16. Filled bars, 2014; hatched, 2015; open, 2016

2. ábra Befogási mintázatok (a fogás egy órájában gyűrzött madarak aránya) tíznapos időszakokra bontva, 2014–2016. január 11. és március 20. között. Fekete: 2014, szürke: 2015, fehér: 2016

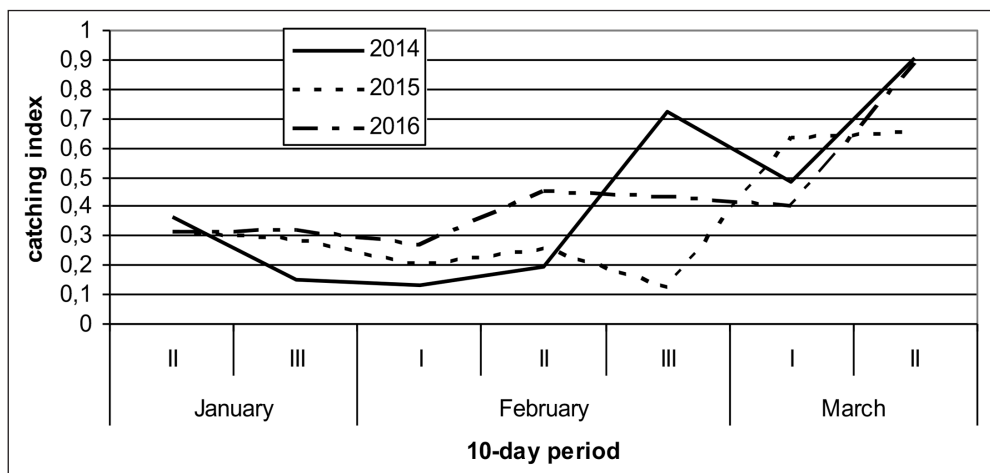


Figure 3. Catching index along the southern Tyrrhenian coastline for 10-day period, 2014–16: catching index = (no of birds ringed / net m² × hours) × 1000

3. ábra Fogási index a Dél-Tirén partszakaszon, tíznapos bontásban 2014 és 2016 között. Fogási index = (gyűrűzött madarak száma / hálóméret (m²) × órák száma) × 1000

between the first capture session conducted from the second 10-day period of January until the second 10-day period of March were considered.

Figure 2 shows the numbers of birds ringed per hour of catching, considering only the data for the years 2014–2016, as in 2013 a different catching site was used which was characterized by a different vegetation and less involved in the migratory flow.

Histograms relating to 2014 show a small number of captures until the second 10-day period of February, a month featured by minimum temperatures of more than 4° degrees; the first 10-day period of March presented a sudden wave of bad weather with a fall in temperature, whereas during the second 10-day period of March there was a maximum peak of ringed thrushes. The lowest average temperatures were recorded in the third 10-day period of January, while the highest in the second 10-day period of February (Table 1). In 2015 the number of captured birds was low until the end of February; in this period, the lowest average temperatures were recorded during the third 10-day period of January and the first 10-day period of February (Table 1). A considerable increase of captures took place only during the first and second 10-day period of March. In 2016 the captures were of small numbers but constant until the first 10-day period of February and the average temperatures during these three 10-day periods were the lowest (Table 1); from

10-day period	year		
	2014	2015	2016
January II	11.5	10.4	6.1
January III	8.6	7.1	7.2
February I	10.0	5.1	8.7
February II	17.6	8.9	11.2
February III	10.9	9.6	11.6
March I	9.3	8.5	9.1
March II	11.1	9.7	11.0

Table 1. Average temperatures for 10-day period during the ringing activities, 2014–16

1. táblázat Átlagos hőmérséklet a gyűrűzési időszak tíznapos bontásában, 2014–2016

the second 10-day period of February the number of thrushes ringed increased with the highest values recorded in the second 10-day period of March, although there was a small decrease evidenced in captures in the first 10-day period of March, as had happened in 2014. In the three years the percentage of the captures obtained in February were 36.4%, 22.5% and 37.5% respectively, while in March came to 52.3%, 57.5% and 43.7%.

In *Figure 3* results are expressed as a catching-effort index, e.g. number of captures during each 10-day period divided by net-hours.

Plotting the captures in each 10-day period (*Figure 3*) shows a fairly similar pattern in the three years under review. In the first three 10-day periods of investigation (11 January – 10 February) the catching index remains fairly constant with an average value of 0.26 and the captures are only 23.5% of the sample; a slight but noticeable increase was always recorded in the second 10-day period of February and, although there were fluctuations from year to year, the peak was reached in the second 10-day period of March, at the end of which the trapping ended. In this last 10-day period, the average level of captures reached 0.82 and the number of thrushes ringed represented 31.8% of the total sample.

During these three years only five birds were retrapped at the place of ringing with a length of duration on the study site of 13–42 days; during 2015 a Song Thrush ringed during the second 10-day period of January was controlled after 13 days showing an increase in weight of 2.7 g and other two, ringed during the third 10-day period of January, were captured again during the first 10-day period of February after 14 and 15 days, respectively, showing an increase in weight of 3.1g and 2.0g. This last bird was controlled again during the second 10-day period of February with a total increase in weight from the first ringing of 3.6 g; during 2016 one bird ringed during the first 10-day period of February was controlled during the next 10-day period showing an increase in weight of 3.9g after 13 days and one other ringed during the second 10-day period of January was recaptured during the third 10-day period of February with an increase of 9.3g after 42 days.

Figure 4 shows the average body mass changes for 10-day period, bringing together all the data gathered in the four years of investigation. It should be noted that the data for the third 10-day period of March were collected only in 2013 because, due to the poor weather conditions, it was not possible to monitor the previous 10-day period.

Mean body mass calculated for each 10-day period showed the lowest values in the second and third 10-day periods of January. Increases were detected by the following 10-day period but there were significant increases only from the third 10-day period of February with the highest values recorded in March. This trend could also be seen from the accumulation of subcutaneous fat as evidenced by the sample of data collected during the years 2013–16.

Figure 5 shows the percentage of individuals with a score of visible fat greater than or equal to 3, calculated per 10-day periods from 11 January to 31 March.

The graph shows that in the second and third 10-day period of January there were no captures of thrushes with high levels of fat deposits, but almost all examined birds were in classes 0 and 1; in particular, 42% of all those with score 0 has been ringed in this period. The first thrushes with fat appear only from the first 10-day period of February, while a strong increase in their number was recorded from the next 10-day period and reached the highest values in the second and third 10-day periods of March. Overall, 70% of the

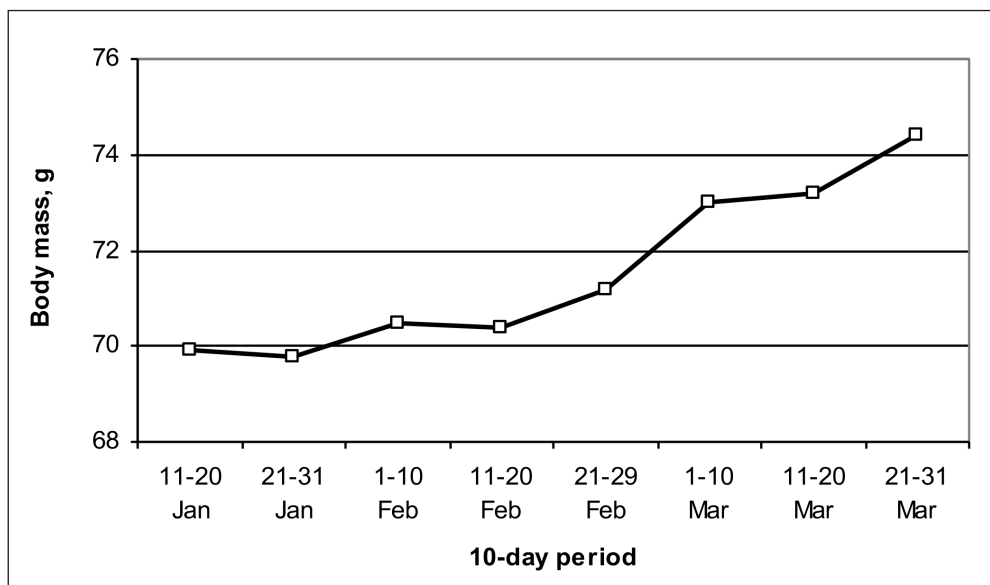


Figure 4. Mean body mass in each 10-day period from January to March. Data from 2013–16 combined

4. ábra Átlagos testtömeg a január-márciusi időszak tíznapos bontásában. Összesített adat 2013 és 2016 között

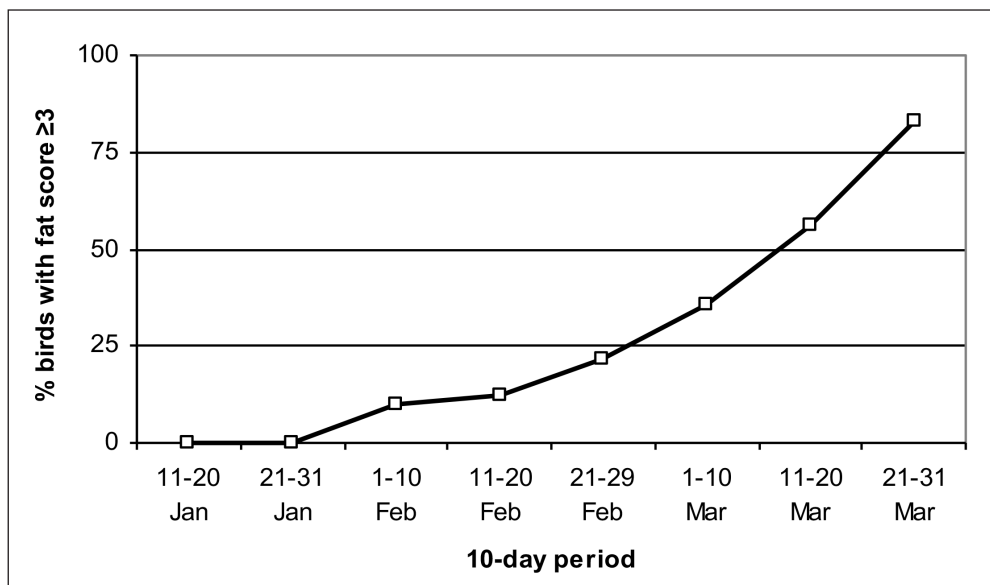


Figure 5. Percentage of birds (with a visible fat score of at least 3), per 10-day periods, during the study. Data from 2013–16 combined

5. ábra A legalább 3-as zsírtartalék értékkel jellemezhető madarak százalékos aránya tíz naponként. Összesített adat 2013 és 2016 között

	Wing	Third primary	Tarsus
2013	118.6 ± 1.80 18	89.0 ± 1.68 18	32.4 ± 0.47 18
2014	118.7 ± 2.05 44	89.1 ± 2.14 44	32.5 ± 0.60 34
2015	118.6 ± 1.93 40	89.0 ± 2.30 40	32.5 ± 0.60 40
2016	118.6 ± 2.92 48	88.9 ± 2.36 48	32.4 ± 0.56 48
All years combined	118.7 ± 2.29 150	89.0 ± 2.19 150	32.5 ± 0.57 140

Table 2. Measurements (in mm) of Song Thrushes ringed during the period from 11 January to 20 March, 2013–2016. Mean, SD and N are given

2. táblázat A vizsgálati időszakban gyűrűzött énekes rigók testméret adatai (mm) 2013 és 2016 között átlag, szórás és mintaszám megadásával

examined thrushes presented little or no fat reserves (scores 0–2), while birds with large fat deposits (scores 3 and 4) represented only 30% of the total sample; it is however important to point out that 91% of these birds with fat were concentrated between the third 10-day period of February and the third 10-day period of March.

Mean wing lengths, third primary lengths and tarsus lengths calculated for separate years and for all years combined are presented in *Table 2*; no attention was paid to the age of the birds, as if adults and young are considered separately, there were no significant differences in biometrics between the age groups (wing length: adults 118.8mm ± 2.61 (N = 60), young 118.6mm ± 2.07 (N = 90); third primary length: adults 89.1mm ± 2.51 (N = 60), young 88.9 ± 1.96 (N = 90); tarsus length: adults 32.6mm ± 0.56 (N = 54), young 32.4mm ± 0.58 (N = 86)).

The values obtained for the three morphometric variables did not differ from year to year.

As for the age classes, in 2016 the collected sample was composed of 31 young, hatched in the spring 2015, and 17 adults, hatched before the year 2015, with a young/adults ratio of 1.8:1 and a percentage of 64.6% of young, values that do not differ from those reported in 2015 (1.7:1 and 62.5%) and 2014 (1.9:1 and 65.9%), and slightly lower than those calculated in 2013 (2:1 and 66.7%).

Discussion

The olive crops and the maquis present on the hills, which reach down the lower foothills of the mountains Picentini and Lattari, are an important habitat for birds. In particular the area located on the edge of the Regional Park Picentini, shows a remarkable environmental diversity due to the presence of a mixture of Mediterranean maquis, coppice with large tracts of scrubland and woods, large meadows and extensive olive groves, of great importance for the stopover and wintering of numerous bird species.

The Song Thrush is one of the dominant species in the bird population of the study area and the relatively small number of ringings was probably caused by winter dispersion and scarce

territoriality of the species at this time of year as well as to the passive capture method used. The trend of captures was slow but steady from the second 10-day period of January, when the trapping began, until the first 10-day period of February, without evidence of peaks due to the arrival of migrant birds. An increase of captures was recorded in the second 10-day period of February with a very considerable peak during the second 10-day period of March.

The timing of migration is also regulated by many exogenous factors. These include climatic factors, such as temperature, wind conditions, ice and snow cover (Richardson 1990, Hüppop & Hüppop 2003); the temperature, for example, affects not only the fattening of birds, a necessary requirement to undertake migratory movements (Bairlein & Gwinner 1994, Berthold 1996), but also the phenology of migration of species. During our research the mean body mass showed significant increases from the third 10-day period of February, with the highest values recorded in March, coinciding with a trend also found in the accumulation of subcutaneous fat; examination of the data shows that 91% of subjects with fat scores 3 and 4 were concentrated between the third 10-day period of February and the third 10-day period of March, while the first birds with fat reserves appeared during the first 10-day period of February. In the second and third 10-day periods of January there were no captures of thrushes with fat, but the birds were distributed between the classes 0, 1 and 2. This trend is the same as that detected in similar projects carried out in Lazio (Scebba *et al.* 2014) and Puglia (Scebba *et al.* 2015).

The averages of the wing length, the third primary length and the tarsus length recorded during this study (*Table 2*) does not differ (t-test, data not show) from the values recorded in the period from January to March in the province of Latina in Lazio in the years 2012–14 (118.8 ± 2.67 mm, N = 341; 88.9 ± 2.34 , N = 340; 32.5 ± 0.88 mm, N = 335) (Scebba *et al.* 2014) and on birds ringed in autumn in the province of Caserta in Campania in the years 2003–05 (118.5 ± 2.48 , N = 1,340; 88.8 ± 2.27 , N = 1,331 and 32.3 ± 0.97 mm, N = 1,333) (Scebba 2006). It is therefore possible that these catching sites intercept the same migratory flow through southern Italy.

In the last two 10-day periods of January, only birds with low fat scores and low weight were captured and the number of captures has been small. Weather conditions, characterised by rather low temperatures, both in the study area and in the breeding countries, were not favourable to undertake the migration until the first 10-day period of February. All these factors combined lend support to the hypothesis that these are wintering birds. Furthermore a sample obtained during the early stages of migration should be composed of wintering birds, of individuals on migration which stopped to replenish depleted fat deposits and of individuals that are starting to accumulate fat before leaving, while the chances of catching only birds that have newly arrived, lean, and not those that are fattening or are fat enough and ready to leave is very low.

High fat deposits are essential in order to reach the nesting areas as the average distance that the thrushes which visit Campania have to travel is at least 1,400 km. This distance may be underestimated because from a sample of 40 Song Thrushes recovered in Campania and ringed either in the breeding areas or during the autumn migration (Archive GIL); there were several birds ringed in Sweden, Finland, Belarus and Russia. These areas are located more than 1,700 km away and these movements can hardly be achieved with very low fat deposits.

The duration of the wintering period in Campania can be inferred from an examination of some recoveries of the 3,851 thrushes ringed by GIL between 1978 and 2015 in the provinces of Caserta, Naples and Salerno. In particular, three birds ringed in October, November and December on the island of Vivara (Gulf of Naples) were still there the following year on March 6 and on January 5 and 9 respectively. Two others ringed in January were controlled after 57 and 58 days. Unfortunately, there are no recoveries during the northward migration or in the nesting areas of thrushes ringed in Campania, probably due to the small number of marked individuals; these data do not allow us to determine when the birds leave the wintering area; vice versa, there have been three recoveries in Algeria and Tunisia between the second 10-day period of January and the second 10-day period of February.

If we take into account the recoveries of thrushes ringed in other regions of Italy, we find five individuals ringed in Lombardy during the autumn migration and recovered the following year in Campania between the third 10-day period of January and the first 10-day period of April. It should also be noted that several recoveries of birds ringed in Austria, Switzerland, Germany, Poland, Hungary, Finland, Lithuania and Russia, both in the nesting period and during the autumn migration, confirm the presence of these birds in Campania in the period between the third 10-day period of January and the third 10-day period of March (archive Gruppo Inanellamento Limicoli).

Also Macchio *et al.* (1999), based on trapping activity in Italy in the years 1980–1994, stated that spring migration takes place from February, which is also suggested by the trend of the annual index of abundance, and Licheri and Spina (2002) reported that “ringing data – collected in Italy in the years 1982–1999 – show that return migration is from February to April, with a few birds still present in early May”.

The data gathered during the four years of our investigation, carried out in the province of Salerno, corroborated by the analysis of several recoveries, and by the results of similar research (Scebba *et al.* 2014, 2015), provide an indication of the temporal trend of pre-nuptial migration of Song Thrush, which never usually begins before the second 10-day period of February, although it is possible that some birds on migration can be present in the previous 10-day period. However, to define more accurately the start of the spring migration of the Song Thrush it would be necessary to undertake further research, covering a period as long as possible, so as to highlight inter-annual variability and properly assess the status of wintering populations and their migrations over the years.

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