

The role of Italy within the Song Thrush (*Turdus philomelos*) migratory system analysed on the basis of ringing-recovery data

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Song Thrush migrations and wintering in Italy have been studied on the basis of 3.518 recoveries stored at the Italian Ringing Scheme, and referred to both foreign birds reported from Italy, and Italian ringed birds recovered in Italy and abroad. The breeding quarters of Song Thrushes migrating through Italy are located in the Baltic area (northern Poland, Baltic Republics, Baltic area of Russia, Finland), in central-eastern Europe (southern Poland, Germany, Czech and Slovak Republics, Austria, Hungary) and central Europe (Switzerland, eastern France). On the basis of the geographical distribution of the ringing localities of the birds recovered in Italy while on autumn migration we can assume that Italy is reached by birds originating from areas where no ringing activities at the nest are carried on, in particular central-northern European Russia, but possibly also Belarus, Ukraine and the Balkans.

Song Thrushes start reaching Italy from the end of August, stronger movements being observed during the second half of September, with a peak of migration between end of October – early November. Wintering birds are recorded between the second half of November and early January, when the first return movements start. Pre-nuptial migration is longer than the autumn passage, continuing till the end of March. The general seasonal pattern of recoveries is the result of the passage of thrushes coming from different breeding areas, and with different phenologies. Distinct migratory routes across Italy are also suggested by the uneven distribution of recoveries at the national scale.

Recoveries of foreign birds ringed during the breeding period and on autumn migration indicate three distinct routes towards Italy: a south west route from central-eastern Europe, one from the Baltic countries to the Alps, and a south-south east route from central Europe. Once in Italy, the thrushes follow several different routes. The data available allowed tracking those used by birds passing through some of the provinces of Lombardia (EURING areas IA01, IA04, IA13); these thrushes mainly head towards Mediterranean France, Spain, the Balearics and hence Algeria. From here they fly back via Sardegna and Corsica to western Liguria and the Mediterranean coasts of France, performing a typical loop migration. The absence of recoveries after January from the Italian regions north of Liguria supports the hypothesis that these birds would continue flying to their breeding quarters through France, therefore avoiding crossing the Alps. A smaller fraction of birds ringed in the same EURING areas heads south towards Toscana, and is likely to stop and winter in the central Tyrrhenian regions. The data do not allow a detailed description of the routes followed by autumn migrants flying further east and south than the study areas, although a general tendency has been observed for these birds to move towards central Italy, rather than France, Spain and the Balearics.

Winter recoveries show how thrushes tend to move also during the winter months; clear northward return movements from north Africa start from January via Sardegna and Corsica, when other birds are still flying to Algeria. The main winter quarters of birds ringed in Italy are located in fairly restricted areas of Mediterranean France, the Balearics and Algeria. Winter recoveries in Italy are mainly concentrated in the northern and central Tyrrhenian regions.

The results of this analysis show the potential of ringing/recoveries stored at the single national ringing schemes to analyse species-specific migratory strategies through vast geographical areas, despite the human-related problems affecting the spatio-temporal distribution of data. The better knowledge of the flyways followed by Song Thrushes of different geographical origin is a prerequisite for the proper management of this species, which is intensively hunted within the Mediterranean. The need for an adequate conservation strategy of the fairly restricted key wintering areas is also addressed.

Key words: Song Thrush (*Turdus philomelos*), recovery data analysis, migration, wintering, flyways, Italy, Mediterranean.

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1. Introduction

Started some 70 years ago, bird ringing in Italy has been carried on intensively especially in the last few decades, providing the national data bank with a considerable amount of recoveries of both birds ringed in Italy and abroad. Data collected at the national level, although often not having originated from specific co-ordinated projects, can effectively be used to the better understanding of migratory movements and strategies of certain species or populations over wide geographical areas. With this paper we aim at showing the potential of information of ringing recoveries hosted by a national ringing scheme through the specific case of the Song Thrush (*Turdus philomelos*) data set stored at the Italian Ringing Scheme. We decided to select this species for the following reasons:

1. the Song Thrush is a common species in Italy both during migrations and wintering;
2. a large historical data set of recoveries is available;
3. these data originate both from birds ringed abroad and in Italy;
4. the data set is suitable for a detailed investigation of the role played by Italy both as staging and wintering area for this species, given also the minor influence potentially referred to the small Italian breeding population (ASHMOLE 1962, BUSSE 1986, BRICHETTI & MESCHINI 1993, TUCKER & HEATH 1994, TOMIALOJC 1997).

Studying Song Thrush migratory and wintering strategies within the Mediterranean region can be of importance also from the management perspective, as it is one of the focal quarry species in the area. Song Thrush hunting is practised mainly in Portugal, Spain, France, Italy, Malta, Greece, Cyprus, Morocco, Algeria and Tunisia (GUTIERREZ 1991, MAGNI 1991, FENECH 1992, McCULLOCH et al. 1992); yet no sound estimates are available on the hunting pressure on the Mediterranean wintering populations (HEPBURN 1985, CONSIGLIO 1990). Bag statistics have only been collected on limited geographical areas, and over short time periods. Only generic estimates referred to the Turdidae species are available, making the contribution of hunting to overall mortality difficult to evaluate (CHAMBOLLE 1986, FERRAND 1988, MASSA & BOTTONI 1989, CARRERA I GASSILLÀ 1991, FENECH 1992, LUCIO & PURROY 1992). This is further complicated by the unsatisfactory level of knowledge of the main flyways and wintering ranges of the different populations, as well as of the numbers of birds wintering within the Mediterranean region.

The Song Thrush is a quarry species over most of Italy (having recently been protected in the Province of Bolzano), although the hunting pressure on the species is likely to vary among regions, on the basis of both different migration patterns and traditional hunting practices. In Lombardia, Veneto, Friuli-Venezia Giulia, Liguria, Emilia-Romagna and Toscana the main hunting technique is from fixed posts, where living decoys are used to attract birds (MASSA & BOTTONI 1989). Despite the absence of any bag statistics from our country, the results of an analysis by McCULLOCH et al. (1992) indicates an increased hunting pressure on the species during the last decades in Italy.

In 1962, a complete analysis of thrush recoveries by ASHMOLE took into account the main migratory routes and winter quarters in Europe while, for the Mediterranean, recovery data have more recently been used to study thrush migration and wintering in Spain (SANTOS MARTÍNEZ, 1982), France (CLAESSENS 1988b, OLIOSO 1989, 1995) and Italy (SCEBBA 1987, 1988).

Our study aims at improving the comprehension of the role played by Italy within the Song Thrush migratory system by analysing in particular the following aspects:

1. the origin of the birds migrating through Italy;
2. the phenology of the species in Italy and in the different Italian regions;
3. the migratory routes followed in autumn and spring;
4. the wintering ranges.

2. Materials and Methods

Our analysis is based on 1275 recoveries referred to foreign ringed birds reported from Italy and 2243 recoveries in Italy as well as abroad of Italian ringed thrushes, during the period 1929–1995.

2.1. Origin

In order to locate the origin of Song Thrushes migrating through or wintering in Italy, recoveries of birds ringed abroad during the breeding period (CRAMP & SIMMONS 1988, MELDE & MELDE 1991) have been selected on the basis of standardised 5-day periods (BERTHOLD 1973): i.e. birds ringed as pulli at the nest (EURING age code 1), or as full grown birds (EURING age codes ≥ 2) between May 21 – July 29 (EURING 1979). Since the number of recoveries in Italy of birds ringed in a given geographical area is influenced both by the fraction of these birds reaching Italy and the ringing effort during the breeding season, also recoveries of birds ringed during the autumn migration (*i.e.* August 4 – November 1) have been taken into account. In both cases also recoveries in following years from ringing have been considered, given the high fidelity to breeding, staging and wintering grounds shown by the species (VERHEYEN & LE GRELLE 1951, ASHMOLE 1962, MELDE & MELDE 1991, OLIOSO 1995).

In order to have a general idea of the ringing effort during the breeding season, the data referred to the number of *pulli* ringed in each country between 1975 and 1995 have also been analysed, as reported in the EURING annual reports produced by the different national ringing schemes (Tab. 1).

Tab. 1: Mean annual number of Song Thrush pulli ringed by the different European centres, on the basis of the national EURING reports available. National abbreviations refer to the political situation of the 80ies, except for RDT and RFT, reported as D.

Tab. 1: Durchschnittliche Zahl nestjung beringter Singdrosseln von verschiedenen europäischen Stationen nach den verfügbaren nationalen Euring-reports. Die Abkürzungen der Länder beziehen sich auf die politische Lage der 80er Jahre, mit Ausnahme der BRD und DDR, die beide mit D gekennzeichnet werden.

Country	Ringling Centre	Yearly average number of <i>pulli</i> ringed at the nest	Number of years for which data are available
BG	Sofia	28	9
CH	Sempach	16	19
CS	Praha	36	5
D	Helgoland	21	22
D	Hiddensee	92	16
D	Radolfzell	71	7
DK	Copenhagen	74	11
DK	Kalø	4	11
E	Madrid	11	8
E	Icona	16	7
URSS	Matsalu	310	11
F	Paris	73	11
GB	Jersey	60	10
GB	London	1863	7
H	Budapest	26	10
URSS	Kaunas	156	10
N	Stavanger	79	8
N	Oslo	36	6
NL	Arnhem	196	10
PL	Gdansk	189	9
R	Bucarest	9	6
S	Stockholm	384	9
SF	Helsinki	356	21
USSR	Moskwa	474	8
YU	Ljubljana	16	9
YU	Zagreb	3	9

We also tried to clarify whether single Italian regions are used as staging or wintering areas by thrushes of different geographical origin by analysing regional sub-samples of recoveries. Given the uneven distribution of recoveries on a national basis, only 5 regions from which a reasonable sample was available ($n > 100$) were taken into account, while all recoveries originated from southern Italy have been grouped together; to reduce the variables to few independent factors, a Principal Component analysis has been performed. In this analysis cases were countries and variables were Italian regions; for each country, the percentage of recoveries in the various Italian regions was used.

2.2. Phenology

The analysis of the phenology of Song Thrushes migrating through or wintering in Italy has been based on the whole data set of foreign recoveries in Italy. Data with inaccuracy of the recovery date as to prevent allotting them to a standardised pentade have been omitted.

2.3. Main migratory routes

Song Thrush autumn migratory routes towards Italy have been described on the basis of direct recoveries of birds ringed during the breeding period (see 2.1.) and reported within November 16 of the same year of ringing. Median directions have also been calculated for birds ringed abroad between August 19 – November 16 and recovered in Italy within November 16 of the same year. The formula described by PERDECK & CLASON (1982) has been used to calculate the median ringing and recovery co-ordinates, based on the conversion of the co-ordinates of each locality into spatial rectangular co-ordinates:

$$X = \cos B \cos L, \quad Y = \cos B \sin L, \quad Z = \sin B, \quad (B = \text{latitude}, \quad L = \text{longitude}).$$

Median co-ordinates have been determined using the median values of X, Y and Z through the following equations:

$$B = \arctg ((Z/X^2 + Y^2)^{1/2}), \quad L = \arctg (Y/X).$$

To describe the movements of Song Thrushes once they've reached Italy, recoveries of birds ringed in Italy during their autumn migration have been taken into account. In order to analyse homogeneous data sets, recoveries have been selected on the basis of ringing areas (as from the EURING code, EURING 1979) characterised by the passage of birds heading towards common winter quarters. Hence, the distribution of recoveries originated from birds ringed on autumn migration (August 29 – November 16) and reported between September and April from four different staging and wintering focal areas (Balearics, Algeria, Sardegna-Corsica and Toscana) have been analysed, showing that Song Thrushes migrating through the EURING areas IA01 (Bergamo), IA04 (Como, Lecco, Varese and Sondrio) and IA13 (Milano and Lodi) are heading to common winter quarters, while birds ringed in areas further east and south in Italy are following different migratory routes (Figs. 1, 2). Therefore, in order to describe autumn and winter movements, only recoveries of birds ringed in EURING areas IA01, IA04 and IA13 during their post-breeding migration and recovered both in Italy and abroad within January 15 of the following year have been selected. Data with recovery date inaccuracy have been omitted from the analysis. Recovery data have been divided into five distinct 20-day periods between October 8 – January 15. For each period, median co-ordinates have been calculated from recoveries in Italy and abroad. Since Song Thrushes winter already in northern Italy (CRAMP & SIMONS 1988, RIGHINI 1992, CUCCO et al. 1996), we can assume that only a proportion of the birds ringed there would proceed further south, such proportion getting progressively smaller as the fronts of migration move southward, given the increasing number of thrushes which stop for wintering in the different areas along these routes. In order to overcome the bias due to birds settling to winter, for periods 2–5 only recovery localities further to the south than the median value recorded for the previous period have been selected when calculating median co-ordinates, assuming recoveries more to the north to be referred to birds which are no longer moving.

A general perspective of Song Thrush movements within the Mediterranean has been obtained by analysing recoveries of birds ringed in autumn in the EURING areas IA01, IA04 and IA13, and recovered within April 30 of the following year. For each of the main staging and wintering geographical areas of Song Thrushes ringed in Lombardia, the data have been divided on the basis of the recovery period: autumn (August 29 – November 16); early winter (November 17 – December 31); late winter (January 1 – February 14); spring (February 15 – April 30).

Following the results obtained, the pre-nuptial migration through Sardegna and Corsica has been described by calculating the median co-ordinates of recoveries during three different 20-day periods. Similarly and in-

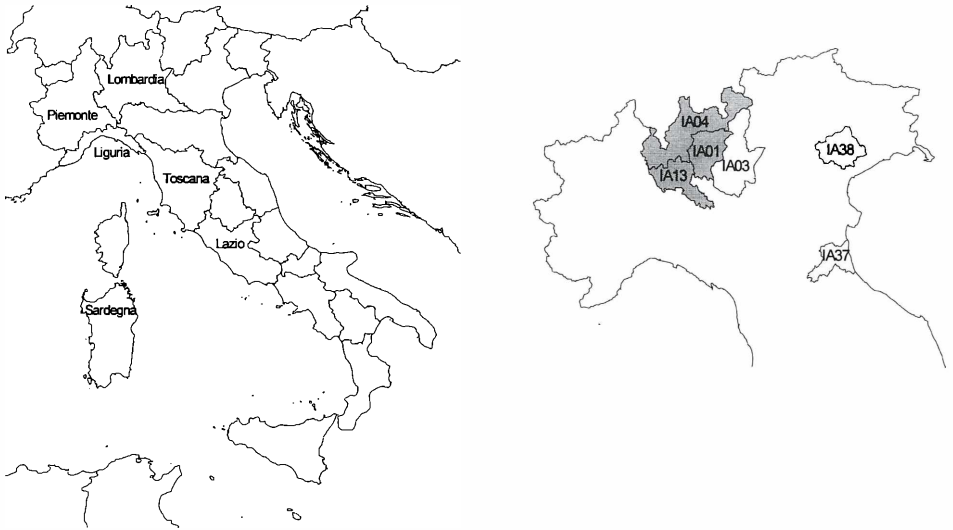


Fig. 1: Italian EURING areas with intense Song Thrush ringing and large samples of recoveries. IA01 = Bergamo; IA03 = Brescia; IA04 = Como, Lecco, Sondrio and Varese; IA13 = Lodi and Milano; IA38 = Treviso; IA37 = Ravenna.

Abb. 1: Euring-Zonen mit starker Beringungstätigkeit von Singdrosseln und großer Wiederfundzahl. IA01 = Bergamo; IA03 = Brescia; IA04 = Como, Lecco, Sondrio und Varese; IA13 = Lodi und Milano; IA38 = Treviso; IA37 = Ravenna.

versely to what already done when describing autumn movements, recoveries from lower latitudes than the median values recorded for the previous period have been excluded. Only recoveries from Algeria, Italy and Corsica have been taken into account, assuming birds recovered further to the west to be still in their winter quarters.

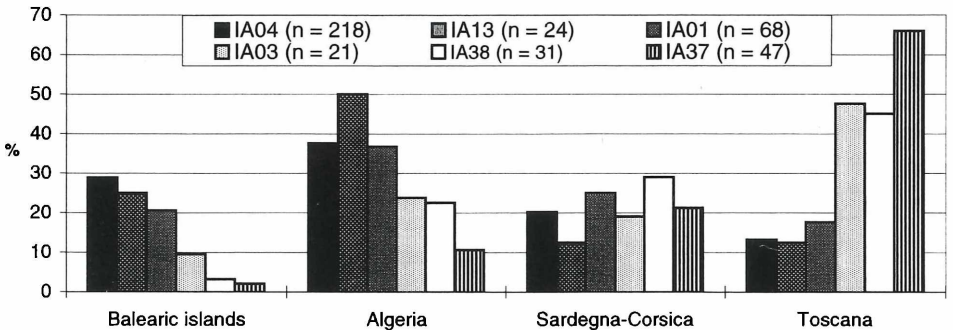


Fig. 2: Comparison among six Italian EURING areas based on the percentage distribution of recoveries in four different regions of the central-western Mediterranean: Balearics, Algeria, Sardegna-Corsica and Toscana (see also Fig. 1).

Abb. 2: Vergleich zwischen sechs Euring-Zonen nach der prozentualen Verteilung der Wiederfunde in vier verschiedenen Regionen des zentral-westlichen Mittelmeeres: Balearen, Algerien, Sardinien-Korsika und Toscana (siehe auch Abb. 1)

2.4. Wintering

Recoveries of birds ringed in Italy and reported both from Italy and abroad have been used to locate the wintering areas within the central and western Mediterranean. Based on the findings referred to the phenology of migration (see 3.2., Figs. 6, 8), two distinct periods have been selected: a first one between November 17 – December 31, and January 1 – February 14, the second being characterised still by the presence of wintering birds, together with others in active pre-nuptial migration. Recoveries within 15 days from ringing have not been taken into account. The situation recorded in the same period in Italy has then been investigated, based also on the recoveries of foreign ringed birds.

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3. Results

3.1. Origin

Recoveries in Italy of birds ringed during the breeding period (Fig. 3, Tab. 2) indicate a main origin from central-eastern Europe (Czech and Slovak Republics, Hungary, Germany, Austria), from the Baltic countries (Finland, northern Poland and Baltic regions of the former USSR) and from central-western Europe (Switzerland and eastern France). This is largely in agreement with what reported by ASHMOLE (1962) and BUSSE (1986); with respect to earlier analyses, there is a stronger indication for a passage of birds of central-western European origin. Recoveries of birds ringed while on autumn migration (Fig. 4, Tab. 2) indicate that Song Thrushes reach Italy coming from the Baltic coasts (former USSR, Sweden, Finland, Poland, northern Germany and Denmark), central Europe (Switzerland, southern Germany, Austria and France) and eastern Europe (Hungary and Czech and Slovak Republics).

When comparing the origin of foreign ringed thrushes reported from Italy, a significantly non-uniform frequency of recoveries among the different Italian regions (Tab. 3) is found ($\chi^2 = 163.58$, $df = 40$, $p < 0.01$).

The results of the Principal Component analysis are shown in Fig. 5, where loadings and factor scores are represented together. Factor 1 (eigenvalue 2.9) explained 47.7% of the total variance and factor 2 (eigenvalue 2.1) explained 35.1% of the variance (cumulative percentage of explained variance: 82.7%). The main results of these analyses are:

- a) thrushes of Hungarian origin clearly tend to concentrate in Lazio and in southern Italy, with lower frequencies from northwestern regions, like Liguria and Lombardia;
- b) a high frequency of birds ringed in Switzerland is reported from Liguria and Sardegna, compared with the low values observed in Toscana and southern Italy;

Tab. 2: Countries of origin of Song Thrushes ringed during the breeding season ($n = 322$) and the autumn migration ($n = 759$) and recovered in Italy. Data referred as percentage; national abbreviations as in Tab. 1.

Tab. 2: Ursprungsländer der zur Brutzeit ($n = 322$) und während des Herbstzuges ($n = 759$) beringten und in Italien wiedergefundenen Singdrosseln. Die Daten wurden prozentual von der Gesamtzahl angegeben; Länderabkürzungen wie in Tab. 1.

	CH	CS	D	USSR	H	PL	S	SF	Others
breeding	8.0	36.5	11.0	7.7	13.2	6.7	0.9	5.2	10.8
migrating	10.9	6.2	10.9	14.6	8.3	9.1	10.9	8.6	20.5

c) in Sardegna, both a high frequency of thrushes originating from central-western Europe (e.g. France) and a low frequency of birds of north-eastern Baltic origin (e.g. Finland) is observed;

d) a relatively uniform frequency among regions is only found when analysing birds ringed in the Czech and Slovak Republics.

3.2. Phenology

The general seasonal pattern of recoveries (Fig. 6) shows that the first migrants start reaching Italy in autumn from early September, while the bulk of arrivals starts in October. The post breeding migration peaks between the end of October and the beginning of November, to continue till early December. Very early return movements are observed from late December, to increase from the end of January and peak around mid-February. Overall, pre-nuptial migration seems to be less intense and longer (well into March and early April) than the autumn movements.

A comparison of recoveries of birds ringed during the breeding period in the Czech and Slovak Republics and in central-western Europe (Switzerland and eastern France) is shown in Fig. 7, indicating how the former are mostly staging in Italy during their migratory journeys, while the latter come later and stay to winter in Italy. This suggests how the general situation as shown in Fig. 6 is the result of different seasonal patterns which may vary among thrushes coming from different breeding areas.

The uneven geographical distribution of recoveries across Italy may reflect different migratory routes and winter quarters. Fig. 8a-f suggests that:

- migration periods change considerably in regions at different latitude;
- while clear peaks coincident with the migratory periods are observed in Liguria, Toscana and Sardegna, these are much less evident in Lazio and southern Italy, where in particular a decrease in recoveries is reported during autumn migration;
- an intense autumn migration involves the Lombardia region, which is only marginally influenced both during the return movements and wintering;
- a similar seasonal pattern is observed in Liguria and Sardegna, with wintering birds and two distinct and clear peaks, the main of which during pre-nuptial migration.



Fig. 3: Ringing localities of Song Thrushes recovered in Italy (birds ringed at the nest). Symbol proportional to sample size ($n = 322$).

Abb. 3: Beringungsorte von in Italien wiedergefundenen Singdrosseln (nestjung beringte Vögel). Symbol proportional zur Gesamtzahl ($n = 322$).

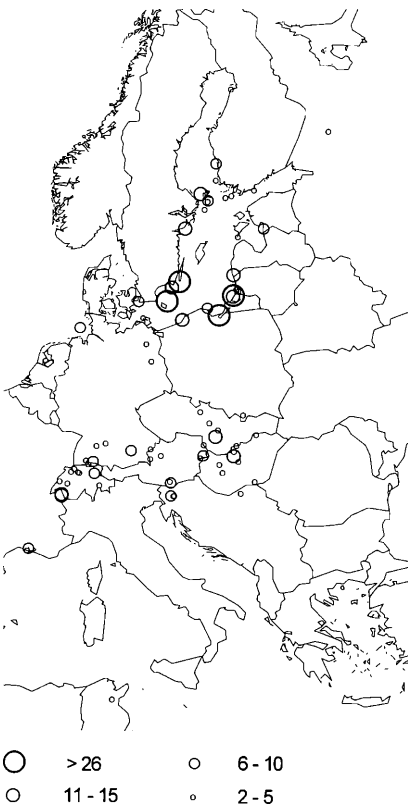


Fig. 4: Ringing localities during autumn migration. Symbol size proportional to the number of birds recovered in Italy.

Abb. 4: Beringungsorte während des Herbstzuges. Die Symbolgröße ist proportional zur Zahl der in Italien wiedergefundenen Vögel.

If plotting the distance of each of the recoveries of Italian-ringed thrushes abroad already used for calculating the median co-ordinates against the elapsed time from ringing, a clear increasing trend of distance with time is found. A significant linear correlation is observed for recoveries within 40 days and 600 km ($r^2 = 0,76$, $P < 0,0001$, Fig. 12); no correlation is found for later recoveries over longer distances (as to indicate a change in the migratory direction implying a significant difference between the distance actually flown and the linear distance between the ringing and recovery sites). An average speed of migration towards north Africa of ca. 16.1 km/day is obtained, a lower value than that reported by ALERSTAM & LINDSTRÖM (1990) for songbirds migrating within the temperate zone.

When analysing the movements of the fronts of migration within Italy (Fig. 11), the median co-ordinates calculated by the same procedure used for foreign recoveries do not allow a detailed de-

3.3. Main migratory routes

The analysis of direct recoveries of birds ringed at the nest (Fig. 9) and on autumn migration (Fig. 10) shows three main routes followed by Song Thrushes to reach Italy during their post-breeding movements. The first to the south-south west is followed by birds breeding in the Baltic area; we can assume a part at least of these birds to directly cross the Alps, which would explain the relatively high number of Italian recoveries of birds ringed in autumn immediately north of the Alps (see 3.1., Fig. 4). A second route is oriented to the south west and is followed by thrushes originating from central-eastern and eastern Europe; in this case migrants would fly east from the Alps, reaching Italy by crossing the northern Adriatic sea. Birds following this route seem to move at lower latitudes than those of Baltic origin. A third route to the south-south east might be followed by birds of central European origin (western Germany, eastern France and Switzerland).

Recoveries of birds ringed in Italy indicate that autumn migrants flying along the westernmost part of the Pre-Alps (EURING areas IA01, IA04 and IA13, see 2.3., Fig. 1) head mainly towards the western Mediterranean, while those recorded from further east (EURING areas IA03 and IA38) tend to winter progressively more within Italy and much less in north Africa or along the coasts of the western Mediterranean. Thrushes ringed further to the south, as those in area IA37, are recovered chiefly from Toscana, the Sardo-Corsican area and Algeria, and less frequently from France and the Balearics (see 2.3., Fig. 2).

When analysing the route followed by birds passing through the areas IA01, IA04 and IA13 in detail (Fig. 11) we note that a considerable percentage flies along the Mediterranean coasts of France and Spain, to reach the Balearics and Algeria.

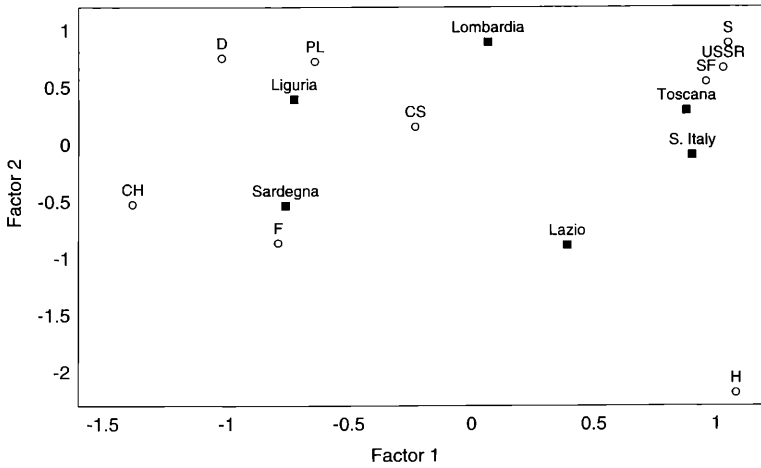


Fig. 5: Results of the Principal Component analysis. Countries (empty circles) represent the factor scores, Italian regions (black squares) represent the factor loadings.

Abb. 5: Ergebnisse der Hauptkomponentenanalyse. Die Länder (leere Kreise) stellen die „factor scores“ dar, die italienischen Regionen (schwarze Vierecke) die „factor loadings“.

scription of the preferred directions followed by migrating thrushes, given the high number of recoveries reported from the close vicinity to the ringing sites, which produce median values of latitude much biased to the north. Moreover, the high concentration of recoveries observed in western Liguria, which is likely to be due to the presence there of both an important line of migration towards the Mediterranean regions of France and a very favourable wintering area (see 3.4., Fig. 15), would mask the southward migration along the Tyrrhenian coast of the Italian peninsula, biasing to the north west the median value of latitude observed for the third period considered. The seasonal distribution of recoveries from Toscana (Fig. 13) shows how a percentage of the thrushes migrating through our focal EURING ringing areas follows the Tyrrhenian coast; such route is coherent with the phenology of foreign recoveries in central and southern Italy (see 3.2., Fig. 8b–d).

The comparative analysis of the seasonal distribution of recoveries within 250 days from ringing in the different coastal staging and wintering areas of the western Mediterranean (Fig. 13) al-

Tab. 3: Countries of origin of Song Thrushes recovered in: a) Lombardia (n = 146), b) Toscana (n = 239), c) Lazio (n = 108), d) southern Italy – including Sicilia (n = 92), e) Liguria (n = 175), f) Sardegna (n = 184). Data referred as percentage; national abbreviations as in Tab. 1.

Tab. 3: Ursprungsländer der Singdrosseln, die in: a) Lombardei (n = 146), b) Toskana (n = 239), Latium (n = 108), d) Süditalien, Sizilien eingeschlossen, (n = 92), e) Ligurien (n = 175), f) Sardinien (n = 184) wiedergefunden wurden. Die Daten wurden prozentual von der Gesamtzahl angegeben; Länderabkürzungen wie in Tab. 1.

	CH	CS	D	F	H	PL	S	SF	USSR	Others
LOMBARDIA	6.5	16.3	14.4	3.3	1.3	13.1	10.5	6.5	15.0	13.1
TOSCANA	6.2	15.8	8.5	4.6	8.8	5.0	8.8	8.5	14.2	19.6
LAZIO	12.9	15.5	4.3	6.0	23.3	4.3	5.2	6.0	10.3	12.1
SOUTHERN ITALY	3.3	6.5	6.5	2.2	16.3	4.3	8.7	13.0	14.1	25.0
LIGURIA	20.3	16.6	21.4	4.8	1.6	7.5	3.7	8.6	7.5	8.0
SARDEGNA	18.3	16.8	13.9	11.1	11.1	9.6	3.4	1.9	4.8	9.1

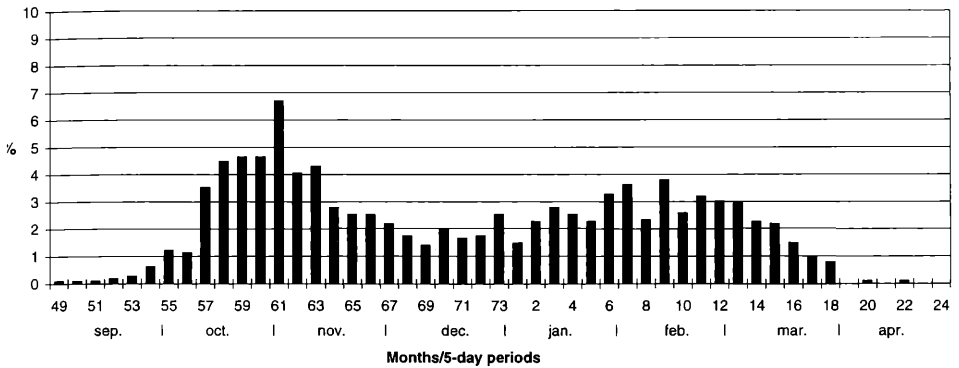


Fig. 6: Seasonal pattern of foreign recoveries in Italy. Data are grouped by standardised 5-day periods and shown as percentage of the total sample ($n = 1167$).

Abb. 6: Zeitliches Muster ausländischer Wiederfunde in Italien. Die Daten wurden periodenweise zusammengefaßt und als Prozentsatz der Gesamtzahl angegeben ($n = 1167$).

lows pointing out a considerable variation in the relative importance of each of those from autumn to spring. It is quite evident in particular how in autumn and early winter the vast majority of recoveries are concentrated in some Mediterranean regions of France, Spain and in the Balearics, while a progressively increasing importance of Algeria and the Sardo-Corsican area becomes evident later in the season.

The analysis of pre-nuptial migration through Sardegna and Corsica on the basis of median coordinates of recoveries (Fig. 11) offers a less accurate description of the movements of the fronts of migration than for the autumn, since the median values can be influenced by the presence of birds still wintering in areas further north than those across which migrants are flying. Yet, the median coordinates recorded confirm the existence of a migratory route leading thrushes in western Liguria and Mediterranean France through Sardegna and Corsica.

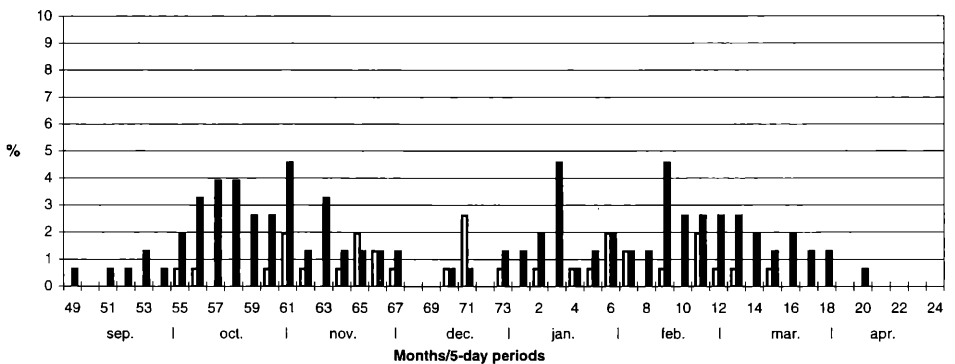


Fig. 7: Comparison of the seasonal pattern of recoveries in Italy of birds ringed in the Czech and Slovak Republics (black bars, $n = 118$) and central-western Europe (white bars, $n = 35$). Data shown as in Fig. 6.

Abb. 7: Vergleich zwischen dem zeitlichen Muster der Wiederfunde in Italien von in der tschechischen und slowakischen Republik (schwarz, $n = 118$) und in Mittel/Westeuropa (weiß, $n = 35$) beringten Vögeln. Die Daten wurden wie in Abb. 6 bearbeitet.

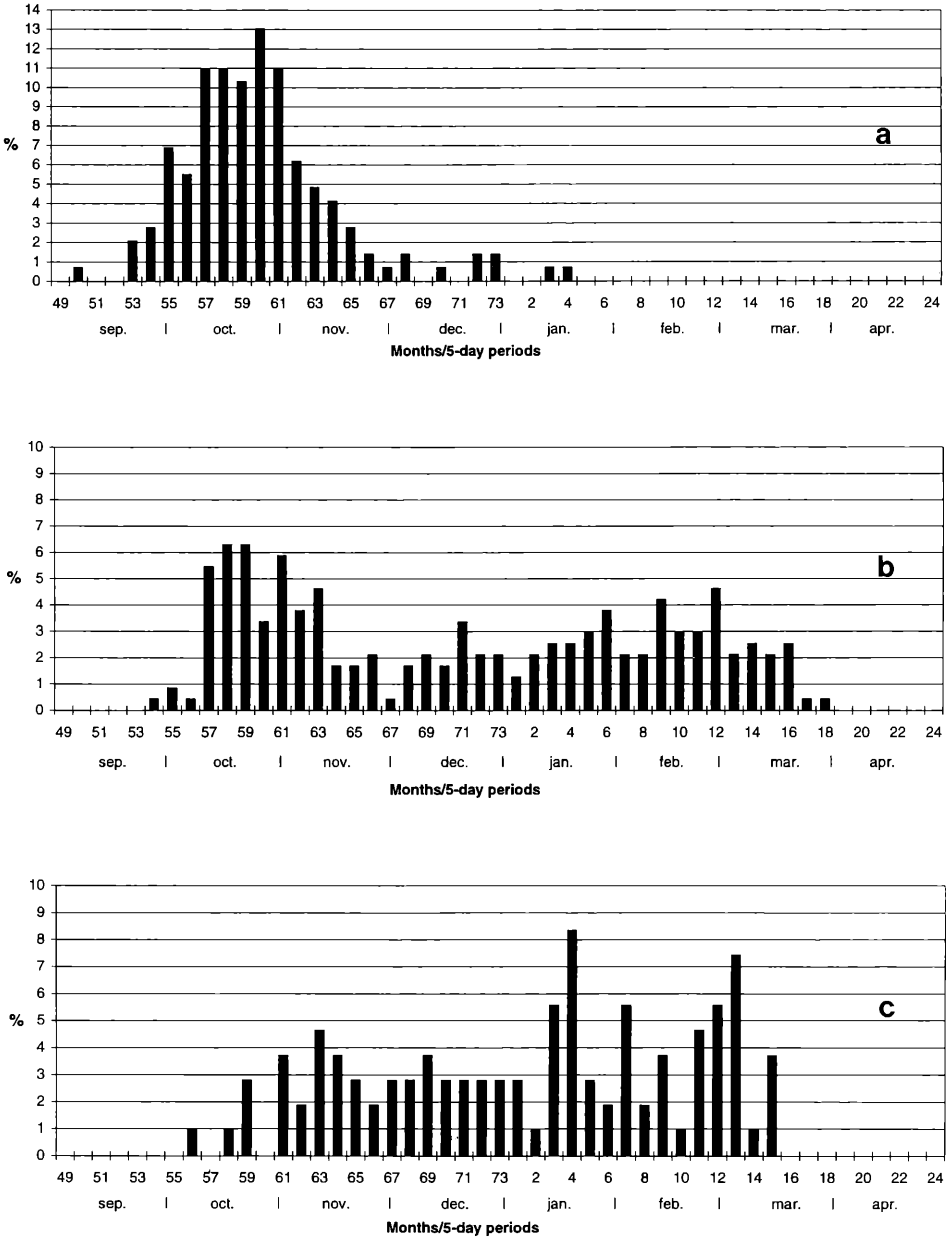
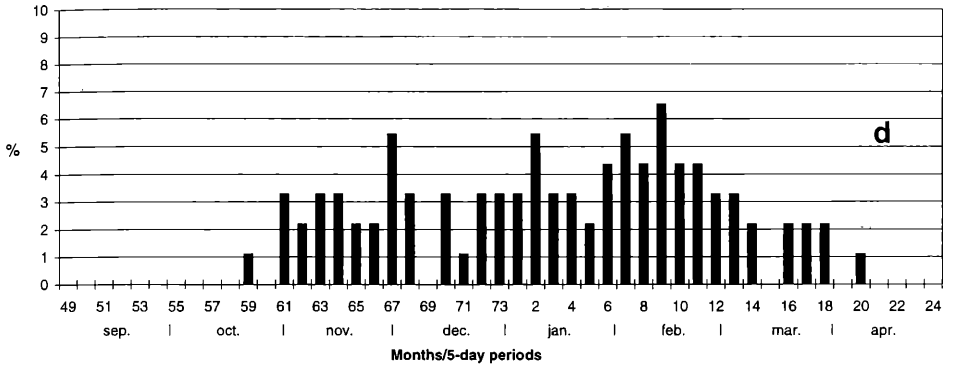


Fig. 8: Seasonal pattern of recoveries of foreign ringed birds in: a) Lombardia (n = 146), b) Toscana (n = 239); c) Lazio (n = 108); d) southern Italy, including Sicilia (n = 92); e) Liguria (n = 175); f) Sardegna (n = 184). Data shown as in Fig. 6.

Abb. 8: Zeitliches Muster ausländischer Wiederfunde in: a) Lombardei (n = 146), b) Toscana (n = 239); c) Latium (n = 108); d) Süditalien, Sizilien eingeschlossen (n = 92); e) Ligurien (n = 175); f) Sardinien (n = 184). Die Daten wurden wie in Abb. 6 bearbeitet.



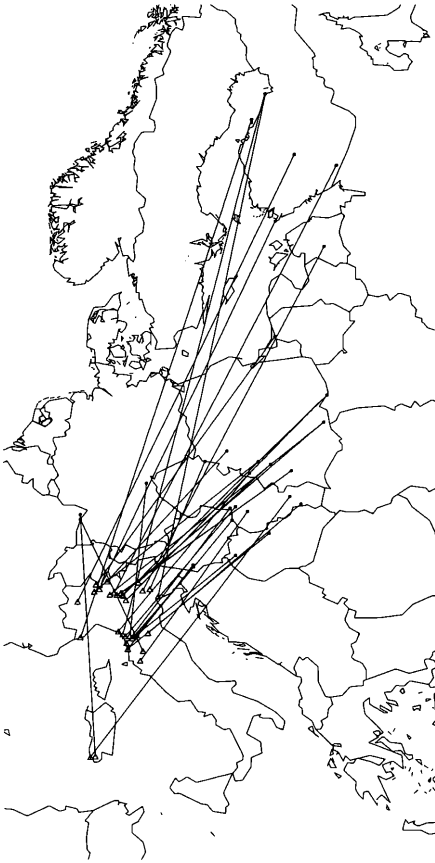


Fig. 9: Recoveries of birds ringed abroad during the breeding season and reported in Italy within November 16 of the same year of ringing (n = 32).

Abb. 9: Italienische Wiederfunde von im Ausland während der Brutzeit beringten Vögeln bis zum 16. November des gleichen Beringungsjahres (n = 32).

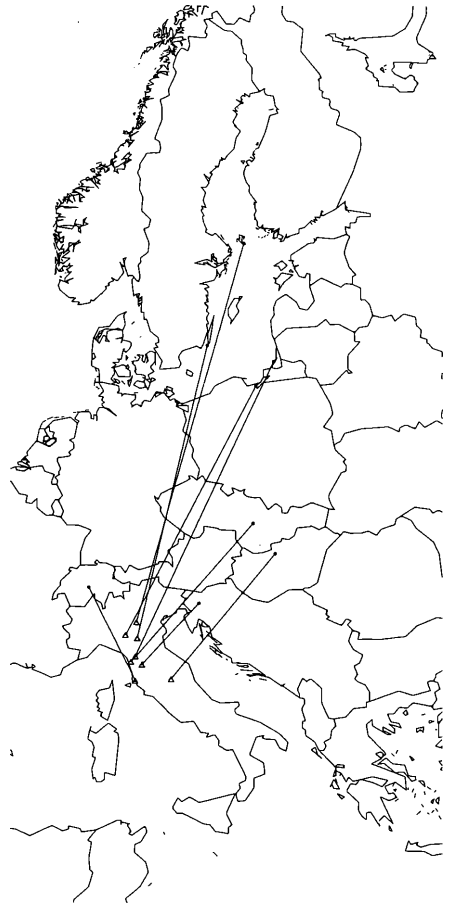


Fig. 10: Median directions followed by birds ringed abroad during autumn migration and reported in Italy within November 16 of the same year of ringing. Data have been grouped by country of origin to calculate median values (n = 91).

Abb. 10: Mediane der Richtungen von während der Herbstwanderung im Ausland beringten und in Italien wiedergefunden Vögeln bis zum 16. November des gleichen Beringungsjahres. Die Daten wurden nach den Ursprungsländern zusammengestellt, um die Medianwerte zu berechnen (n = 91).

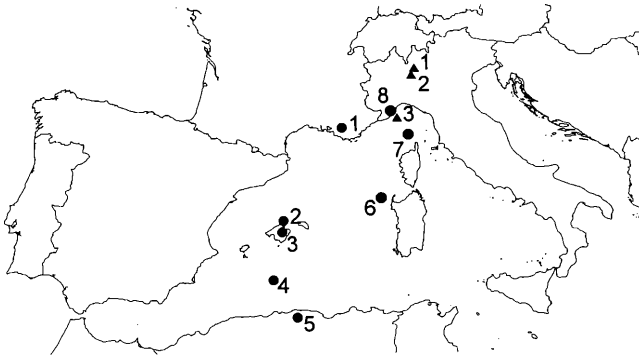


Fig. 11: Progression of the fronts of migration in the western Mediterranean. Autumn migration heads towards France, Spain and Algeria (dots 1–5) and along the Italian peninsula (triangle); pre-nuptial migration from Algeria towards Sardegna-Corsica and the northern coasts of the Mediterranean (dots 6–8). Symbols represent median co-ordinates calculated from recoveries, within March 16 of the following year, of birds ringed during autumn migration in the EURING areas IA01, IA04 and IA13 on the basis of 20-day periods. 1: October 8 – 27; 2: October 28 – November 16; 3: November 17 – December 6; 4: December 7 – 26; 5: December 27 – January 15; 6: January 16 – February 4; 7: February 5 – 24; 8: February 25 – March 16. For further details see 2.3.

Abb. 11: Verlauf der Zugfronten im westlichen Mittelmeerbereich. Der Herbstzug verläuft nach Frankreich, Spanien und Algerien (Punkte 1–5) und entlang der italienischen Halbinsel (Dreiecke); der Heimzug geht von Algerien aus Richtung Sardinien, Korsika und nach den nördlichen Küsten des Mittelmeeres (Punkte 6–8). Die Symbole stellen die Median-Koordinaten der bis zum 16. März des folgenden Jahres erfolgten Wiederfunde von auf dem Herbstzug in den Euring-Zonen IA01, IA04 und IA13 beirngten Vögeln in 20-Tage-Abschnitten dar. Für weitere Informationen, siehe 2.3.

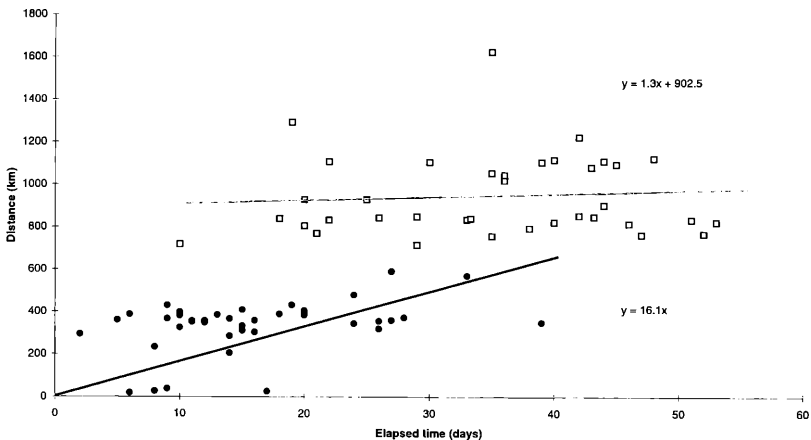


Fig. 12: Correlation between elapsed days from ringing and distance covered. The data set used is the same as for Fig. 11. A significant linear correlation is observed for recoveries within 40 days and 600 km ($r^2 = 0.76$; $P < 0.0001$); no correlation is found for later recoveries over longer distances.

Abb. 12: Korrelation zwischen der Entfernung von Wiederfunden und der seit der Beringung vergangenen Zeit. Die Daten sind die gleichen von Abb. 11. Eine signifikante lineare Korrelation wurde für Wiederfunde innerhalb von 40 Tagen und 600 km ($r^2 = 0.76$; $P < 0,0001$) gefunden; keine Korrelation ergab sich bei späteren Wiederfunden über längeren Entfernungen.

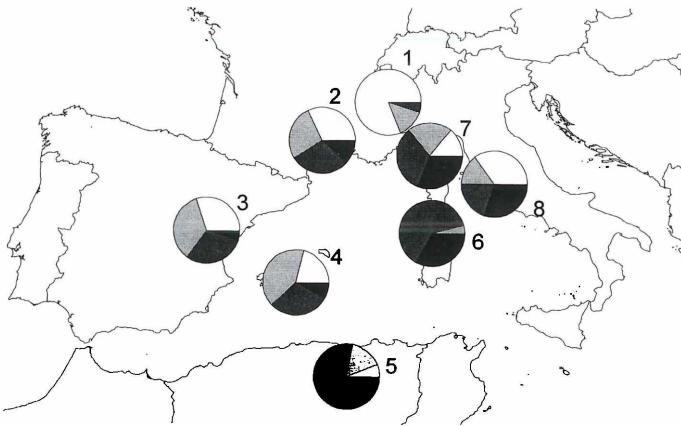


Fig. 13: Percentage annual distribution of recoveries in different regions of the central-western Mediterranean of birds ringed in the EURING areas IA01, IA04 and IA13 during autumn migration and reported within 250 days from ringing ($n = 445$). Pie graphs refer to the following periods: autumn (white), early winter (light grey), late winter (dark grey), spring (black). For further details see 2.3.

Abb. 13: Prozentuale Wiederfund-Verteilung in verschiedenen Zonen des Zentral- und Westmittellmeeres von Vögeln, die in den Euring-Zonen IA01, IA04 und IA13 während des Herbstzuges beringt und innerhalb von 250 Tagen gemeldet wurden ($n = 445$). Die Darstellung umfaßt folgende Perioden: Herbst (weiß), Anfang Winter (hellgrau), Ende Winter (dunkelgrau), Frühling (schwarz). Für weitere Informationen, siehe 2.3.

3.4. Wintering

The wintering areas of thrushes migrating through Italy extend from the Atlantic coast of Morocco and Iberian Peninsula to Tunisia and southern Italy. Between mid-November and late December, recoveries abroad are mainly concentrated in three relatively limited areas situated in Mediterranean France (Alpes Maritimes, Var, Bouches du Rhône, Vaucluse), the Balearics (Majorca and Menorca) and Algeria (Grande Kabylie) (Fig. 14a). Later in the season (Fig. 14b), a relatively unchanged situation is found in France and the Balearics, while a substantial increase in the frequency of recoveries occurs from eastern Algeria and even more from Sardegna and Corsica.

In Italy a fairly important wintering quarter is represented by the northern and central regions along the Tyrrhenian (Fig. 15); two areas, namely northern Italy and Sardegna, show considerable concentrations of recoveries only in limited periods, respectively in the first and in the second part of the winter. Only scattered data have been recorded from the southern regions. The frequency of recoveries of birds originating from different countries (Tab. 4) changes significantly during the

Tab. 4: Countries of origin of Song Thrushes ringed abroad and recovered in winter in Italy: a) November 17 – December 31 ($n = 123$); b) January 1 – February 14 ($n = 173$). Data referred as percentage; national abbreviations as in Tab. 1.

Tab. 4: Ursprungsländer von im Ausland beringten und in Italien im Winter wiedergefundenen Singdrosseln: a) 17. November – 31. Dezember ($n = 123$); b) 1. Januar – 14. Februar ($n = 173$). Die Daten wurden prozentual von der Gesamtzahl angegeben; Länderabkürzungen wie in Tab. 1.

	CH	CS	D	DK	F	USSR	H	PL	S	SF	YU	Others
nov. 17/dec. 31	4.9	2.4	1.6	10.6	8.1	8.1	10.6	15.5	9.7	15.5	6.5	6.5
jan. 1/feb. 14	8.1	8.1	11.0	4.6	6.9	8.1	19.1	8.1	3.5	11.6	2.3	8.6

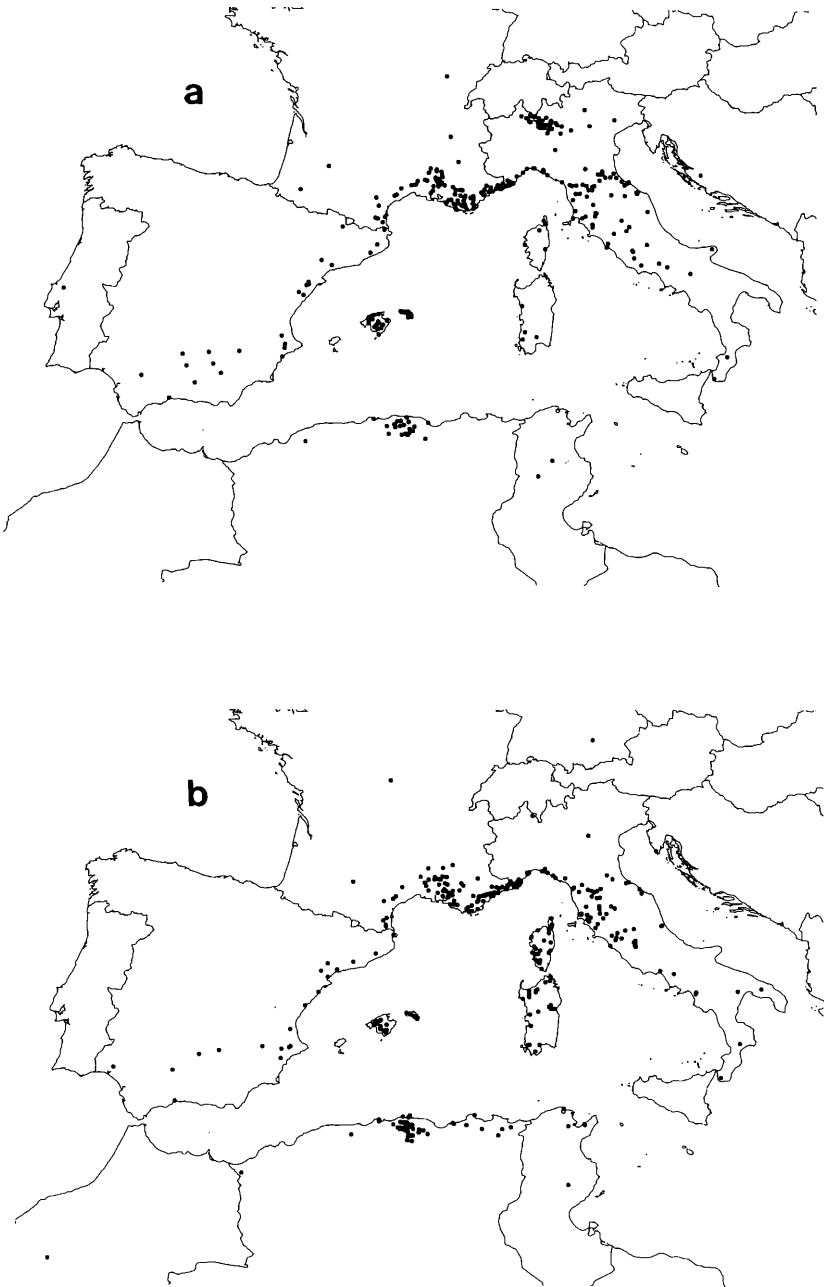


Fig. 14: Distribution of winter recoveries of birds ringed in Italy: a) November 17 – December 31 (n = 321); b) January 1 – February 14 (n = 355).

Abb. 14: Verteilung der Winterfunde von in Italien beringten Vögeln: a) 17. November – 31. Dezember (n = 321); b) 1. Januar – 14. Februar (n = 355).

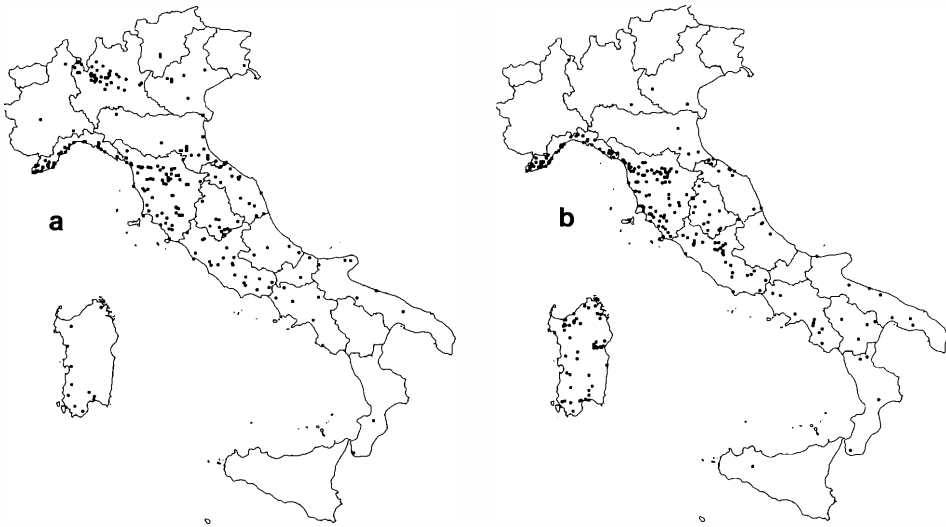


Fig. 15: Distribution of winter recoveries of birds ringed in Italy and abroad: a) November 17 – December 31 (n = 263); b) January 1 – February 14 (n = 291).

Abb. 15: Verteilung der Winterfunde von den in Italien und im Ausland beringten Vögeln: a) 17. November – 31. Dezember (n = 263); b) 1. Januar – 14. Februar (n = 291).

winter ($\chi^2 = 32.98$, $df = 10$, $p < 0.01$). In particular, between January 1 – February 14, when a general increase in foreign recoveries is observed, higher numbers of data referred to birds ringed in Germany, the Czech and Slovak Republics and Hungary are recorded, along with a decrease of those from Sweden, Denmark and Poland.

4. Discussion

4.1. Origin

The high number of Italian recoveries originating from birds ringed in the Baltic area in autumn suggests that Italy is likely to be reached by birds breeding further north and east from this ringing region, than indicated by recoveries of thrushes ringed at the nest. This seems a convincing hypothesis, already suggested by ASHMOLE (1962), also when considering the very low ringing effort from vast areas of the former USSR during the breeding season, as to virtually cancel any probability of recoveries in Italy.

4.2. Phenology

The overall picture originating from the phenological analysis at the national level is the result of patterns which can also be clearly different among regions (as a possible consequence of the differential passage of distinct geographical populations). Hence, a general analysis of the seasonal distribution of recoveries which would leave out of consideration different local situations might be misleading. From this respect, we object to what concluded by CLAESSENS (1988b) on the starting dates of pre-nuptial migration in France, as these seem to disagree with the data the Author reports from the single French regions.

When comparing seasonal recovery patterns in different regions, in particular Liguria and Lombardia, we can suggest different routes being followed by Song Thrushes in spring than in autumn (loop migration, BERTHOLD 1993).

In Italy the progressive temporal shifting of the periods of migration related to latitude could be explained by the relatively low migration speed reported for short-distance migrants (ALERSTAM & LINDSTRÖM 1990) like the Song Thrush (CURRY-LINDAHL 1977). The slow movements of the fronts of migration would therefore explain why northern regions – like Liguria – are reached earlier during the post-nuptial migration and later during the pre-nuptial migration respectively, when compared to southern regions – like Sardegna.

The phenology of foreign recoveries in Lombardia during autumn migration appears remarkably different from the seasonal pattern of catches reported from the ringing stations. The delay observed in the peak of recoveries in comparison with the peak of migrant thrushes netted in the ringing stations (DUSE & TOSCHI 1930, BASSINI 1964, MICALI & MASSA 1983, SCHUBERT et al. 1986) could be explained assuming an earlier passage of unringed thrushes originating from northern and eastern areas where ringing activity is not intensively carried on. This hypothesis fits with what observed on the origin of birds migrating through and wintering in Italy (see 4.1.) and could also explain the lower number of recoveries in Italy during March and the first half of April, when pre-nuptial migration has not yet ended (PETTERSSON et al. 1990, SCEBBA 1993, SPINA et al. 1993). In fact, Song Thrushes nesting in areas with unfavourable climatic conditions leave their breeding quarters earlier and stay on the wintering grounds longer (SCHÜZ et al. 1971, OLIOSO 1989, 1995), starting their northward migration later. Yet, since shooting represents the most important source of recoveries, the lower number of spring recoveries could also be due to the earlier end of the hunting season introduced in the 70ies.

4.3. Main migratory routes

In order to properly evaluate the results of this analysis, it should be considered that the Alps are likely to represent an important obstacle for thrushes migrating towards Italy, significantly affecting their routes. In fact, the rugged and complex morphology of this mountain range, acting as an important ecological barrier (BRUDERER & JENNI 1988), would cut off Italy from the flyways followed by those birds which might tend to avoid the barrier crossing.

Recoveries of Italian ringed birds can help describing the movements of only a (minor?) fraction of the Song Thrushes reaching Italy on autumn migration, and which are passing through a fairly limited area of the Pre-Alps of Lombardia. While moving south, these birds follow two main routes (Fig. 16), a minor one along the Tyrrhenian coasts, used by birds heading to Toscana and Lazio, from where they do not move further south, while larger numbers funnel along the coasts of Mediterranean France through Piemonte and western Liguria, to reach Spain and hence the Balearics and Algeria to winter. The particular seasonal distribution of recoveries in different western Mediterranean areas (Fig. 13) confirms northward return movements along different routes than those followed to the south, as already suggested when discussing the phenology of recoveries in Italy (see 4.2.). These supposed pre-nuptial flyways would lead thrushes from Algeria to Liguria and the Mediterranean coast of France via Sardegna and Corsica. Despite the small number of recoveries from Piemonte, the almost absolute lack of recoveries in this region after January 31 strongly suggests that birds ringed in autumn in the focal Italian EURING areas avoid the barrier represented by the Alps by flying in spring towards the coasts of France, rather than along the Pre-Alps and the Po plains. This hypothesis is supported also by the seasonal distribution of foreign recoveries in Lombardia (see 3.2., Fig. 8a), and by observing that over 90% of the recoveries in Liguria between January 1 – April 30 are concentrated in the western part, close to the French border (EURING area IA24). This strategy is also confirmed by the lower number of recoveries reported from the Balearics in spring than in autumn (SANTOS MARTÍNEZ 1982). Such loop migration might

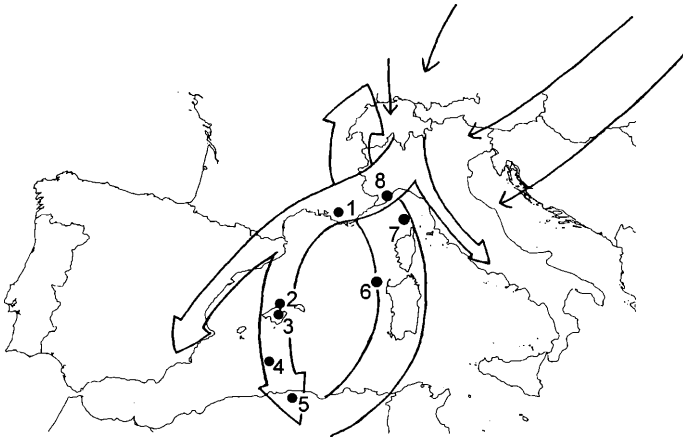


Fig. 16: General overview of the routes followed by Song Thrushes migrating through Italy.
Abb. 16: Allgemeiner Überblick über die Routen, auf denen Singdrosseln durch Italien wandern.

be not adopted by those birds which winter along the French coasts, and therefore need not crossing the Mediterranean.

A fraction of birds start their return movements already in January, when others are still moving south towards Algeria (Fig. 13). This finding is confirmed when examining the variations in the distribution of recoveries during the winter (see 4.4., Fig. 14). The relatively long pre-nuptial migration, spanning from January till April, is likely to be related to an earlier start of the breeding season for birds living in milder climates than those which find suitable breeding conditions only in late spring, and therefore stay longer in their wintering quarters (SCHÜZ et al. 1971, OLIOSO 1989, 1995).

The early northward movements recorded in January confirm observations by OLIOSO (1995) in Provence, supporting his criticism on the analysis by RICCI et al. (1995) from the same area.

4.4. Wintering

By the comparison of Fig. 14a and Fig. 14b we can observe the existence of winter movements along the Mediterranean coasts which are in accordance with the already proposed 'loop migration' strategy (BERTHOLD 1993). Moreover, the simultaneous increase in the recoveries from Algeria and Sardegna-Corsica suggests how some birds may reach north Africa only in late winter, when the return migration has started already. The existence of diffuse winter movements and the very early start of pre-nuptial migration are also confirmed by the variation, on a seasonal basis, of the relative importance of recoveries of birds originating from different countries (Tab. 4).

Between January to mid-February (Fig. 14b), the first recoveries reported from the eastern coasts of Algeria indicate movements of birds from the Grande Kabylie area towards Tunisia, suggesting that thrushes which have been wintering in Algeria leave the coasts of north Africa towards Sardegna from an area which allows them to minimise the stretch of sea to overfly.

In Italy the many recoveries from mid-November to December in the northern regions (Fig. 15a) could be related rather to the presence of many active ringing stations than to wintering areas of particular relevance, given the increasing probability of finding ringed birds in the vicinity of ringing sites. This hypothesis is confirmed both by the decrease of recoveries observed from Ja-

nuary – ringing activities generally decreasing from late autumn – (Fig. 15b), and by the results obtained by local winter atlas projects (RIGHINI 1992, CUCCO et al. 1996). On the contrary, the low number of recoveries reported from regions which are well known important wintering areas for the Song Thrush, and where the species is under heavy hunting pressure (like Puglia, DI CARLO 1965, 1966) could be explained by geographical populations which are not adequately ringed.

5. Closing Remarks

Although bird ringing still represents the best way of describing migratory movements, the interpretation of results obtained through recovery data analyses may be complicated by the distribution of recoveries as being correlated not only to the number of birds staging or wintering in a given area, but also by other factors of anthropogenic origin (PERDECK 1977). For a species like the Song Thrush one could expect the probability of obtaining recoveries in Italy as being strongly correlated to hunting pressure (CLAESSENS 1988b). As observed in 4.2., the progressively earlier end of the hunting season introduced in the 70ies could have made the actual pattern of pre-nuptial migration not so evident. Nonetheless, the observed differences among regions in the density and temporal distribution of recoveries of foreign ringed birds (see 3.2., Fig. 8a–f) cannot be fully explained by higher local levels of hunting pressure for the following reasons:

1. songbird hunting is largely diffused in most of the regions of northern Italy (TOSCHI 1933, MASSA & BOTTONI 1989), but an important concentration of Song Thrush recoveries is observed in Lombardia and Liguria only;

2. while few recoveries refer to regions with high numbers of hunters, like Sicilia and Campania (CAPPUCCIO 1990), a remarkable amount of data originate from Sardegna, an area characterised by a lower hunting pressure;

3. before the law n. 157 was enforced in 1992, Italian hunters could freely move across the national territory; by tradition, many hunters used to hunt also outside their home regions (CAPPUCCIO 1990);

4. the seasonal pattern of recoveries is extremely variable among regions, despite a significant uniformity in the hunting seasons as indicated by the different regional legislations;

5. although high concentrations of migrating and wintering thrushes are recorded in southern regions like Puglia (DI CARLO 1965, 1966, SPAGNESI 1973), Campania (SCEBBA 1993) and Sicilia (IAPICHINO & MASSA 1989, LO VALVO et al. 1994), all areas with a well known high hunting pressure on songbirds (DI CARLO 1965, TORNABUONI 1966), progressively less Song Thrush recoveries are observed while moving south across Italy;

6. when comparing the geographical distribution of Song Thrush recoveries with that of Starling *Sturnus vulgaris* (ANDREOTTI et al. 1997), the latter shows a strong concentration in Emilia-Romagna, where only scanty records are available of the former species, despite both birds being potentially exposed to a similar hunting pressure. This finding also reassures on a potentially minor risk of inter-regional difference in reporting rates.

The observed concentration of over 70% of foreign recoveries in the westernmost regions (Lombardia, Liguria, Toscana, Lazio and Sardegna) can be better explained by assuming the passage of birds of different geographical origin across Italy. Song Thrushes passing through Lombardia and the regions along the coasts of the central and northern Tyrrhenian produce quite many recoveries since they come from areas where an intense ringing activity is devoted to this species; on the contrary, the birds migrating along the Italian Adriatic coasts and the southern regions could originate from areas where only minor ringing activities are carried on. This hypothesis seems to be confirmed by the general north east-south west autumn route followed by the species as reported by ASHMOLE (1962), and given also the low number of birds ringed in the Balkans and Black Sea regions (Tab. 1). We can therefore assume yet unknown migratory routes leading Song Thrushes to cross the Adriatic Sea and reach southern Italy to then move on towards Tunisia, as already obser-

ved for other species (DEJONGHE 1980, GUSTIN 1989). The almost complete lack of recoveries does not allow so far to properly describe the movements of these birds.

The results of the analysis of Song Thrush recoveries stored at the Italian Ringing Scheme show the great potential of single national data banks to understand migratory and wintering strategies over wide geographical areas, addressing the even greater possibilities offered, from this respect, by continental analyses based on the main data sets stored at the EURING Data Bank.

This paper also clearly shows that adequate samples of data on the geographical origin, routes and wintering areas of Song Thrushes migrating across Italy are only available from a limited number of regions, the rest of the country suffering from a bad lack of information. More intense ringing activity in south-eastern Italy should be further promoted in order to get an adequate knowledge at the national level. Apart from recoveries, the collection of biometrical data following standardised methods would provide in itself crucial pieces of information to try and identify the different populations migrating through Italy (GRATTAROLA et al. 1999). This is a basic prerequisite when trying to assess the hunting pressure exerted on Song Thrush populations in Italy. Nonetheless, a detailed knowledge of the origin, phenology and migratory routes of the thrushes which reach the different Italian regions would not solve the problem of estimating the size of the populations which are harvested. The main difficulties from this respect are related to the possibility for a given winter quarter to host birds of different geographical origin at a same time (JONES 1961, ASHMOLE 1962, SNOW 1986, CLAESSENS 1988b), also in relation to particular climatic conditions (CLAESSENS 1988a). Birds originating from a same locality can also show a different migratory behaviour (LACK 1944, ISENMANN & SCHIERER 1971), as shown also among different age classes (MAKSALON 1983, CLAESSENS 1988b, MURGIA et al. 1997). Additional difficulties are related to the lack of information on the yearly numbers of birds shot in Italy and in the other Mediterranean countries.

The analysis of winter recoveries indicates a tendency for the species to concentrate in relatively few areas of limited extension; even if such concentrations could be partly related to a higher local reporting rate due to anthropogenic factors, an efficient preservation of the main staging and wintering habitats is crucial for the proper conservation of the Song Thrush populations migrating through Italy.

5. Zusammenfassung

Der Zug und die Überwinterung von Singdrosseln in Italien wurde anhand der 3 518 bei der Italienischen Beringungszentrale vorliegenden Rückmeldungen (italienische Funde von im Ausland beringten Vögeln und italienische und ausländische Funde von in Italien beringten Vögeln) näher analysiert. Die Brutorte der Singdrosseln, die durch Italien wandern, befinden sich im baltischen Gebiet (Nordpolen, baltische Republiken, baltischer Teil Rußlands, Finnland), im östlichen Mitteleuropa (Südpolen, Deutschland, tschechische und slowakische Republiken, Österreich, Ungarn) und im westlichen Mitteleuropa (Schweiz, Ostfrankreich). Nach der geographischen Verteilung der Beringungsorte während des Herbstzuges von in Italien wiedergefundenen Vögeln ist zu vermuten, daß Italien von Vögeln erreicht wird, die aus Ländern kommen, wo keine Nestlings-Beringung durchgeführt wird, u. a. aus dem europäischen Mittelrußland und Nordrußland, aber wahrscheinlich auch aus Weißrußland, der Ukraine und den Balkan-Ländern.

Die Singdrosseln beginnen Ende August Italien zu erreichen; der Zug verstärkt sich während der zweiten Septemberhälfte mit einem Gipfel zwischen Ende Oktober und Anfang November. Überwinternde Vögel wurden zwischen der zweiten Novemberhälfte und Anfang Januar erfaßt, wenn bereits die ersten Rückwanderungen einsetzen. Der Heimzug dauert länger als der Wegzug und setzt sich bis Ende März fort. Das saisonale Fund-Muster ist das Resultat des Durchzugs von Singdrosseln aus verschiedenen Brutregionen mit unterschiedlicher Phänologie. Auch die nicht gleichartige Verteilung der Funde läßt verschiedene Zugrouten über Italien vermuten.

Die Funde von im Ausland zur Brutzeit und während des Herbstzuges beringten Vögeln lassen drei verschiedene Zugrouten nach Italien erkennen: eine SW-Route aus dem östlichen Mitteleuropa, eine aus den baltischen Gebieten in Richtung Alpen und eine SSE-Route aus dem westlichen Mitteleuropa. Innerhalb Italiens

folgen die Singdrosseln verschiedenen Routen. Die verfügbaren Daten ermöglichen es, die Routen von Singdrosseln, die durch einige lombardische Provinzen (Euring-Zonen IA01, IA04, IA13) ziehen, weiter zu verfolgen; diese Vögel ziehen vor allem Richtung mediterranes Frankreich, Spanien, Balearen nach Algerien. Der Heimzug verläuft über Sardinien und Korsika nach Westligurien und die Mittelmeer-Region Frankreichs, so daß die Vögel einen typischen Bogenzug durchführen. Das Fehlen von Funden ab Januar aus den italienischen Gebieten nördlich von Liguria stützt die Hypothese, daß diese Vögel auf ihrem Zug zu den Brutgebieten über Frankreich fliegen, ohne die Alpen zu überqueren. Ein kleinerer Anteil der in den gleichen Euring-Zonen beringten Singdrosseln zieht auch nach Süden Richtung Toscana, um wahrscheinlich in der zentralen tyrrhenischen Region zu überwintern. Die Daten ermöglichen es nicht, die Herbstzugroute der Vögel, die an den Untersuchungsgebieten östlich und südlich vorbeiziehen, näher zu beschreiben. Generell ließ sich jedoch feststellen, daß diese Vögel eher in Richtung Mittelitalien als nach Frankreich, Spanien oder den Balearen ziehen.

Die Winterfunde weisen auch auf Wanderbewegungen der Drosseln während der Wintermonate hin; klarer nordwärts gerichteter Rückzug von Nordafrika über Sardinien und Korsika ist bereits ab Januar erkennbar, wenn andere Vögel noch nach Algerien ziehen. Die hauptsächlichsten Überwinterungsorte der in Italien beringten Vögel befinden sich in ziemlich begrenzten Regionen von Frankreich (Mittelmeer), den Balearen und Algerien. Winterfunde in Italien verdichten sich vor allem in den nord- und mittelttyrrhenischen Gebieten.

Die Ergebnisse dieser Studie zeigen den Wert der in einer einzigen nationalen Beringungszentrale verfügbaren Beringungs- und Funddaten für die Analyse artspezifischer Zugstrategien über ausgedehnte geographische Räume hinweg trotz der anthropogen bedingten Probleme hinsichtlich der Raum/Zeit-Verteilung der Daten. Die bessere Kenntnis der Flyways, denen Singdrosseln verschiedener geographischer Herkunft folgen, ist Voraussetzung für ein adäquates Management für diese Art, die in der Mittelmeer-Region noch stark bejagt wird. Die Notwendigkeit für eine angemessene Schutzstrategie im Hinblick auf die wichtigsten – sehr begrenzten – Überwinterungsgebiete wird ebenfalls angesprochen.

6. References

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