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ARTIFICIAL ROOSTS FOR BATS: EDUCATION AND RESEARCH. THE "BE A BAT'S FRIEND" PROJECT OF THE NATURAL HISTORY MUSEUM OF THE UNIVERSITY OF FLORENCE

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ABSTRACT - The project "BAT BOX: Be a Bat's Friend" was launched in 2006 with the aim of spreading correct information about the ecological role of bats, rehabilitating their image and fostering the involvement of the public in conservation actions. A wooden, single-chamber bat box was designed and produced at low cost. Through collaboration with Coop, to date ca. 25000 bat boxes have been sold over much of the country at cost price. Private citizens, institutions and associations installed and monitored the boxes using a standard form for the collection of data. The sale of a range of project-related merchandising articles has raised funds used for bat research and conservation projects. Conferences, public meetings, school lessons, papers and an informative brochure helped to spread the aims of the project. In 2010, Disney Italia produced a new brochure and the educational comic strip "Donald Duck and Kiro the Bat". The monitoring of bat boxes showed a progressive increase in the success of colonisation over time, up to 40.0%. In general, both time from installation and height above ground proved to significantly influence colonisation success.

Key words: Chiroptera, conservation, bat box, Italy

RIASSUNTO - ***Rifugi artificiali per i pipistrelli: didattica e ricerca. Il progetto "un pipistrello per amico" del Museo di Storia Naturale dell'Università di Firenze***. Il progetto "BAT BOX: Un pipistrello per amico" inizia nel 2006 per diffondere la corretta divulgazione del ruolo ecologico dei pipistrelli, riabilitare la loro immagine e stimolare la partecipazione delle persone a concrete azioni di conservazione. È stato allora elaborato e prodotto a basso costo un modello di bat box in legno a camera singola. Grazie alla collaborazione di Coop, si sono finora distribuite su gran parte del territorio nazionale e a prezzo di costo circa 25000 bat box. Privati cittadini, enti pubblici e associazioni hanno provveduto autonomamente all'installazione ed al monitoraggio dei rifugi, tramite un'apposita scheda per la raccolta dei dati. La vendita di alcuni articoli di merchandising legati al progetto ha consentito la raccolta di fondi, utilizzati per progetti di ricerca e conservazione sui chirotteri. Con-

ferenze, incontri pubblici, lezioni nelle scuole, articoli e un opuscolo informativo hanno permesso la diffusione del progetto su vasta scala. Nel 2010 Disney Italia ha realizzato un nuovo opuscolo e il fumetto divulgativo "Paperino e il pipistrello Kiro". I dati di monitoraggio delle bat box mostrano un progressivo aumento del successo di colonizzazione col passare del tempo, fino al 40.0% dopo tre anni dall'installazione. In generale, il tempo di permanenza e l'altezza dal suolo delle bat box sono gli elementi che più influenzano il successo di colonizzazione.

Key words: Chirotteri, conservazione, bat box, Italia

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INTRODUCTION

The decline of bats all over Europe (Stebbings 1988; Hutson et al. 2001; Bontadina et al. 2008) is a matter of widespread concern. In Italy, in the last decades several large bat colonies have declined or disappeared (Agnelli 2006). Currently 14 species are listed as "threatened" (CR, EN, VU) and 5 as "near threatened" in the National Red List for Mammals, while data are insufficient to assess the status of a further 5 species (DD) (GIRC 2007).

Today the main challenge facing European chiropterologists is the need to intervene with concrete conservation initiatives for the protection of all bat species.

Prejudices and superstitions still play a role in the relationship between bats and human beings, so the circulation of correct scientific information is among the major actions to be taken for the conservation of bats

In 2006, in collaboration with the Town Council of Fiesole (province of Florence, Tuscany), during a public meeting, 10 artificial roosts (bat boxes) were distributed free of charge, while many people decided to build their own on the basis of supplied construction diagrams. Following the enthusiastic participation of the public and the rapid colonisation of some bat boxes, we decided to map out a more complex and extensive information project to involve a broader public.

The project "BAT BOX: Un pipistrello per amico" (*Be a Bat's Friend*) was launched in 2006 with the aim of informing people about i) the life of bats, the importance of their ecological role and their usefulness for the control of insect populations, ii) the underlying biological reasons and potential benefits for human welfare of a conservation program and iii) the importance of peoples' involvement for the success of the program itself.

To realize this goal, essentially four things were necessary:

- a model of a bat box that was effective while simple and cheap;
- mass production, to enable the construction of a large number of bat boxes at moderate cost;
- good distribution capacity, so as to make the bat boxes available over a large area;
- the ability to advertise the project adequately so as to reach a large number of people.

MATERIALS AND METHODS

To design the bat box, some available models were checked and assessed (Steb-

bings and Walsh 1991; Mitchell-Jones and McLeish 1999; Tuttle and Hensley 2000). The resulting model (Fig. 1) was made entirely of wood, with a single internal chamber and one entrance at the base. The details of the construction techniques were further refined with the three different firms that have taken over from each other in the construction of our bat boxes over the last four years.

Figure 1 - Bat box designed by the Natural History Museum of Florence

A collaboration agreement was drawn up with Unicoop Firenze, a retail distribution chain with several sales outlets scattered over most of Tuscany. In 2007, the collaboration with Coop led to the construction of about 220 bat boxes, which were distributed free of charge to various Town Councils, mainly in Tuscany, which, in their turn, offered them to volunteers. To satisfy the large number of requests, in 2008 bat boxes were directly sold through the Coop supermarket chain. A BAT BOX logo (registered trademark) was produced with the graphic designers of Unicoop Firenze, to provide all the material related to the project with a characteristic graphic symbol. Stimulated by the public success achieved in Tuscany, Unicoop Tirreno and Coop Adriatica in 2009 and Coop Lombardia, Coop Estense and Coop Consumatori-NordEst in 2010 offered their collaboration to the project. As a consequence, we formalised the liaison directly with Coop Italia, which co-ordinates all the Italian cooperatives, ensuring the spread of the project over most of the country, from Campania in the south to Lombardy and Friuli Venezia-Giulia in the north. This collaboration offered a wide array of benefits:

- the availability of numerous firms - linked to the Coop by long-standing commercial relations - for the standardised and economic construction of the bat boxes;
- distribution and sale of the bat boxes over most of the country through a broadly ramified network;
- the possibility of utilizing the advertising channels of Coop to promote the product to its members;
- the possibility of selling the bat boxes to the public at the production cost;
- the vast potential for creating and selling merchandising material connected with the project to raise funds for the project itself and research on Chiroptera in general.

The efficiency of bat boxes in attracting bats was monitored by volunteer collaborators through a specific form for the collection of data about the features of the location, modes of installation and results of regular checks for the presence of bats and or faeces (Tab. 1).

Boxes were checked at least once a month and considered as used by bats whenever an individual or faeces were detected at least once. During the monitoring of the bat boxes the species were not identified by the volunteers in order to avoid disturbance and the consequent risk of the roost being abandoned. To identify which factors had the greatest influence on the success of colonisation, we carried out a multivariate analysis, using Permanova (Permutational Anova), while a Simper (Similarity percentages) test was used to appraise the impact of the factors identified.

To foster the exchange of data between the volunteers and our working group, we then

Table 1.Data of installation and monitoring of the bat-boxes.

Owner bat box	Name, address, e-mail, telephone.
Installation data	Date of placement Height from the ground Height from the floor Orientation Hours of sunlight Date of purchase Distance from water bodies with a diameter of at least 1.5 m (classes) Distance from tree-lined squares, parks, forests (classes) Placed on: building/tree/pole/other
Monitoring data	Number of specimens and of excrement (checked every 10 days) Notes

set up an e-mail address for the project, batbox@unifi.it, while to enhance involvement and information, several web pages (www.msn.unifi.it) were created to spread the aims and results of the project, together with information on bats and the downloadable leaflet "Un pipistrello per amico" ("Be a Bat's Friend"; Agnelli et al. 2007, 2009). The latter, periodically updated since 2007, is also delivered together with the bat box and distributed in the Coop supermarkets. During the first 5 years of activity information on bat ecology was spread through conferences and public meetings, in liaison with Town Councils, private associations, the teaching staff of primary, middle and secondary schools and the technicians from local health agencies (ASL).

Moreover, we released TV interviews and informative papers were monthly published on the magazine "L'Informatore", published by Unicoop Firenze in about 650,000 copies, and, opportunistically, on other magazines and newspapers. Finally, the graphic designers of the Museum "La Specola", Florence, and Coop have collaborated in the design of many gadgets on naturalistic themes, including t-shirts, beach towels, exercise books, pencil cases, satchels and school diaries, all accompanied by our logo and a brief description of the project.

RESULTS

The number of bat boxes sold every year grew in an almost exponential manner, from 3000 bat boxes sold in 2008 up to 8000 in 2009 and over 14000 in 2010 (between the months of March and August alone). To this total of about 25000 bat boxes sold at cost price we have to add thousands of bat boxes which, over the last two years, have been sold by other firms, both retail and online, or built by private citizens.

So far the advertising campaign has included:

- 42 public meetings (conferences, bat-nights and lessons) held by our working group;
- 112 papers published in both local and national newspapers and magazines (www.msn.unifi.it/CMprov-p-938.html);
- 10 TV interviews produced and broadcast on local and national channels, even involving a Swiss TV

channel (www.msn.unifi.it/CMpro-v-p-1078.html);
- over 5000 e-mails sent to batbox@unifi.it
- the sale of approximately 41694 t-shirts, 8651 beach towels and about 138318 articles of school stationery (www.msn.unifi.it/CMpro-v-p-933.html);
- Walt Disney Italia took over for us the graphic design of the new guide to bats and the bat box, entitled "Un pipistrello in famiglia" (*A bat in our family*; Agnelli et al. 2010) and further supported our project through the creation of an original comic story "Paperino e il pipistrello Kiro" (*Donald Duck and Kiro the Bat*), who lead young readers through the world of bats (Fig. 2).

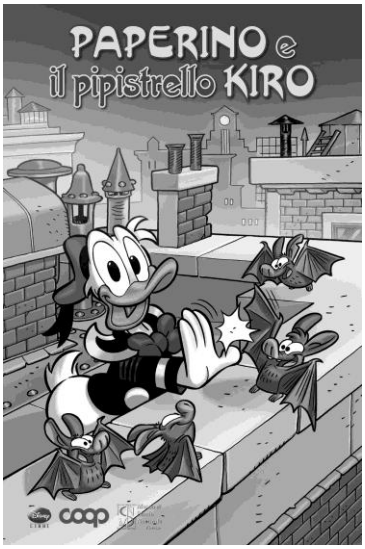

Figure 2 – Disney comic booklet "Donald Duck and Kiro the Bat"

A total of ca. 100000 Euro has been gathered so far to finance bat research, allowing also the funding of a three-year PhD and the payment of professional collaboration fees to young graduates.

At present (2010), we have received about one thousand registration forms from people engaged in the study, but only a small percentage of bat-boxes (about 30%) has been checked once a month and so considered suitable for statistical analyses. In 2007 we recorded a colonisation success of 20.6% (N= 68). In 2008, colonisation success was 34.9% (N= 43) for the boxes set up the previous year and 16.0% (N= 81) for the boxes set in position and correctly monitored in 2008.

In 2009, colonisation success rose to 40.0% (N= 30) and 25.5% (N= 51) for the boxes set up in 2007 and 2008, respectively, while that of the boxes installed in 2009 was 11.5% (N= 61).

Multivariate analysis showed a significant difference between colonised and non-colonised bat boxes (Pseudo F: 4.94, $p < 0.01$). The variables height from the ground, months of placing in position and hours of exposure of the bat-boxes to sunlight explained 66.32% of the variability of the data (24.15%, 23.77% and 18.39%, respectively). The success of colonisation increased linearly with the height from the ground at which the bat box was positioned (R^2: 0.9997; Fig. 3), while the trend in terms of hours of exposure to sunlight was unclear (Fig. 4). Colonisation success clearly increased (R^2: 0.9194) with the time that bat boxes were in place (Fig. 5).

In 2008 colonisation increased (R^2: 0.9201) throughout the monitoring season with a peak in October, while in 2009 the peak of bat occurrence into bat boxes was in August, two months earlier than the previous year.

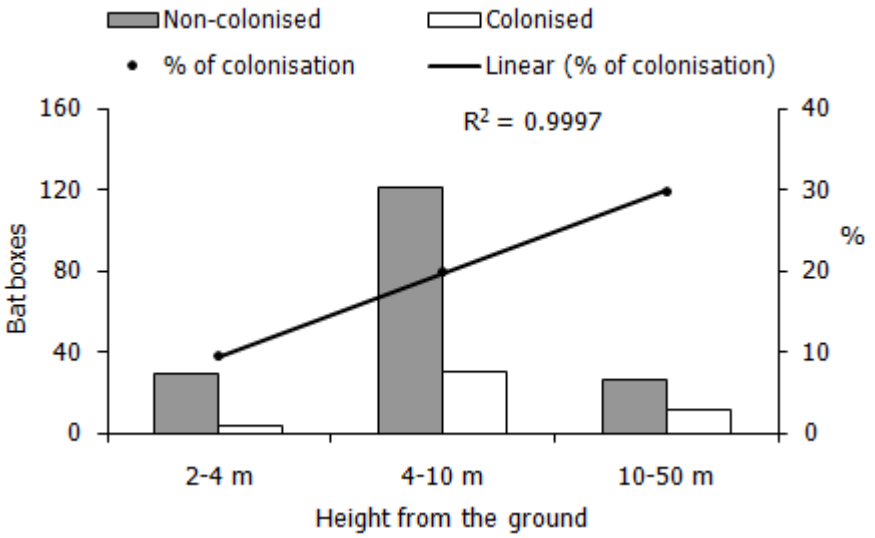

Figure 3 - Univariate analysis of the variable "height from the ground".

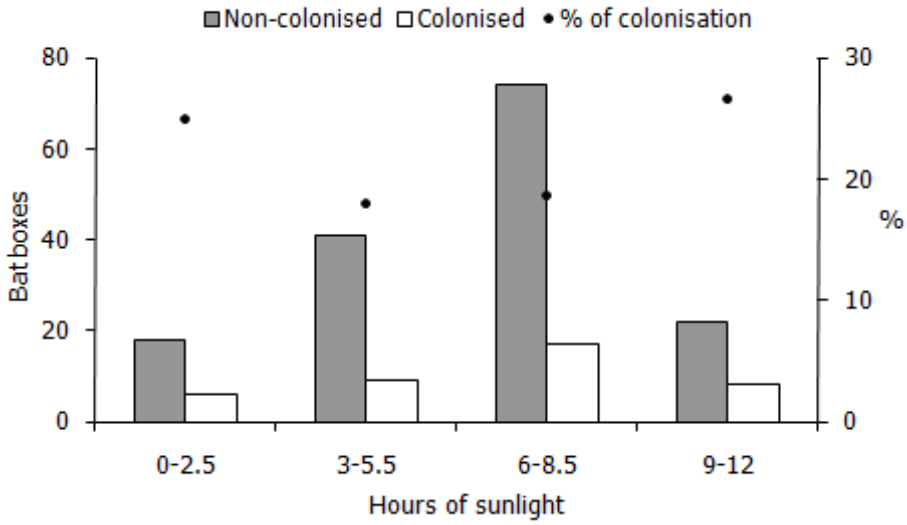

Figure 4 - Univariate analysis of the variable "hours of sunlight exposure".

DISCUSSION

The educational and informative campaign "BAT BOX: Un pipistrello per amico" spread over a vast area of Italy. Considering its features of popularity and continuity, it is undoubtedly the largest awareness-raising campaign carried out in Italy in favour of bats, and ranks among the most important Eu-

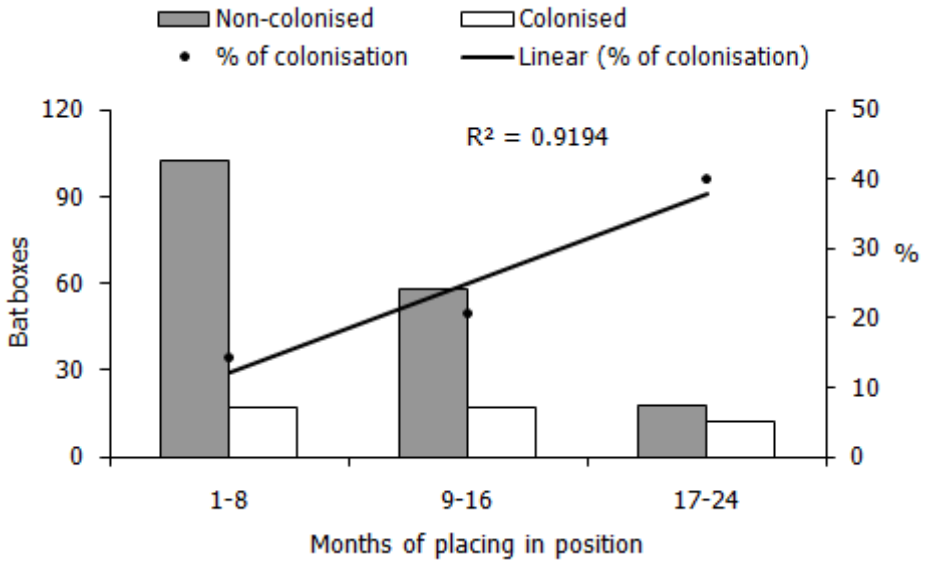

Figure 5 - Univariate analysis of the variable "months of placing in position".

ropean initiatives. As a result of the enthusiastic participation of so many people who have contributed to the growth of the project, we hope that the need for bat conservation has come to be shared by a large part of the population.

As regards the experimentation of the bat boxes, bats' preference for high box-sites can be interpreted as the search for safer roosts, while the increase of bat colonisation with time depends on both the increasing probability of discovery and reliability of the bat boxes which have been placed in position for longer . The absence of a clear trend with respect to the hours of sunlight could perhaps be explained by the different microclimatic requirements of the two sexes: males generally tend to prefer cooler roosts, since these are better suited to daytime rest in a state of torpor, while mature females need warmer quarters for reproduction (Lanza 1959). Finally, the increase in the number of colonisations between late summer and autumn suggests that boxes are mainly occupied by young bats and adults for autumn mating. Ongoing monitoring will enable us to analyse the results over a larger number of seasons and point out more accurately which parameters dictate the success of our bat boxes. A future implementation of the project will involve faecal analysis to confirm the effectiveness of bats in pest control.

Scheduled for 2011 is the creation of two new models of bat box - one in wood and a second model made of inert material and recycled plastic - which are innovative, cheaper, and hopefully as efficient as the previous model. A new information campaign will be

launched with the support of Coop and Disney's Kiro.

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