Autumn captures from Torre Flavia ringing station (Latium, central Italy) in 2001-2014

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Abstract – Ringing is an effective tool to monitor bird species. The present contribution presents some data on the autumn passage of migrants in 'Palude di Torre Flavia' natural Monument (and SPA IT6030020) collected during 2001-2014. A total of 10,630 birds, from 55 species were ringed during the 14 years of study. *Remiz pendulinus*, *Emberiza schoeniclus*, *Phylloscopus collybita*, *Erithacus rubecula* and *Acrocephalus melanopogon* produced the highest numbers followed by *Cettia cetti*, *Saxicola torquatus* and *Acrocephalus scirpaceus*. Among the species of conservation concern, Torre Flavia appears to be of particular importance for the passage of *Alcedo atthis*, *Luscinia svecica* and *Acrocephalus melanopogon*. Trends in the number of yearly captured species and individuals showed fluctuations during the 14 years of study. As far as single species are concerned, the positive trend of *Alcedo atthis* and *Cettia cetti* and the negative trend of *Saxicola torquatus* and *Passer italiae* were statistically significant.

Key-words: monitoring, long time span, dynamic fluctuations, pluri-yearly trends.

INTRODUCTION

Annual migratory passage throughout an investigated area often show marked fluctuations and date changes in seasonal peaks (Messineo *et al.* 2001, Sorace *et al.* 2006, Pedrini *et al.* 2008, Muzzatti *et al.* 2010, Leoni *et al.* 2012). Therefore, for the proper assessment of migratory movements and faunal management within a protected area, a long-term study is fundamental. From this perspective, in 2000 the Province of Rome initiated a monitoring project in order to enhance information relative to the migratory passage throughout the 'Palude di Torre Flavia' natural Monument (SAC IT6030020; central Italy) in particular to monitor yearly population trends of migrant species through the creation of a bird ringing station (Sorace *et al.* 2001, 2003, 2006). Indeed, bird ringing is an effective technique to monitor environmental and biodiversity changes and a valid tool for the conservation of bird species (Spina 1999, Berthold 2000, De Santis *et al.* 2008, Spina & Volponi 2008, La Gioia & Scebba 2009, Cuti & Canale 2014).

Some national monitoring projects such as the 'Progetto Piccole Isole' coordinated by the Institute for Environmental Protection and Research (I.S.P.R.A.) focused specifically on migrant birds. These projects provided very useful data in the investigation of sites and habitats of primary importance for the conservation of Euro-African migratory species and in obtaining original indications of migrants as indicators of environmental effects through climatic change (Spina *et al.* 1993, Spina & Pilastro 1998, Montemaggiori & Spina 2002, Rubolini *et al.* 2004, Jonzén *et al.* 2006).

Migrant species, compared to resident species, are more sensitive to environmental changes; indeed their complex yearly cycle, long migratory routes and dependence on different sites in different seasons expose them to many risks (Newton 2004). The increasing amount of information, highlights the fact that long-distance migrants arriving from Africa are declining in Europe, showing a population decline that is often more marked than in short-distance or sedentary species (Sanderson *et al.* 2006, Heldbjerg & Fox 2008, Møller *et al.* 2008, Hewson & Noble 2009, Thaxter *et al.* 2010, Van Turnhout *et al.* 2010).

This decrease is an issue of concern for both the scien-

tific and politic scenarios (e.g. www.cms.int/bodies/COP/cop10/resolutions_adopted/10_27_landbirds_e.pdf), since the populations of some European breeding species, formerly largely widespread, have halved in the last 30 years (Vickery *et al.* 2014).

The present contribution reports quantitative and qualitative aspects of autumn passage of migratory species throughout the 'Palude di Torre Flavia' natural Monument in period 2001-2014, investigated by means of bird ringing.

METHODS

Ringing activities were carried out in the 'Palude di Torre Flavia' natural Monument (41°58'N; 12°03'E; central Italy), a remnant fragment of wetland within an agricultural and urbanized matrix.

At local scale, it shows a semi-natural heterogeneity with *Phragmites australis* reed-beds, channels, flooded meadows with *Carex hirta*, *Juncus acutus* and *Cyperaceae* corresponding to *Juncetalia maritimi* habitat type according to EC "Habitat" Directive 92/43/EC, dune and backdune areas. Climate is xeric-meso-Mediterranean (Tomaselli *et al.* 1973; Blasi & Michetti 2005). The water in the wetland area is mainly of meteoric and sea storm origin and flow from surrounding areas is scarce. The ringing station was manned for 24 consecutive capture days; from 15 October to 7 November throughout the whole study period 2001-2014. Mist-nets were opened at daybreak and maintained open for a period of six hours. A total of 10 mist-nets (12 m x 2.4 m with four pockets and 16 x 16 mm mesh) placed along a 120-m transect in a *Phragmites australis* reed-bed (about 10 ha) were used.

All captured individuals were ringed with ISPRA rings and from each individual the usual morphological and morphometric measures (wing, III primary and tarsus length; weight, fat reserves; Magnani *et al.* 2000) were collected.

Statistical significance of annual trends was evaluated with non parametric Spearman test for the following parameters: species number; total number of individuals captured; number of captured individuals for each species with at least 50 birds captured during the 14 years of study. Capture was interrupted on some days due to bad climatic conditions. To avoid that the different annual number of capture days affected the yearly trends of the above reported parameters, in every study year the value of each parameter was divided by the annual number of capture days. For the analysis, in each year only the first capture of an individual (i.e., either not yet ringed or ringed in previous years) was considered in the total number of captured individuals.

As species of conservation concern, we considered those birds included in the:

1) Annex I of EC Directive 2009/147/CE on wild bird conservation;
2) Categories 1-3 of the Species of European Conservation Concern (SPEC) (BirdLife International 2004);
3) Categories of concern in Italian Red List 2011 of breeding birds (Peronace *et al.* 2012).

RESULTS

On the whole, during the 14 years of study, 10,630 individuals from 55 different species were captured (Tab. 1). The species most caught being: *Remiz pendulinus*, *Emberiza schoeniclus*, *Phylloscopus collybita*, *Erithacus rubecula* and *Acrocephalus melanopogon* (fi > 0.05) in decreasing order of abundance. *Cettia cetti*, *Saxicola torquatus* and *Acrocephalus scirpaceus* resulted subdominants (fi > 0.02).

Non passerine species were scarcely caught, except for *Alcedo atthis*, regularly captured throughout the study period (Tab. 1). Other non passerine species included: one Ardeidae (*Ixobrychus minutus*), two Falconidae (*Falco tinnunculus* and *F. columbarius*), two Rallidae (*Rallus aquaticus*, *Gallinula chloropus*), two Scolopacidae (*Gallinago gallinago*, *Calidris alpina*), one Columbidae (*Streptopelia turtur*) and one Picidae (*Jynx torquilla*).

The number of species captured annually varied between 23 and 33 while the number of individuals captured annually varied between 554 and 1117. Trends in the number of species and individuals captured annually were rather fluctuating during the 14 study years (Tab. 1 and Figs. 1-2), although the second parameter showed a stability period between 2005 and 2010 (Tab. 1 and Figs 1-2).

In general, also the number of individuals from a single species captured annually showed no define trend (see, for example, Figs. 3-6 with the trends of the ten more captured species in the 14 years of study).

Trends did not result statistically significant for the species number, total number of captured individuals and number of captured individuals of most species (Tab. 2); the only exceptions were the positive trends in the number of individuals of *Alcedo atthis* (Fig. 6) and *Cettia cetti* (Fig. 5) and negative trends of *Saxicola torquatus* (Fig. 5) and *Passer italiae* (Fig. 7)

Regarding those species of conservation concern, the trend of the three (*Alcedo atthis*, *Luscinia svecica*, *Acrocephalus melanopogon*) included in All. I of Dir.

Table 1. Number di individuals and relative frequency (fi) of each species captured in autumn (15 October-7 November) in the 14 years of study (2001-2014) at Torre Flavia ringing station. In bold, dominant species (pi > 0.05); in italic, sub-dominant species (pi > 0.02).

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	total	fi
Remiz pendulinus	262	405	161	333	119	177	93	111	117	131	194	251	115	354	2823	**0.2656**
Emberiza schoeniclus	233	224	127	180	88	101	128	110	264	40	363	138	121	164	2281	**0.2146**
Phylloscopus collybita	114	228	63	153	95	77	196	223	80	136	130	128	180	177	1980	**0.1863**
Erithacus rubecula	42	59	30	138	93	84	53	51	51	58	92	95	108	92	1046	**0.0984**
Acrocephalus melanopogon	80	30	37	39	43	37	33	26	31	56	81	26	35	64	618	**0.0581**
Cettia cetti	7	12	10	22	12	16	25	20	14	33	47	21	18	22	279	*0.0262*
Saxicola torquatus	34	33	7	25	16	10	14	11	9	17	20	11	9	7	223	*0.0210*
Acrocephalus scirpaceus	6	14	3	52	13	7	4	24	4	15	19	16	11	25	213	*0.0200*
Alcedo atthis	3	5	9	19	8	6	7	12	11	19	19	21	18	16	173	0.0163
Turdus merula	5	10	11	17	33	13	5	7	10	4	8	14	14	15	166	0.0156
Cisticola juncidis	4	6	5	19	14	9	8	1	1	5	5	1	4	7	89	0.0084
Turdus philomelos	1	2	3	7	17	18	4	6	2	3	3	5	9	9	89	0.0084
Sylvia atricapilla	3	4	1	8	10	11	2	4	2	4	7	8	10	7	81	0.0076
Carduelis chloris	13	3	8	16	1	1	1	5	6	4	11	5	5	1	80	0.0075
Passer italiae	10	31	5	4	7	4	0	2	2	0	3	1	0	2	71	0.0067
Luscinia svecica	1	14	1	5	2	0	4	0	0	9	11	5	4	5	61	0.0057
Troglodytes troglodytes	0	6	4	9	1	2	1	2	4	5	4	0	0	1	39	0.0037
Prunella modularis	0	0	0	5	0	0	0	4	11	2	9	3	0	0	34	0.0032
Motacilla alba	0	5	1	0	2	2	15	3	0	0	2	0	0	0	30	0.0028
Acrocephalus arundinaceus	4	1	0	0	2	2	4	1	0	0	0	3	4	2	23	0.0022
Passer montanus	4	1	1	2	4	0	1	3	3	0	0	1	1	0	21	0.0020
Sylvia melanocephala	2	8	2	0	0	1	1	1	0	0	2	1	1	1	20	0.0019
Regulus regulus	3	0	0	1	0	2	1	0	3	4	0	1	1	4	20	0.0019
Hirundo rustica	1	1	0	4	3	2	1	0	0	0	2	2	0	1	17	0.0016
Acrocephalus schoenobaenus	0	2	0	0	0	2	0	4	0	2	4	0	2	1	17	0.0016
Sturnus vulgaris	1	0	0	0	2	0	4	1	0	1	0	1	1	3	14	0.0013
Parus major	0	2	0	0	0	0	0	1	0	3	2	1	2	3	14	0.0013
Phoenicurus ochruros	0	0	1	3	1	0	1	2	0	1	0	1	0	1	11	0.0010
Carduelis carduelis	1	1	1	3	0	0	1	0	0	0	0	0	0	2	9	0.0008
Fringilla coelebs	0	0	0	0	0	3	1	0	2	0	1	0	2	0	9	0.0008
Emberiza calandra	2	0	2	0	0	2	0	0	0	0	0	0	1	2	9	0.0008
Anthus spinoletta	2	0	0	1	1	2	1	0	0	1	0	0	0	0	8	0.0008
Cyanistes caeruleus	0	6	0	0	0	0	0	0	0	0	0	1	0	1	8	0.0008
Motacilla cinerea	2	0	0	0	0	1	1	0	3	0	0	0	0	0	7	0.0007
Rallus aquaticus	1	0	0	0	0	1	3	0	0	0	0	0	0	1	6	0.0006
Motacilla flava	1	0	0	0	0	0	0	0	0	0	2	0	1	2	6	0.0006
Regulus ignicapilla	0	0	0	0	0	0	0	3	2	0	0	0	0	0	5	0.0005
Anthus pratensis	0	0	0	1	0	0	0	2	0	0	1	0	0	1	5	0.0005
Gallinago gallinago	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3	0.0003
Panurus biarmicus	0	0	0	0	0	0	1	0	0	0	2	0	0	0	3	0.0003
Sylvia borin	0	0	0	0	0	0	0	1	0	0	0	1	1	0	3	0.0003
Gallinula chloropus	1	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0.0002
Jynx torquilla	0	0	1	0	0	0	0	0	0	0	0	0	0	1	2	0.0002
Ixobrychus minutus	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0.0001
Calidris alpina	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0.0001
Falco columbarius	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.0001
Emberiza cirlus	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0.0001

continued

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	total	fi
Saxicola rubetra	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0.0001
Phoenicurus phoenicurus	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0.0001
Sylvia curruca	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0.0001
Phylloscopus trochilus	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0.0001
Sylvia undata	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0.0001
Locustella luscinioides	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0.0001
Falco tinnunculus	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0.0001
Streptopelia turtur	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0.0001
Number of individuals	**843**	**1117**	**495**	**1069**	**587**	**594**	**615**	**642**	**633**	**554**	**1046**	**762**	**678**	**995**	**10630**	
Number of species	**29**	**28**	**25**	**28**	**24**	**28**	**31**	**29**	**23**	**24**	**29**	**27**	**26**	**33**	**55**	

2009/147/CE is not uniform: positive for *Alcedo atthis* (Fig. 6), fundamentally positive for *Luscinia svecica* (Fig. 7) and negative for *Acrocephalus melanopogon* (Fig. 4) but, as reported above for the last two species, yearly variations were not statistically significant (Tab. 2). Moreover, for other species of conservation concern (i.e. included in Italian Red List), a statistically significant negative trend was highlighted (Tab. 2) for *Saxicola torquatus* (Fig. 5) and *Passer italiae* (Fig. 7).

DISCUSSION

Autumn migration in 'Palude di Torre Flavia' natural Monument, recorded in the period 2001-2014, was characterized by the dominance of species (e.g. *Remiz pendulinus*, *Emberiza schoeniclus*) that in October-November period resulted among the most captured, as reported for other ringing stations of similar habitat type (reed-beds) in central Italy (Gustin & Sorace 1999, 2001, Gustin *et al.* 2001, Muzzatti *et al.* 2010, Sorace *et al.* 2010).

Table 2. Results of Spearman test for trends of species number, total number of captured individuals and number of captured individuals of a single species (only the species with at least 50 birds caught in the 14 study years are reported in table). In bold, statistically significant trends ($P < 0.05$).

	Spearman rank test			
	N	**R**	**t**(N-2)	**p-level**
Number of species	14	0.015	0.053	0.958
Number of individuals	14	-0.103	-0.360	0.725
Remiz pendulinus	14	-0.262	-0.939	0.366
Emberiza schoeniclus	14	-0.196	-0.691	0.503
Phylloscopus collybita	14	0.213	0.756	0.464
Erithacus rubecula	14	0.405	1.534	0.151
Acrocephalus melanopogon	14	-0.117	-0.407	0.691
Saxicola torquatus	14	-0.680	-3.212	**0.007**
Cettia cetti	14	0.609	2.663	**0.021**
Acrocephalus scirpaceus	14	0.306	1.113	0.288
Turdus merula	14	0.000	0.000	1.000
Alcedo atthis	14	0.601	2.603	**0.023**
Luscinia svecica	14	0.236	0.842	0.416
Passer italiae	14	-0.802	-4.648	**0.001**
Carduelis chloris	14	-0.251	-0.899	0.387
Cisticola juncidis	14	-0.416	-1.586	0.139
Turdus philomelos	14	0.246	0.881	0.396
Sylvia atricapilla	14	0.343	1.266	0.230

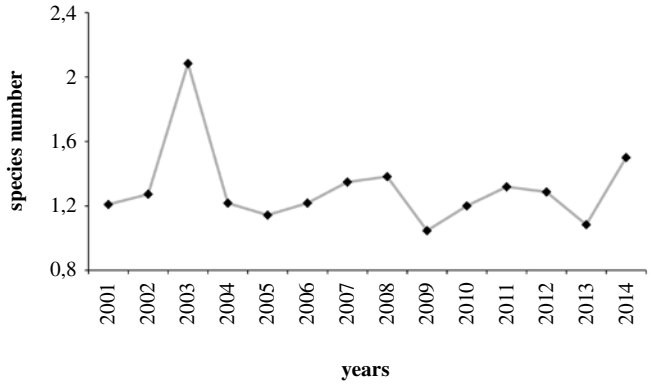

Figure 1. Trend in the number of species captured annually between 2001 and 2014. In each study year the value of the parameter was divided by the annual number of capture days.

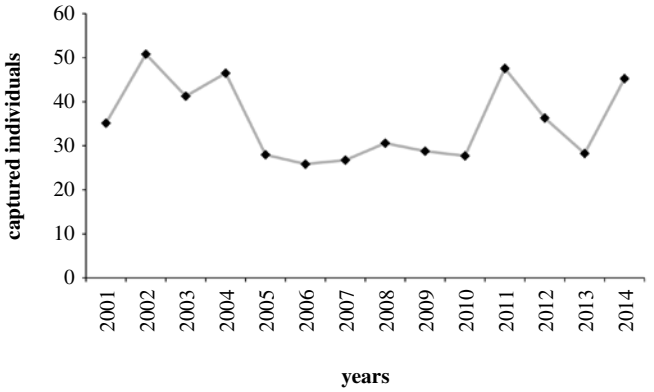

Figure 2. Trend in the number of annually captured individuals between 2001 and 2014. In each study year the value of the parameter was divided by the annual number of capture days.

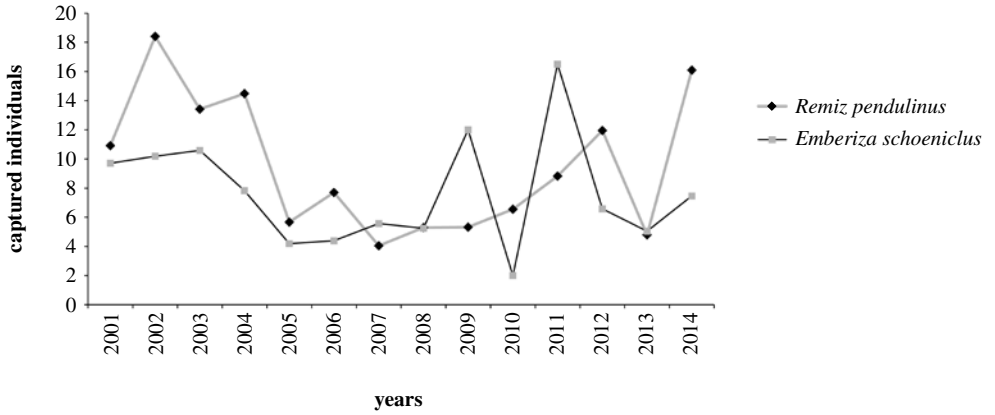

Figure 3. Trends in the number of annually captured individuals of *Remiz pendulinus* and *Emberiza schoeniclus* between 2001 and 2014. In each study year the value of the parameter was divided by the annual number of capture days.

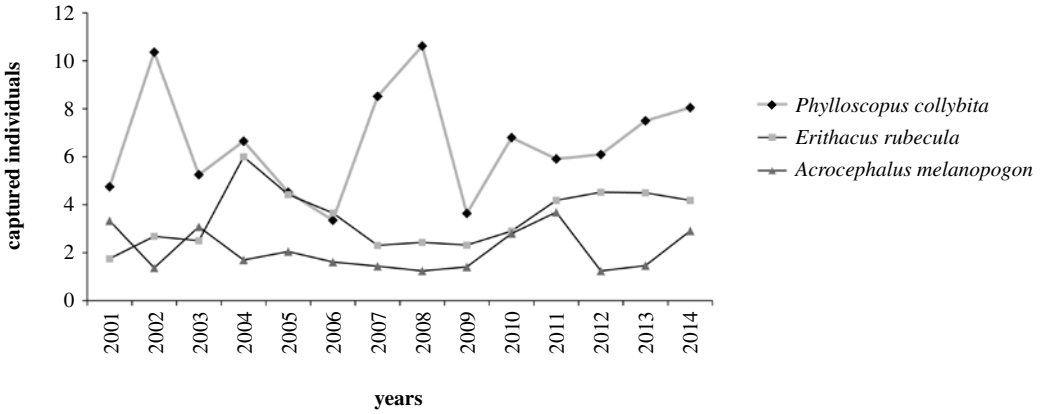

Figure 4. Trends in the number of annually captured individuals of *Acrocephalus melanopogon*, *Erithacus rubecula* and *Phylloscopus collybita* between 2001 and 2014. In each study year the value of the parameter was divided by the annual number of capture days.

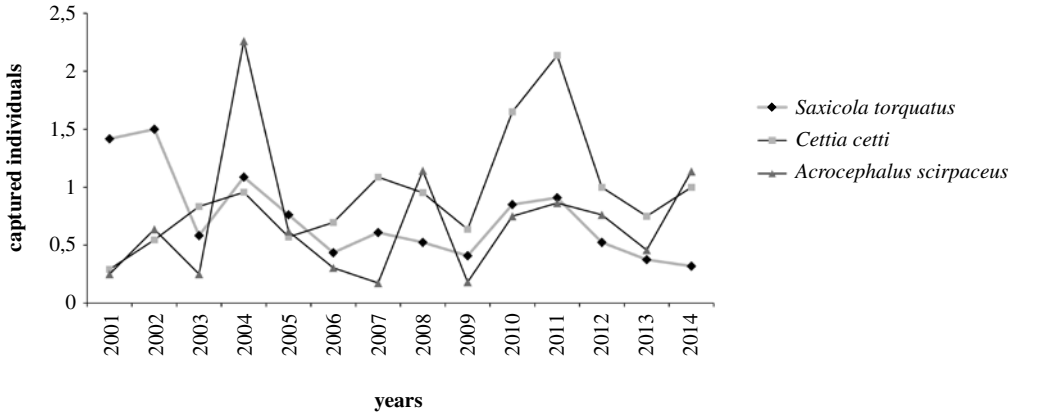

Figure 5. Trends in the number of annually captured individuals of *Cettia cetti*, *Saxicola torquatus* and *Acrocephalus scirpaceus* between 2001 and 2014. In each study year the value of the parameter was divided by the annual number of capture days.

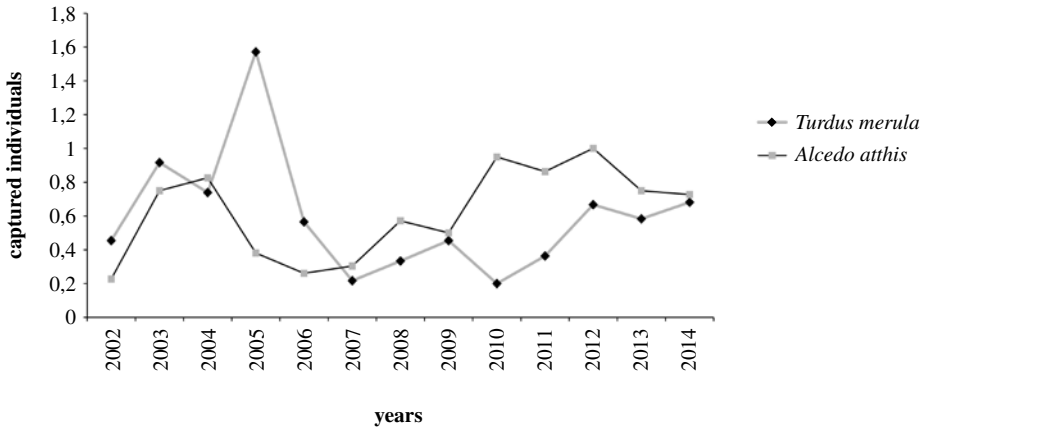

Figure 5. Trends in the number of annually captured individuals of *Cettia cetti*, *Saxicola torquatus* and *Acrocephalus scirpaceus* between 2001 and 2014. In each study year the value of the parameter was divided by the annual number of capture days.

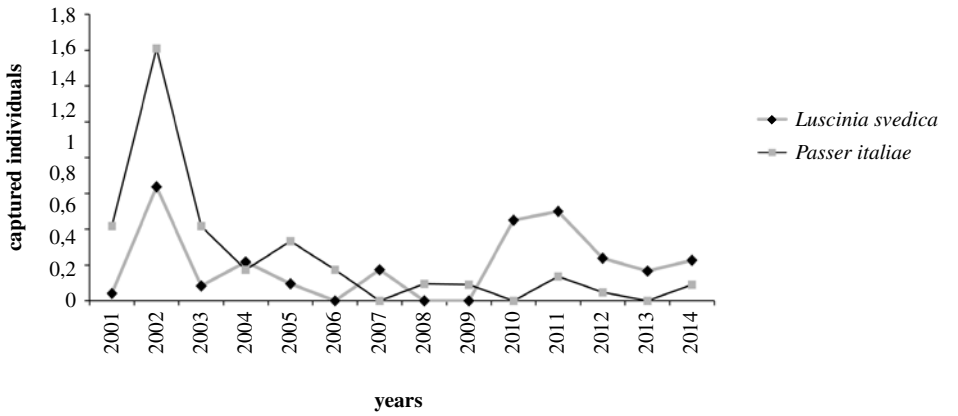

Figure 7. Trend in the number of annually captured individuals of *Passer italiae* and *Luscinia svecica*. In each study year the value of the parameter was divided by the annual number of capture days.

Among the captured species in the Torre Flavia ringing station, several are of conservation concern, and in particular three (*Alcedo atthis*, *Luscinia svecica*, *Acrocephalus melanopogon*) are included in All. I of Dir. 2009/147/CE, six (*Alcedo atthis*, *Streptopelia turtur*, *Jynx torquilla*, *Sturnus vulgaris*, *Passer montanus*, *Emberiza calandra*) in the categories SPEC 2-3 (BirdLife International 2004), 12 (*Jynx torquilla*, *Motacilla flava*, *Saxicola torquatus*, *Acrocephalus melanopogon*, *Acrocephalus schoenobaenus, Acrocephalus arundinaceus*, *Regulus regulus*, *Remiz pendulinus*, *Passer italiae*, *Passer montanus*, *Carduelis chloris*, *Emberiza schoeniclus*) in the categories of Italian Red List 2011 of breeding birds (Peronace *et al.* 2012). Among these species of concern, 'Palude di Torre Flavia' seems to be of primary importance for *Alcedo atthis*, *Luscinia svecica* and *Acrocephalus melanopogon* which are annually caught in quite conspicuous numbers.

Analysis of collected data from the 2001-2014 periods confirms (see Introduction) the marked annual variations of bird community of a coastal area, including changes of specific composition and abundance. The trends of the majority of species usually resulted as fluctuating and indefinite. Yearly trends of autumn captures resulted statistically significant only in four species: *Alcedo atthis*, *Cettia cetti*, *Saxicola torquatus* and *Passer italiae*.

To explain the results obtained for these species, local factors and/or factors acting on larger scale may be involved. As far as *Saxicola torquatus* and *Passer italiae* are concerned, results from the MITO2000 project (Rete Rurale Nazionale & LIPU 2014), elaborated at national level, indicate a moderate decline of the breeding populations of the two species in the period under study (2000-2013). Therefore, the decrease of their captures at the Torre Flavia ringing station might be attributed to negative processes for *Saxicola torquatus* and *Passer italiae* occurring on a wider scale than at a local one. Nevertheless, *Alcedo atthis*, showing an unfavourable conservation status in Europe (see above), and *Cettia cetti*, which according to the data of the MITO2000 project is decreasing in Italy (Rete Rurale Nazionale & LIPU 2014), have highlighted a positive trend in Torre Flavia area.

This suggests that the observed results might arise, at least partially, from some local environmental changes; among them, mainly the factors tied to the water level in the wetland channels, structure and extension of reed-beds and bush vegetation cover. In the first years of study, the water level was characterized by drastic oscillations (Battisti *et al.* 2004, 2005, 2006, Causarano *et al.* 2009) that did not occur in the following years, mainly because of changes in the management of the protected area (interruption of fish farming in the channels; artificial hydric provision to stabilize water level). A constant water presence might have promoted the settlement of a more stable community of prey available for *Alcedo atthis*. In addition, initially at the start of the study, reed-beds were younger and more restricted (Aglitti *et al.* 2006) and bush presence very reduced. The enlargement and ageing of reed-beds and the increase of bush area (re-vegetation with *Tamarix* sp. and *Sambucus* sp.) on their edge might have favoured *Cettia cetti* which prefers such habitat (Cramp 1992, Baker 1997, Kennerley & Pearson 2010). Moreover, the reduction of open habitats might have unfavoured *Saxicola torquatus* and *Passer italiae*. Finally, since *Cettia cetti* is a species sensitive to the rigours of winter (Cramp 1992, Brichetti & Fracasso 2010), mild winters recorded in coastal Latium in the last years might have increased its abundance in Torre Flavia area.

EC Directive 2009/147/CE on wild bird conserva-

tion emphasizes the importance of the monitoring of population levels of migratory species as shown by ringing. Therefore, long-term investigations on these species are particularly necessary. Nevertheless, the paper of Muzzatti *et al.* (2010) and the present one are the only published papers on autumn migration of passerines in Italian wetlands, based on a large set of study years. Other published works on migratory species, investigated by means of bird ringing, referred only to one or few years (e.g. Gustin & Sorace 1999, 2001, Gustin *et al.* 2001, Termine *et al.* 2008, Sorace *et al.* 2010). However, since other Italian ringing stations worked on long-term projects in several of the Italian regions (e.g., Emilia-Romagna: Giannella & Gemmato 2005; Lazio: Landucci *et al.* 2010; Piemonte and Liguria: Fasano unpublished data; Lombardia: Cecere unpublished data; Veneto: Pesente unpublished data; Friuli-Venezia Giulia: Guzzon unpublished data), we strongly recommend that this "dormant" data on the periods of migration is published.

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