

Barn Owl *Tyto alba* in Italy: Data from fauna recovery centers show a patchy decline

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Abstract - The conservation status of the Barn Owl *Tyto alba* at continental level is not favourable. A way to assess the success and effectiveness of conservation actions regarding the Strigiformes is to use data collected at recovery centers that host thousands of individuals. Individual Barn Owl's information were collected at their arrival in six recovery-centers in Italy, two in northern Italy, two in central and two in southern Italy. Data were analysed for 1.393 Barn Owls recovered from 1993 to 2016. Four different recovery reasons were used to classify the individuals: i) trauma, ii) intoxication, iii) illegal hunting, iv) other. In three of the six centers we found a significant decrease of hospitalized Barn Owls over the years, possibly because of changes in the local situations. The percentage of chicks recovered is low. Traffic death rate significantly affects young owls during their post-fledging dispersal period and at a local level, this effect could contribute significantly to the demographic collapse of the populations, contributing to a patchy decline of the species in Italy. The collision with motor vehicles proved to be the primary cause of hospitalization, but the recovery due to illegal hunting is significant too, in particular in central and southern Italy. To limit the use of anticoagulant rodenticides, turns out to be a necessary and urgent action to help this species.

Keywords: Barn Owl, Italy, recovery-centers, patchy decline

Barn Owl *Tyto alba* populations are declining across Europe (BirdLife international 2017) and the rest of the species' range (Taylor 1994, Roulin 2020). Main causes are urbanization's increase (Hindmarch et al. 2014), road kill (Borda-de-Agua et al. 2014) and secondary poisoning due to ingestion of prey contaminated with anticoagulant rodenticides (Huang et al. 2016, Kross et al. 2016). A broad and detailed analysis of the causes of death, the connections between them and the actions to be taken to reduce the im-

pact of human activities on this species is reported in Barn Owl Trust (2012).

Gustin et al. (2016) highlighted the unfavourable conservation status of Barn Owl in Italy, especially in the continental and alpine biogeographical regions; populations living in the Mediterranean bioregion show a rather poor conservation status too. Wild Fauna Recovery Centers (WRCs) host many Accipitri-formes and Strigiformes every year, offering a very good opportunity to investigate several aspects of

life, ecology and conservation status of these elusive species. Data collected by WRCs can also be used to investigate the effectiveness of conservation actions (Molina-López et al. 2011).

In our study, by analysing data collected in six Italian WRCs from 1993 to 2016, we aimed to investigate Barn Owl population trends in Italy and to assess the causes of local declines' causes. We collected data on all Barn Owl recoveries from the following WRCs managed by Lipu (BirdLife-Italy): i) "La Fagiana" (Pon-tevecchio di Magenta, Lombardy), ii) "Il giardino delle capinere" (Ferrara, Emilia-Romagna), iii) Marine and Aquatic Bird Recovery Center (CRUMA) (Livorno, Tus-cany), iv) WRC (Rome, Lazio), v) WRC (Casacalenda, Molise); vi) WRC "Bosco di Ficuzza" (Ficuzza di Corle-one, Sicily). A total of 1393 Barn Owls were recovered between 1993 and 2016 at the six WRCs.; a high numerical variation between WRCs was recorded (Tab. 1). For each Barn Owl recorded at WRCs, we classified the recovery reason by using four categories: i) trauma, ii) intoxication, iii) illegal hunting, iv) other. Under the term trauma we grouped all those cases referable

to collisions with cars or man-made construction/in-frastructure. It must be considered that, both for the type of fractures, and for the mostly rural discovery sites, almost all of the traumas were caused by road accidents. The cases classified as intoxication refer both to poisoning from products used for rodents, and other toxic substances. Due to the impossibility of carrying out toxicological analyses in all cases, the symptomatology was considered. With the term il-legal hunting, we classified the cases in which there were evident gunshot wounds (or owls with the pres-ence of hunting bullets in their radiographies). Since some fractures classified as trauma are likely the re-sult of a shooting, this cause of hospitalization is likely underestimated. With the term other we classified a wide range of different causes such as individuals fall-en into flues or entangled in barbed wire fences. We used Spearman's correlation test (R_s) and χ^2 test for statistical analyses, with a 0.05 level of significance.

To avoid biases of the collected dataset, we analysed all species' recoveries (112.644 recovered indi-viduals) at the three main WRCs for the number of

Table 1. Barn Owls admitted to six wildlife recovery centers (WRCs) in Italy, years of activity of the wildlife recovery centres, percentage of chicks and average annual number of hospitalizations.

WRCs	Region	Years of activity	N. of individuals	% chicks	Average n. individuals/year \pm S.D.
WRC "La Fagiana"	Lombardia	2000-2016	41	9.8	2.4 \pm 2.9
WRC "Il giardino delle capinere"	Emilia-Romagna	1993-2016	113	11.5	4.7 \pm 3.7
CRUMA	Toscana	2003-2010/2012-2016	217	13.8	16.7 \pm 6.0
WRC Roma	Lazio	2000-2016	258	12.0	15.2 \pm 9.6
WRC Casacalenda	Molise	2001-2013	59	---	4.5 \pm 3.5
WRC "Bosco di Ficuzza"	Sicilia	1998-2016	705	27.8	37.1 \pm 11.6
Total			1393	19.7	58.0 \pm 35.9

hospitalized individuals (Rome, Ficuzza, La Fagiana), in order to assess if differences were present due to awareness' changes of people among different years, or to the efficacy of single WRCs.

The overall number of all recovered individuals at the three main WRCs shows a significant increase during the years (Fig. 1; WRC Roma $R_s = 0.776$, $P < 0.001$; WRC "La Fagiana" $R_s = 0.746$, $P < 0.001$; WRC "Bosco di Ficuzza" $R_s = 0.773$, $P < 0.0001$). This suggests, with a reasonable degree of certainty, that the number of recovered Barn Owls is not biased by a different sampling effort.

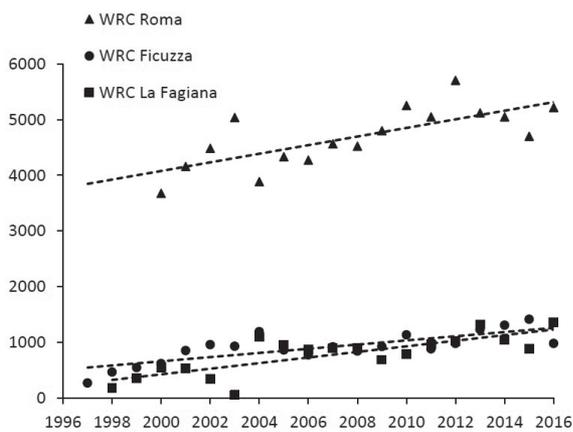


Figure 1. Total number of birds hospitalized over the years in three of the main recovery centers managed by Lipu

There were significant temporal and spatial differences in the number of recoveries of Barn Owls (Fig. 2). At the WRC "La Fagiana" we found a statistically significant decrease of recoveries over the study period ($R_s = -0.495$; $P < 0.05$); at the WRC "Il giardino delle capinere" from 1993 to 2016 we found no statistically significant variations between recoveries during the years ($R_s = -0.286$, N.S.); at CRUMA from 2003 to 2016 a statistically highly significant decrease of hospitalised Barn Owls was recorded ($R_s = -0.854$; $P < 0.001$). In Rome's WRC from 2000 to 2016 we found a statistically highly significant decrease of recoveries ($R_s = -0.838$; $P < 0.0001$); at WRC Casacalenda from 2001 to 2013 no statistically significant variations in recoveries were recorded ($R_s = -0.286$, N.S.); finally at WRC "Bosco di Ficuzza" from 1998 to 2016 we found no statistically significant variations between the number of hospitalised Barn Owls ($R_s = -0.137$; N.S.).

The percentage of chicks recovered in all WRCs is low (Tab. 1), and largely due to the renovation of old buildings, used as nesting sites by the species. In some individuals age was not clearly recorded in the WRCs files, but 76% of recovered animals were adults, and the main reason of recovery was trauma, followed by intoxication (Tab. 2).

Table 2. Reasons of hospitalisations in percentage of Barn Owls in six Lipu wildlife recovery centers (WRCs). The sum of the percentages for WRC Casacalenda does not reach 100% as a result of rounding by default.

WRCs	N.	Trauma	Intoxication	Illegal hunting	Other
WRC "La Fagiana"	36	61.1	--	2.8	36.1
WRC "Il giardino delle capinere"	100	65.0	1.0	0	34.0
CRUMA	178	72.5	1.7	6.7	19.1
WRC Roma	225	78.2	8.0	7.1	6.7
WRC Casacalenda	35	48.6	17.1	17.1	17.1
WRC "Bosco di Ficuzza"	517	60.0	34.0	0.2	5.8
Total	1057	68.0	19.3	3.4	9.3

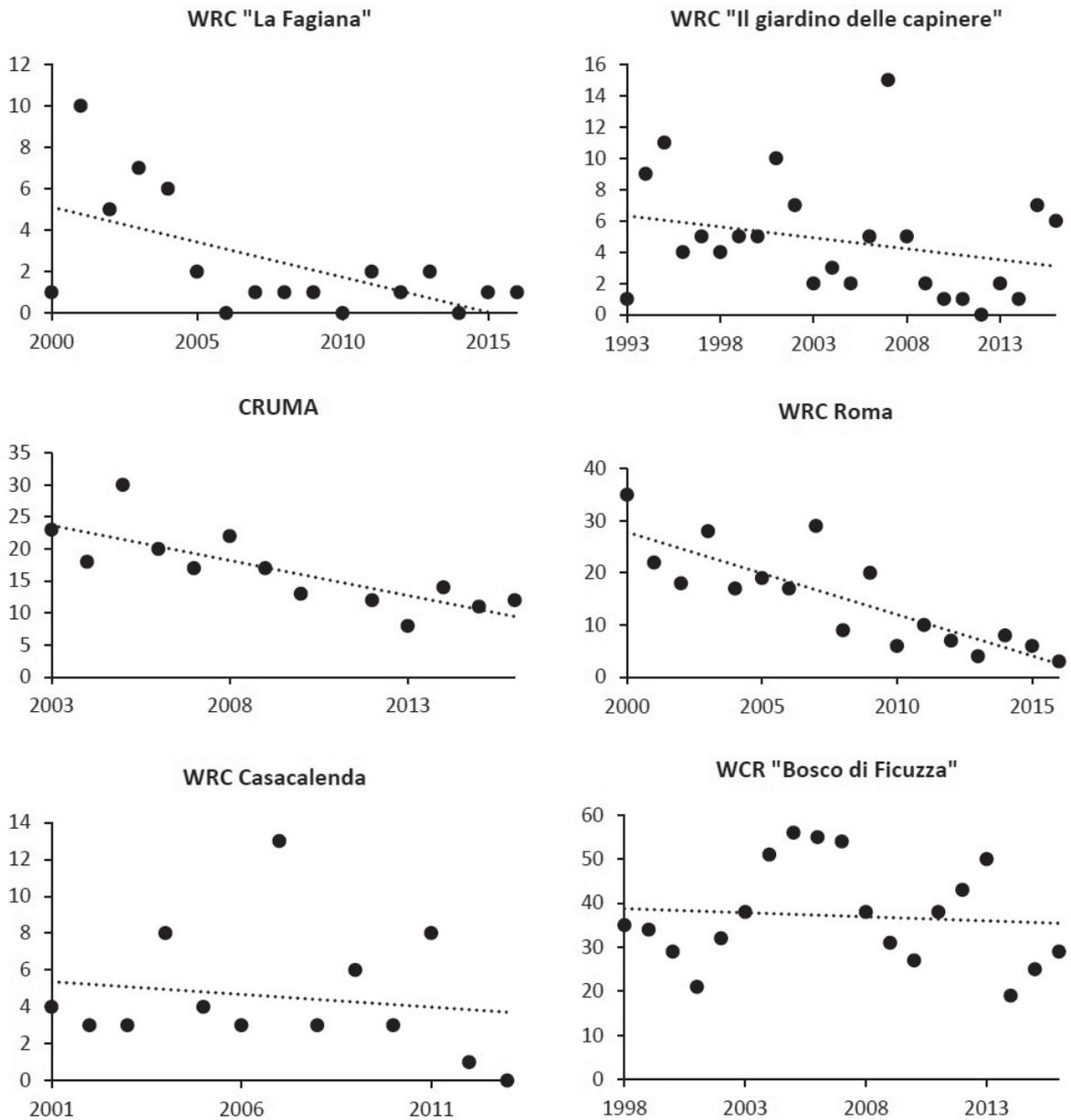


Figure 2. Temporal trends in the amount of Barn Owl recoveries in six Lipu wildlife recovery centers (WRCs).

Due to the nocturnal foraging habits of the species, which hunts in rural as well as urban areas, the collision with motor vehicles proved to be the primary cause of hospitalization (Tab. 2). This fact could cause a drastic reduction in population size and could even lead to local extinctions in the short term as has occurred in Spain (Grajera et al. 1992) and in Great Britain (Ramsden 2003). This threat is particularly serious considering that Italy is the country with the highest number of vehicles per 1000 inhabitants in continental Europe, and the sixth for the extension of the road network (www.nationmaster.com/country-info/stats/Transport; verified December 2019).

By analysing the two main recovery reasons during the study period we found that “trauma” recoveries slightly decreased, even if not significantly ($R_s = -0.43$; N.S.), while poisoning frequency was relatively stable over the years ($R_s = -0.24$; N.S.).

The traffic death rate significantly affects young owls during their post-fledging dispersal period (Massemin et al. 1998) and could seriously alter the population dynamics of this species in the long term (Altwegg et al. 2003). At a local level, this effect could contribute significantly to the demographic collapse of this species nationwide.

In the 221 cases for which the side where the trauma was suffered was recorded, the left side accounted for 58.4% of traumas, while the remaining 41.6% from the right side. The difference between these two values is highly significant ($\chi^2 = 12.39$, $P < 0.001$). This could indicate that more frequently the impact with the vehicles takes place on the right lane compared to the direction of travel, therefore on the left side of the individual. The impacts on the left roadway, therefore on the right side of the individual, are less frequent probably because the Barn Owl has more time to change its flight path when a car arrives.

In conclusion intervening on the traumatic cause of recovery is very complex and no short-term solutions are seen, however a more conscious use of anticoagulant rodenticides, currently not adequately regulated (Cabella et al. 2015), seems highly feasible and,

given the limited alternatives, this turns out to be an area for necessary and urgent action to help this species. Finally, in certain local areas and in particular in Central Italy, the recovery due to illegal hunting (Cianchetti-Benedetti et al. 2016) is significant, considering the elevated impact of poaching in our country (Brochet et al. 2016).

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