The Melodious Warbler (*Hippolais polyglotta*) at a constant-effort site in northwestern Italy: phenology, biometry, productivity and survival rate

Giovanni Boano[1,2*], Gloria Ramello[2], Silvio Varagnolo[2,3], Irene Pellegrino[2,4]

Abstract - Capture-mark-recapture data for the Melodious Warbler (*Hippolais polyglotta*) were collected at a ringing station in northwestern Italy (Villalvernia, AL). A sample of 697 individuals (456 adults and 241 juveniles) was ringed and then partially recaptured in the following years, providing 868 capture events from 2007 to 2019.

We analyzed phenology, capture trend, sex and age ratios, biometry, productivity, and survival rate.

Survival and recapture probabilities were estimated with the program MARK and compared to other data on warblers' survival. The recapture probabilities were relatively high (0.22, se=0.05) up to 2014, then dropped to a lower level due to changes in the ringing protocol. The survival rate was estimated to be the same between the sexes and constant in the study period (0.52, se=0.06).

Contrary to what was expected for a migratory bird wintering in W-Africa, the survival rate was apparently not influenced by rainfall fluctuations in the Sahel region and was similar to the values obtained by other research from the northern (Burgundy, France) and eastern (northeastern Italy) boundaries of the species' breeding range and in different habitats and years.

Key words: Acrocephalidae, ringing, biology, mortality, Piedmont.

Riassunto - Dati di cattura, marcatura e ricattura di Canapino comune (*Hippolais polyglotta*) sono stati raccolti per diversi anni presso una stazione di inanellamento dell'Italia nord occidentale (Villalvernia, AL). In questo lavoro abbiamo analizzato la fenologia, l'andamento delle catture, i rapporti tra sessi ed età, la biometria, la produttività e il tasso di sopravvivenza sulla base di un campione di 697 individui (456 adulti e 241 giovani) inanellati e delle successive ricatture, per un totale di 868 eventi di cattura dal 2007 al 2019. Le probabilità di sopravvivenza e ricattura sono state stimate con il programma MARK e confrontate con altri dati sulla sopravvivenza di altri Silvidi. La probabilità di ricattura è risultata relativamente elevata (0,22, se=0,05) fino al 2014, poi è scesa a un livello inferiore a causa di cambiamenti nel protocollo di inanellamento. Il tasso di sopravvivenza è stato stimato uguale tra i sessi e costante nel periodo di studio (0,52, se=0,06). Contrariamente a quanto ci si attendeva per un uccello migratore che sverna nell'Africa occidentale, il tasso di sopravvivenza non sembra essere influenzato dalle fluttuazioni delle precipitazioni nella regione del Sahel ed è simile ai valori ottenuti in altre ricerche condotte ai confini settentrionali (Borgogna, Francia) e orientali (Italia nord-orientale) dell'areale di riproduzione della specie e in habitat e anni diversi.

Parole chiave: Acrocephalidae, inanellamento, biologia, mortalità, Piemonte.

[1]Museo Civico di Storia Naturale, Carmagnola (TO), Italy.
[2]Gruppo Piemontese Studi Ornitologici, Museo Civico di Storia Naturale, Carmagnola (TO), Italy.
[3]Museo Civico di Storia Naturale, Stazzano (AL), Italy.
[4]Department for Sustainable Development and Ecological Transition, University of Piemonte Orientale, Vercelli, Italy.

* Corresponding author: g.boano@gmail.com

Received for publication: 14 May 2025
Accepted for publication: 24 June 2025
Online publication: 10 December 2025

INTRODUCTION

The Melodious Warbler (*Hippolais polyglotta*) is a small long-distance migratory bird, breeding from plain to lower montane areas in northern and central regions of the Italian Peninsula. The total Italian population has been roughly estimated at 100,000-250,000 pairs in the mid-2000s (Brichetti & Fracasso, 2020), and is categorized as Least Concern, with the trend of the Italian population being stable according to Gustin *et al.* (2021).

In Piedmont and Aosta Valley, the breeding population has been estimated at 15,000-30,000 pairs (Boano & Pulcher, 2003) or "thousands" of pairs with a stable population in the decade 2010-2019 (Boano *et al*., 2023).

Post-breeding movements occur from July to mid-October, and the species' winter range is in the western part of the Sahel region (Cramp, 1992). Thorup *et al*. (2019) have classified this species as an "itinerant migratory bird"; indeed, it makes movements from one wintering site to another. In contrast, other studied species, like Pied Flycatcher (*Ficedula hypoleuca*) and Redstart (*Phoenicurus phoenicurus*), were found to be more site-persistent. Migrants during pre-nuptial movements are rarely recorded in southern Italian regions and Mediterranean Islands, but are much more frequently seen in the northern and central Italian regions (Brichetti & Fracasso, 2020).

In our study area, the Melodious Warbler is breeding, and the population that has been monitored from 1990 by bird ringing shows a relatively stable population until 2007 (Silvano & Boano, 2008).

This work aims to estimate phenology, sex and age ratios, biometry, juveniles/adults ratio (as an index of productivity), and especially the survival rates of the Melodious Warbler's population breeding in the protected area located along the Scrivia River (Piedmont, northwest Italy), and assess potential relationships with weather conditions at both breeding and wintering sites. Furthermore, we compare our results with the survival rates obtained at different localities and times.

MATERIALS AND METHODS

Study area

The study area is situated in the northwestern Italy along the Scrivia river in the territory of Cassano Spinola (Province of Alessandria), and it is included in the Natura 2000 as a Special Area of Conservation (SAC, Directive 92/43/EEC) and Special Protection Area (SPA, Directive 79/409/EEC) SIC "IT1180004 Greto dello Scrivia" (44°47'N - 8°51'E; 100-110 m a.s.l.). The area is located on the northern margin of the Mediterranean climate zone and experiences one of the driest climates in northwestern Italy, with an average annual rainfall of 600 mm, a mean temperature of 12.7°C, and a considerable water deficit in July and August (Perosino & Rosso, 1986). During the years of the study, rainfall averaged 128.5 mm (range 52-264 mm) in the period from April to July.

The main habitat consists of a large riverbed, wider than 1 km in some places. Riparian vegetation near the river is mainly composed of poplars and willows (*Populus nigra*, *Salix* sp.); the dried-up river bed is colonized by dry meadows with aromatic plants (*Thymus vulgaris*, *Satureja* sp., *Origanum* sp), thorn shrubby vegetation (*Crataegus monogyna*, *Cornus sanguinea*, *Rosa* spp.*)*, scattered trees, and woodlots of Black poplars (*Populus nigra*), Oaks (*Quercus robur*), and Black Alder (*Alnus glutinosa),* with abundant dead and dying wood on a well-drained soil.

Field protocol

Birds were captured with 25-30 mist-nets scattered in the suitable bushy habitat covering about 10 ha (Fig. 1) as a part of a monitoring program started in 1990, and, from 1996, consisting of a constant effort of 12 24-hour capture sessions from dusk to the following evening during May-August up to 2014. Then, additional capture sessions were held, one per month, in March-April and September-November. From 2015 onward, the station adopted 6-hour capture sessions (from 6 a.m. to 12 a.m.) once per decade according to the national "Annual MonITRIng Protocol – Code 100" by ISPRA (months January-December). Meanwhile, the number of nets has been slightly reduced because of changes in the habitat due to river floods.

All the Melodious Warblers trapped were ringed only from 2007, when Fabrizio Silvano, the station's main ringer, obtained the ISPRA permit "A", allowing the ringing of all the species; before that year, only the number of mist-netted capture events was considered for this species, and those data are not considered here.

Each captured bird was measured and aged according to Svensson (1992) using Euring Code 3 for the first calendar year and the Euring Code 4 for the adults. Breeding adults were sexed by examination of the brood patch and the cloacal protuberance.

Analytical methods

Each captured bird was ringed with a metal ring, aged and sexed, and then the maximum wing chord, third primary, tarsus, weight, and fat index were recorded for each bird. We analyzed the biometry of the different age/sex classes, calculating wing length, 8th primary length, and mass averages (se; min-max) for the different age and sex groups. Moreover, we examined the ratio of juvenile birds to adults during the breeding period, from 2007 to 2019, as an index of productivity (p) of our study population. For this scope, we excluded the unsexed adult caught in May and never recaptured (considered here probably transient birds).

Adult survival rate was estimated through analysis with the program MARK (White & Burnham, 1999), selecting the May through July capture-mark-recaptures (CMR) data of adult birds.

Model assumptions of the method are i) every animal, whether marked or not, has the same probability of being caught on one particular occasion (no trap response, no age

Fig. 1 – *Mist-net* transects (white lines from 1 to 26) displaced in the survey area. Reproduced from: ©Google Earth, image © 2024 Maxar Technologies, June 2021. / Reti nebbia (indicate con i numeri 1-26) disposte nell'area di studio. Riprodotto da: ©Google Earth, image © 2024 Maxar Technologies, Giugno 2021.

variation); ii) every marked animal has the same probability of surviving between two sampling occasions (no age variation, no heterogeneity); iii) marked animals do not lose their marks; iv) all samples are instantaneous (Clobert & Lebreton, 1991).

The survival rate and the recapture probability for each sex were calculated using the program MARK on adult birds recaptured once a year during the breeding period from May to July.

MARK estimated the annual survival $\Phi(t)$ and the recapture probability $p(t)$, which was the probability that an individual, already marked at time t, was detected at time t+1.

The result is the apparent survival probability, i.e., the product of true survival and site-fidelity probabilities, since we cannot discriminate between true mortality and permanent emigration from the study site (Boano & Silvano, 2015).

A common problem with MARK is the inclusion of migrating birds, "transient" in the capture site, which are not present in subsequent years in the area, instead of the resident birds that have a greater probability of recapture.

The recapture probability, the probability that a previously marked animal will be captured during a session, was calculated along the study period and for both sexes.

We started to model capture probabilities also considering the effect of potentially lower capture effort after 2015, due to changes in the capture schedule after the introduction of the MonITRIng protocol (ISPRA Prot. 45511/T-C10 del 16/07/18). To do this, we tested models with time-dependent capture probabilities.

For the local climate data, we considered data from the Meteorological Station of Novi Ligure (AL) located about 7 km west of the ringing station (https://www.arpa. piemonte.it/rischi_naturali/snippets_arpa_graphs/). We use the amount of rain in June, because the breeding activity of the Melodious Warbler in Northern Italy is concentrated in this month, with egg deposition from mid-May to the first of July and incubation of 12-13 days (Pazzuconi, 1997). We expected a lower productivity in very wet seasons.

To test the relationship between the survival rate and the weather conditions of the wintering area, we included the Sahel rainfall index by the Joint Institute for the Study of the Atmosphere and Ocean, University of Washington, Seattle, USA (http://research.jisao.washington.edu/data/sahel/#analyses) in the survival model. The Sahel rainy season is centered on June through October, and the yearly Sahel Rainfall index is calculated each year as the mean of precipitation for those months in the area localized between 10-20°N and 20°W-10°E. We expected lower survival probabilities after the dry season (Boano *et al*. 2004). The goodness-of-fit test was assessed with the program U-CARE software (Choquet *et. al.*, 2009).

RESULTS

From 2007 to 2019, we collected data from 697 individuals, including 456 adults (Euring Code 4) and 241 juveniles (Euring Code 3). They all were ringed, and some were recaptured one or more times in different months and years, resulting in a total of 868 capture events.

First annual captures were obtained between the end of April and the beginning of May (28/04/2012; 03/05/2011; 04/05/2009 and 2010). Juveniles started to be captured at the end of June or in the first days of July (24/06/2014; 01-02/07/2014; 03/07/2012), and the latest captures were always in the second week of September (11/09/2015; 10/09/2019; 09/09/2014). The bulk of captures were in May for unsexed adults, May and July for males, June-July for females, and July-August for juveniles (Tab. 1).

The sex ratio of captured adults resulted to be 2.62 males for each female (28% female on the total adult male + female), varying during the season from 12 % in May, to 32% in June and 38% in July, "probably according to migration (females arriving later in May) and to lower degrees of mobility during incubation (June)". Unsexed adults were most common in May (60% of total captures of unsexed adults), probably due to being transient individuals with undeveloped (or not well-developed) gonads. Juveniles were the commonest category in July (52% of total captures), especially in August (87% of total), and the unique category of the few birds ringed in September.

Brood patch was evident in 107 females, starting from 24 May, with a plateau from the second decade of June to the first of July, followed by a few cases in August (the very last 20/08) (Fig. 2).

The annual number of captures (Fig. 3) varied between years, with two main evident peaks, the first in 2008 and 2009, and the second in 2014, with minima in 2010 and from 2015, obviously in relation to a shorter ringing effort after the protocol change.

Male Melodious Warblers exhibit longer wing and P8 measurements than females; however, considerable overlap in these metrics between sexes (Tab. 2 and Fig. 4) necessitates reliance on gonadal examination for accurate sex determination.

Excluding the unsexed birds captured before June, we obtain an average productivity of 0.53 (se=0.068), with higher values in 2008 and 2013 (Tab. 3). The productivity does not appear to be influenced by the local rainfall in June r_s=-0.258, p=0.394, gl=11).

Tab. 1 – Monthly number of captures for each sex and age class. / Numero di catture annuali per ogni classe di sesso ed età.

Sex/age categories	**Month**						
	April	May	June	July	August	September	Total
Juveniles			3	158	90	6	257
Adults unsexed	1	94	26	27	7		155
Adult females		18	61	45	3		127
Adult males		128	125	73	3		329
Total	1	240	215	303	103	6	868

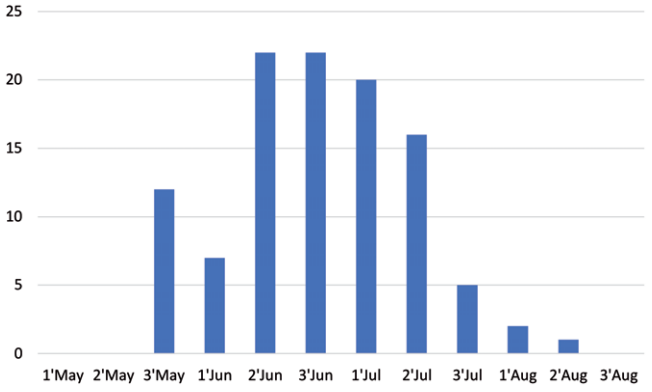

Fig. 2 – Number of females with brood patch (including classified as brood patch "in reduction") from 1 May to 30 August in ten-day intervals. / Numero di femmine con placca incubatrice (incluse quelle classificate come placca incubatrice "in via di riduzione") dal 1 maggio al 30 agosto per periodi di dieci giorni.

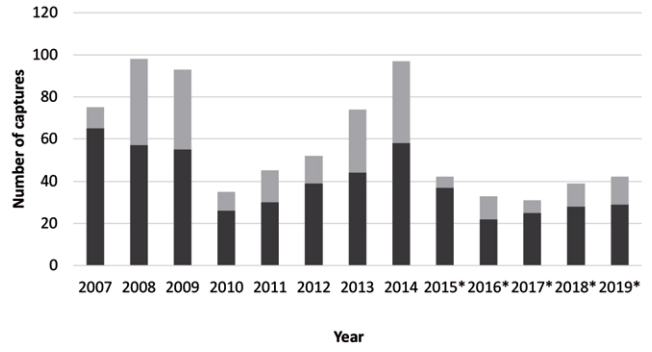

Fig. 3 – Annual total of captures (*change in ringing protocol - MonITRing); black = adults, grey = juveniles. / Totali annuali di catture (con l'asterisco sono indicati gli anni in cui si è seguito il protocollo di inanellamento MonITRing); nero = adulti; grigio = giovani.

There were only 12 (4.98%) juveniles later recaptured as adults, so the survival of juveniles could not be calculated with CMR models; only adults are considered. We also excluded the unsexed adult birds that probably were mainly transients with very low recapture rates after the first captures. For the sexed adult birds, the annual recapture probability was similar between females and males (0.22, se=0.05) in the first period (2007-2014), but very low (0.03) from 2015 onwards, after changing the ringing protocol. The apparent survival rate remained constant throughout the study period and was the same for females and males (Phi=0.52, se=0.06) (Tab. 4).

The oldest ringed individual (ring AX71385) was ringed as an adult male on 19/7/2007 and recovered on 8/5/2013, after 2120 days (5.8 years).

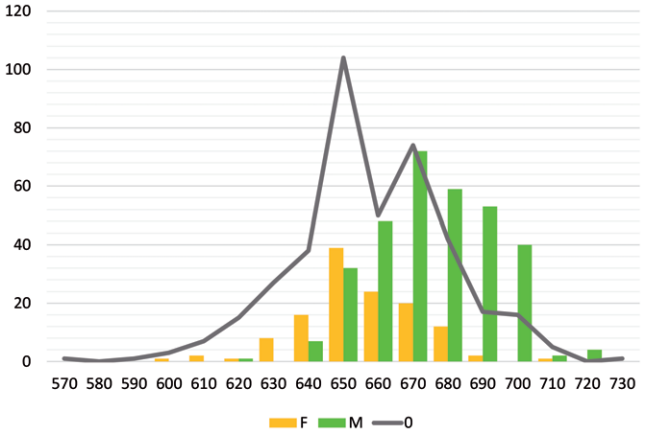

Fig. 4 – Wing length distribution in sexed and unsexed birds. / Distribuzione della lunghezza dell'ala (corda massima) in uccelli sessati e non sessati.

Tab. 2 – Number of samples and average (se; min-max) of wing length, 8th primary length, and mass of different age and sex groups. / Numero di campioni e media (se; min-max) della lunghezza dell'ala, della lunghezza dell'ottava primaria e della massa dei diversi gruppi di età e sesso.

Age	Sex	N	Wing	8th P	Mass
Juvenile	0	248	65.0 (1.99; 56.5-70.0)	49.1 (2.02; 41.0-56.0)	11.0 (0.89; 9.1-14.5)
Adult	0	153	67.1 (1.95; 60.0-73.0)	51.2 (1.75; 46.0-56.5)	11.3 (0.91; 9.6-15.8)
Adult	F	126	65.6 (1.68; 60.0-71.5)	50.1 (1.57; 45.0-57.0)	11.9 (1.46; 9.4-16.3)
Adult	M	318	67.5 (1.70; 62.0-72.0)	51.8 (1.66; 44.0-59.0)	11.1 (0.91; 9.4-16.5)

Tab. 3 – Juveniles/breeding adults ratio in the years (average=0.53; se=0.068). / Rapporto giovani/adulti negli anni.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Productivity	0.18	0.87	0.81	0.45	0.68	0.50	0.86	0.80	0.16	0.55	0.30	0.44	0.62

Tab. 4 – Survival rate estimates of Melodious Warbler in different studies with 95% confidence interval. / Stime di sopravvivenza di Canapino comune ottenute in diversi studi, con intervallo di confidenza al 95%.

Locality	Survival estimate	CI 95%	Source
Italy NW, Piemonte	0.52	0.41-0.63	This paper
Italy NE, Veneto	0.54	0.38-0.69	Pollo & Bombieri, 2000
France, Burgundy	0.50	0.39-0.62	Faivre *et al.*, 2002

NW, northwest; NE, northeast; CI, confidence interval.

DISCUSSION

In this study, we investigated the phenology, productivity, biometrics, and survival rates of the Melodious Warbler (*Hippolais polyglotta*) within a protected area in northwestern Italy (IT1180004 Greto dello Scrivia). Between 2007 and 2014, the annual number of individuals captured ranged from a minimum of 35 to a maximum of 98. From 2015 to 2019, following the nationwide standardization of the ringing protocol and a reduction in session duration, annual captures ranged between 31 and 42 individuals. These figures include both migrating and breeding birds. Captures typically begin in May (with the exception of a single earlier record) and continue through August, with a few late individuals recorded in September. The peak in juvenile captures occurs in July, coinciding with the highest number of ringed fledglings. It is important to note that the number of birds captured cannot be directly related to the specific area covered by mist nets, as individuals move for territorial establishment, foraging, and other behaviors. Therefore, deriving a reliable density estimate from these data is not feasible. Raw counts are an unreliable index of true abundance (Kendall *et al.,* 1981), and we could just note some fluctuations of the capture numbers, especially a drop from 2015 due to a decrease in capture probability after the change in ringing effort.

Breeding phenology was assessed thanks to the number of females showing an incubation patch. Our data showed that in this area, the females start breeding at the end of May, with the maximum during the second and third week of June and the first of July, with a slight delay compared to what is observed in central Spain where in the first week of July the females have the brood patch in regression (Bermejo *et al*., 2002). We found some females with brood patches in August, but the cases could be attributed to some regression stage of the cloacal patch or possibly replacement broods.

The average estimated productivity was estimated according to the ratio between juveniles and breeding adults at 0.53, with a minimum of 0.16 (2015) and a maximum of 0.87 (2008), and seems higher than that found in Spain, where the productivity is near 0.3 juveniles for adult captured (range: 0.2-0.4) (Bermejo *et al*., 2002)

Consistent with the literature (Cramp, 1992; Bermejo *et al*., 2002), male Melodious Warblers in the study areas show longer wings and P8 than females. However, there was a substantial overlap in measurements between the sexes, limiting the reliability of biometric data for sex determination. The average body mass across different sexes and age classes ranged from 11±0.89 to 11.9±1.46 g, slightly higher than previously reported in Spain, where averages ranged from 10.2 ± 0.5 g to 10.4 ± 0.8 g (Bermejo *et al*., 2002).

The survival rate of the Melodious Warblers found in this study was 0.52 (confidence interval=0.41-0.63). It proved to be constant over the years and, apparently, unaffected by fluctuations in rainfall in the Sahel region, contrary to what was expected for a migratory species wintering in West Africa. The survival rate values are similar in both males and females and comparable with the values found in populations of the northern (Burgundy, France) and eastern (northeast Italy) boundaries of the species range and in different years and habitats (Pollo & Bombieri, 2000; Faivre *et al.,* 2022). Our results are in contrast with numerous studies on other passerine and non-passerine trans-saharan migrants that generally show great variation of survival in dependence on the Sahel rainfall (e.g., Boano *et al.* 2004; Salewski *et al*., 2013; Halupka *et al*., 2017; Boano *et al*. 2020).

CONCLUSIONS

Contrary to expectations for a migratory species wintering in western Africa, the survival rate of the Melodious Warbler remained constant across years, sexes, and breeding sites, showing no apparent influence from rainfall fluctuations in the Sahel region, as shown by these results and previous studies of other breeding populations. Moreover, the last data on the range and populations of this species show a positive trend (Keller *et al.*, 2020). This stability may be explained by the species' behavior in wintering quarters. As Thorup *et al.* (2019) observed, the Melodious Warbler exhibits at least some degree of itinerancy during winter, which likely helps buffer the negative effects of adverse weather conditions. Further studies on longer data sets could confirm the high adaptability and resilience of this species.

ACKNOWLEDGMENTS

This paper is written in memory of Fabrizio Silvano, founder of the ringing station of the Scrivia River and main ringer until 2020, and of Claudio Oddone, one of his better friends and helpers during many years of field work. We would also like to thank Piero Bravin, Alessandra Calcagno, Walter Bagnasco, Lorenza Roncali, and all other station staff members who helped us during the fieldwork. Thanks to Horwat Kelsey for English revision.

REFERENCES

Bermejo A., De la Puente J. & Pinilla J., 2002 – Fenología, biometría y parámetros demográficos del Zarcero Común (*Hippolais polyglotta*) en España central. *Ardeola*, 49: 75-86.

Boano G., Bonardi A. & Silvano F., 2004 – Nightingale *Luscinia megarhynchos* survival rates in relation to Sahel rainfall. *Avocetta*, 28:77-85.

Boano G., Pavia M., Alessandria G. & Mingozzi T., 2023 – An Operational Checklist of the Birds of Northwestern Italy (Piedmont and Aosta Valley). *Diversity*, 15: 550.

Boano G., Pellegrino I., Ferri M., Cucco M., Minelli F. & Åkesson S. 2020 – Climate anomalies affect annual survival rates of swifts wintering in sub-Saharan Africa. *Ecology and Evolution*, 10: 7916-7928.

Boano G. & Pulcher C., 2003 – Check-list degli uccelli di Piemonte e Val d'Aosta aggiornata al dicembre 2000. *Bollettino del Museo regionale di Scienze Naturali di Torino*, 20: 177-230.

Boano G. & Silvano F., 2015 – Adult survival probability in a recovered population of Scops Owls *Otus scops*. *Ardea*, 103: 145-153.

Brichetti P. & Fracasso G., 2020 – The birds of Italy. Volume 2. Pteroclidae-Locustellidae. *Edizioni Belvedere*, Latina.

Choquet R., Lebreton J. D. D., Gimenez O., Reboulet A. M. & Pradel R., 2009 – U-CARE: utilities for performing goodness of fit tests and manipulating Capture-Recapture data. *Ecography*, 32: 1071-1074.

Clobert J. & Lebreton J. D., 1991 – Estimation of demographic parameters in bird populations. In: Bird population studies: relevance to conservation and management. Perrins C., Lebreton J. D., Hirons G. (eds.). *Oxford University Press*, Oxford.

Cramp S., 1992 – Handbook of the birds of Europe, the Middle East

and North Africa: the birds of the Western Palearctic, Vol.VI. *Oxford University Press*, Oxford.

Faivre B., Secondi J., Frochot B. & Cézilly F., 2002 – Local survival and breeding ecology in an expanding population of Melodious Warbler *Hippolais polyglotta*. *Ardea*, 90: 293-301.

Gustin M., Nardelli R., Brichetti P., Battistoni A., Rondinini C & Teofili C., 2021 – Lista rossa IUCN degli uccelli nidificanti in Italia 2021. Roma: *Comitato Italiano IUCN e Ministero dell'Ambiente e della Tutela del Territorio e del Mare*.

Halupka L., Wierucka K., Sztwiertnia H. & Klimczuk E., 2017 – Conditions at autumn stopover sites affect survival of a migratory passerine. *Journal of Ornithology*, 158: 979-988.

Keller V., Herrando S., Voříšek P., Franch M., Kipson M., Milanesi P., Martí D., Anton M., Klvaňová A., Kalyakin M. V., Bauer H. G. & Foppen R. P. B., 2020 – European breeding bird atlas 2: distribution, abundance and change. *European Bird Census Council & Lynx Edicions*, Barcelona.

Kendall W. I. L., Sauer J. R., Nichols J. D., Pradel R. & Hines J. E., 1981 – On the use of capture – recapture models in mist-net studies. *Studies in Avian Biology*, 29: 173-181.

Pazzuconi A., 1997 – Uova e nidi degli uccelli d'Italia. *Calderini ed.*, Bologna.

Perosino G. C. & Rosso M., 1986 – Climatologia di Alessandria. *Riv. Piem. St. Nat*, 7: 21-49.

Pollo R. & Bombieri R., 2000 – Survival, phenology and philopatry of the Melodious Warbler *Hippolais polyglotta* in North eastern Italy. *Avocetta*, 24: 45-50.

Salewski V., Hochachka W. M. & Fiedler W., 2013 – Multiple weather factors affect apparent survival of European passerine birds. *PLoS One*, 8: e59110.

Silvano F. & Boano G., 2008 – Gli uccelli della Valle Scrivia ed il Centro di Inanellamento della Provincia di Alessandria. *Provincia di Alessandria.*

Svensson L., 1992 – Identification guide to European passerines. *B.T.O*, Stockholm.

Thorup K, Sørensen I. H., Willemoes M., Lerche-Jørgensen M., Fjeldså J., Tøttrup A. P., Mandrup Jacobsen E., Reeve A. H., Oteng-Appau R., Asamoah A. & Lehmberg T., 2019 – Winter site use by Afro-Palearctic migrants in Ghana: site persistence and densities of Willow Warbler, Pied Flycatcher, Melodious Warbler and Common Redstart. *Ostrich*, 90: 173-177.

White G. C. & Burnham K. P., 1999 – Program MARK: survival estimation from populations of marked animals. *Bird Study*, 46: S120-S139.