Institut Mediterrània
Castelldefels

Comparative study for the conservation of two migrating bird in Aragon and Catalonia

Elán Pérez García

2º de Bachillerato (B)

Tutor: Irene Mateo Molina

November 2015

INDEX

Prologue

I have chosen this work because I love wildlife and nature. Ornithology is one of my hobbies that started several years ago when my brother, also a passionate of ornithology, took me with him in several field trips to watch birds in several surrounding of the Llobregat river and Garraf mountains. I thought this work could be a great opportunity to learn more about several bird species as well as to contribute to their conservation. Working and doing research on a topic that I like very much has been a great motivation. I have enjoyed both the planning of the work and the field activities. It has been especially interesting and encouraging to have the possibility to watch how the baby birds grow.

I also decided to complete the present work in English with an additional goal in order to improve my English vocabulary and written skills.

1 Introduction

Birds, especially owls, have raised great interest among people who love nature. Their traditional adaptation to the human environment and their wild and mysterious aspect has made them recognizable icons for all professional and amateur ornithologists.

Despite the proximity of some species to human beings, most of them are in a delicate preservation condition. The changes in the traditional habits of farming and construction and the expansion of the human societies have significantly reduced the available territory use for bird to obtain food and hunting. There are also a decrease of adequate locations for nesting, and many places are insecure and at risk of been stolen.

Instead of being part of the problem, humans can contribute to the conservation of these species in many ways. One way to facilitate the nesting and reproduction is the installation of artificial nests. Artificial nests, with an appropriate design a strategic locations, are simple tools to benefit some birds species enhancing their reproductive success in specific area. To In order to implement this type of actions at a higher scale, it is important to show results of research projects that prove their utility and benefits, not only for the specific species that is helped, but also for the others species related to it and the environment.

Once the beneficial effects are proven, authorities may realize the convenience of implementing these activities to help the preservation of useful species. In addition, a great advantage is that it is possible to involve the community on the maintenances of these projects.

In the present study, I have focused on two different bird species. The birds species selected have been the Eurasian scops owl and the European roller because they very share similar habitat, use similar nests, and under similar threats.. The European roller was also been selected Bird of the Year 2012 by SEO / Birdlife, with the main objective to report the current threats of this migratory species that is becoming increasingly scarce in our country. Both species are also among the preferred birds for many ornithologists, including myself.

The aim the present study is to contribute to the knowledge about the utility of nest boxes for the preservation of these two bird species, their reproduction and their natural behavior. During an entire season and using nest boxes in two different geographical areas, one in Aragon completely rural and one in Catalonia closer to larger cities, the project aim to compare the results and define the current situation and behavior of these two species.

2 Goals and hypothesis

Goals

1. Review the current knowledge about the habitat, reproduction, diet, nesting cycle and threats for the Eurasian scops owl and the European roller.

2. Further contribute to the knowledge of the life cycle of these species.

3. Perform an intensive monitoring during the reproduction of the species.

4. Contribute to the conservation and maintenance of the species in two different geographical areas.

Hypothesis

- Next boxes are useful tools, but their utility may differ depending on the location. For instance, nesting in the two zones can vary depending on the climate, the predators or other competitors for the nests and different local parasites can hinder the occupation of the nest boxes.

- However, given the relative proximity (in terms of latitude and environment), the Eurasian scops owl and the European roller could probably have the same alimentation in the two geographical areas.

3 Description of the birds

The present work is based on two migration birds, the Eurasian scops owl and the European Roller. The main features of both species are shown on table 1:

FEATURES	EURASIAN SCOPS OWL	EUROPEAN ROLLER
Picture	 ***Picture nº 1:*** *Image of an Eurasian Scops Owl*	 ***Picture nº 2****: Image of an European roller*
Biometrics	Length: 19-20 cm Wingspan: 53-63 cm Weight: 92-145 g	Length: 31 – 32 cm Male weight: 127 – 160 g Female weight: 130 – 154 g
Habitat	Forests, groves, orchards, parks and large gardens with scattered trees.	Forests, orchard and mixed farmlands with pine woods with heathery clearings.
Reproduction	Between Mach and August	Between May and June
Diet	Insects	Invertebrates

Table 1: Features of the Eurasian Scops Owl and the European Roller

3.1 Eurasian scops owl

- **Description**

The European scops owl (Otus scops), also known as the Eurasian scops owl is a small owl with heavily streaked plumage, but it varies in colors from grey, to brown and rufous according to individuals and races. This species is a part of the larger grouping of owls known as typical owls, Strigidae, which contains most species of owl.

The back is spotted white and scapulars are streaked pale greyish-white. We can see a white collar spotted sepia. The tail is greyish, streaked dark and black, and barred by 4-5 whitish bands.

On the head, two ear tufts are visible on crown sides. They can erect and are grey-brown. The eyes are yellow. The bill is bluish-black. Legs and feet are brown to reddish-brown, following the plumage variations.

The Eurasian Scops Owl may become invisible when resting in trees by day, thanks to its cryptic plumage.

- **Habitat**

The Eurasian scops owl frequents the large, open, deciduous forests, groves, orchards, parks, large gardens, cultivated areas with scattered trees, and locally the open conifer forests.

The Eurasian Scops Owl winters in southern Europe and in Africa, south of the Sahara. It breeds in a wide area from NW Africa to Asia, through Europe (France, Spain, Italia, Switzerland, Czechoslovakia, Yugoslavia and Balkans), and all the Mediterranean islands where it is associated to olive groves.

- **Reproduction**

The breeding season varies according to the range, but usually occurs between March and August.

The Eurasian scops owl's nest is often a hole in old tree trunk, or an abandoned woodpecker hole, at some height. There is not addition of other materials. It also may use cavities in walls of old buildings, or under roofs of cabins in parks and gardens.

The female lays 3-6 white, fairly rounded eggs. The incubation lasts 24-25 days, mainly by the female. She is fed by the male, which carries preys at nest, as it does too for the chicks, and the female feeds them with the preys brought by the male. Both adults feed them until they fledge, at about 21-29 days of age, although their plumage is not completely grown. The head and some parts of the body still show down. They are able to fly at one month old, but they still depend on parents for five weeks more.

- **Diet**

The Eurasian scops owl is mainly insectivorous, including many insects and other invertebrates such as reptiles. Feeding usually takes place during the night.

3.2 European roller

- **Description**

The European roller is the only member of the roller family of birds to breed in Europe. The head, neck and under parts are light blue, whilst the upperparts are brownish-orange. When the wings are extended the brilliant azure blue leading edge and the contrasting black wing-tips can be seen. A short, thin black stripe runs through the eye and the tail is greenish-blue with a darker base.

- **Habitat**

The European roller can be found in warm, sunny lowlands. It prefers open countryside with patches of oak forest, mature pine woods with heathery clearings, orchards and mixed farmlands. On its African wintering grounds it primarily inhabits dry, wooded savanna and bushy plains

The European roller breeding range extends from northwest Africa, southwest and south-central Europe, east through Asia Minor to northwest Iran and southwest Siberia.

- **Reproduction**

Nest is situated in a hole in a large tree, building, cliff or riverbank. A clutch of one to seven, but most commonly four or five, eggs are laid from May to June. The eggs are incubated, primarily by the female, for 17 to 19 days. The chicks hatch naked and blind, but quickly develop, and fledge after 25 to 30 days. The young continue to be fed by adults for a further three weeks or more.

- **Diet**

The heavy-bodied European roller feeds on invertebrates, such as beetles, crickets, locusts, caterpillars, flies and spiders. They are also known to prey on small numbers of larger animals such as frogs, lizards, snakes and weak, small birds.

3.3 Main threats

Losing their habitat seems to be the main threats, due to the elimination of natural vegetation, hedges and scattered trees, and the increased use of pesticides as a result of agricultural intensification, usually associated with the transformation in irrigation. These circumstances seem to influence in the availability of potential prey and favor the accumulation of pollutants in the body that causes poor physical conditions of birds and low productivity. Moreover, the abandonment of ranching also involves habitat deterioration, because it reduces the invertebrates associated with it, and therefore, the losing habitat where they found the most suitable conditions for survival.

Another limiting factor is the number of holes to nest: the disappearance of elms in the past by the Dutch elm disease (DED) and other typical trees of boundaries and shores where they nest currently, like poplars, oaks, almonds and corks. And the collapses of buildings isolated on agricultural land are factors that affect it negatively.

The Eurasian scops owl and the European roller have declined about 40% in the recent years. This decline, with their small population, has led them to be considered "vulnerable" in the Red Book of birds of Spain which tells you the most endangered birds, the factors responsible of their present situation and the conservation measures to improve their condition.

4 Nesting cycle

4.1 Finding a place to breed and nest building

The Eurasian scops owl is migratory. The most part of the European population migrates in autumn and reaches inland Africa in a single flight, maybe close to the Sahara. The breeding season varies, but usually occurs between March and August. They have to find new places when they return for the breeding season. They like the vicinity of humans, and they can be seen in towns and cities where the lights attract insects which are their main food. But they also know how to keep a distance from humans. The chosen nest is often a hole in old tree trunk, or an abandoned woodpecker hole, usually at some height to be protected from predators and humans. For the nest, there is not addition of other materials. They also may use cavities in walls of old buildings, or under roofs of cabins in parks and gardens.

4.2 Choosing a mate

The species is monogamous, and may be occasionally polygynous, one male with several females. During the breeding season, they live in pairs, although they gather in small groups when they migrate. The pair forms early in spring, usually in March, but the laying only occurs one month later. This bird shows a characteristic performance involving courtship feeding by male to female, during which the male moves wings and body. Both mates perform mutual preening too, in order to strengthen the pair-bonds, and as pre- and post-copulatory behavior. They frequently utter duets during the displays.

4.3 Copulation and egg formation

During the breeding season, hormonal changes cause internal testes of males and the ovaries and oviducts of females increase in size in preparation for fertilization of the egg and his development. During copulation, the male expels sperm into the female's cloaca. The route of the sperm goes to the oviduct, where they can be stored for long periods. Then, the sperm penetrate through the wall of the ovum (egg) and fertilization takes place. During the first stage of embryonic development, the egg shell develops; pigments are added last. Ovulation and laying take about 24 hours, so female birds typically produce at most one egg per day.

The female lays 3-6 white, fairly rounded eggs. The incubation lasts 24-25 days, mainly by the female. She is fed by the male which carries preys at nest, as it does too for the chicks. The female also feeds the chicks with the preys brought by the male. Both adults feed them until they fledge, at about 21-29 days of age, although their plumage is not completely grown. The head and some parts of the body still show down. They are able to fly at one month old, but they still depend on parents for five weeks more.

5 Materials and methods: Nest boxes as a conservation system

Helping the conservation of many species of nocturnal raptors seems simple considering that they rest during the day and nest in the spring. Therefore, they need a quiet and dark place for these activities available during the spring.

The Eurasian scops owls occupy the peninsula during the spring and summer for breeding and rearing of her chicks, and they mostly nest in tree hollows majority. Because of the scarcity of trees, nest boxes are helpful. Nest boxes allow to marc or label the animals in order to prove whether they return to the same areas (300m radius) or even to the same nests, as previously described.

The location of cameras in nest boxes along with a computerized registration system allows tracking of the species studied, safely and avoiding any disruption of the natural behavior of birds. These cameras facilitate the continuous monitoring, providing valuable information in real-time images on the process of growth of chicks, behavior, alimentation and emancipation. However, no cameras were used for this project, given the additional costs and risks, due to the poor supervision for an individual work.

Picture nº 3: *Image of me with the nest boxes*

5.1 Placement scheme for the monitoring of a specie

As mentioned, the best strategy for monitoring a species (not used in the present study because its difficulties and cost) would be a connected IP camera to get pictures

and videos are searched (figure 1). This camera would have sensors that activate the recording when it detects movement. The router will send us the signal to the server to obtain the tracking of the species that can be followed in real time by the investigator.

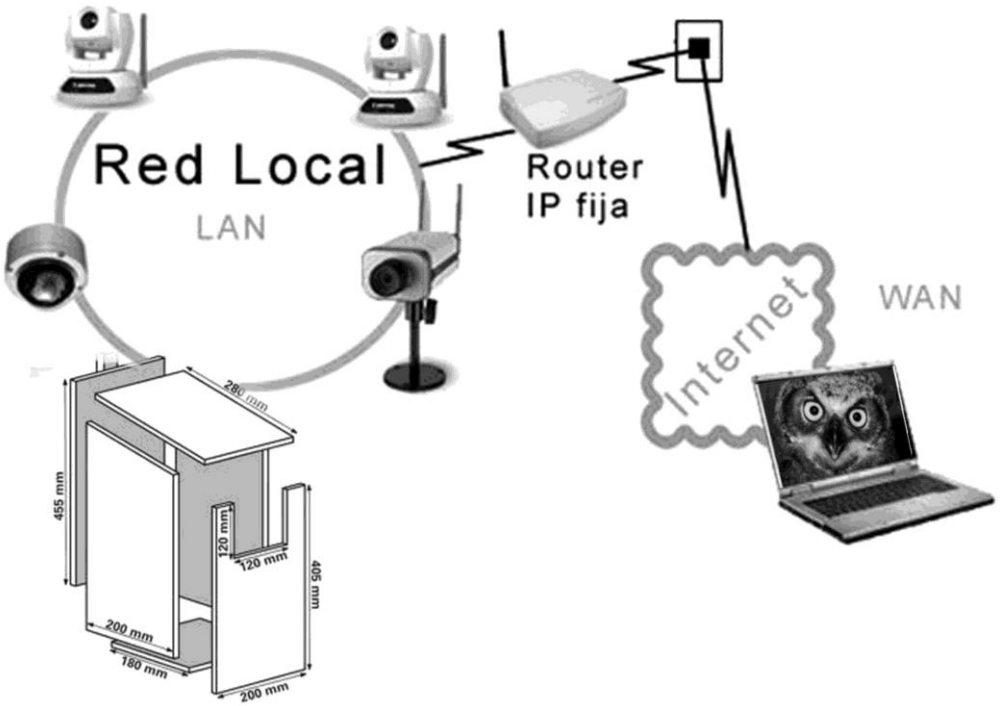
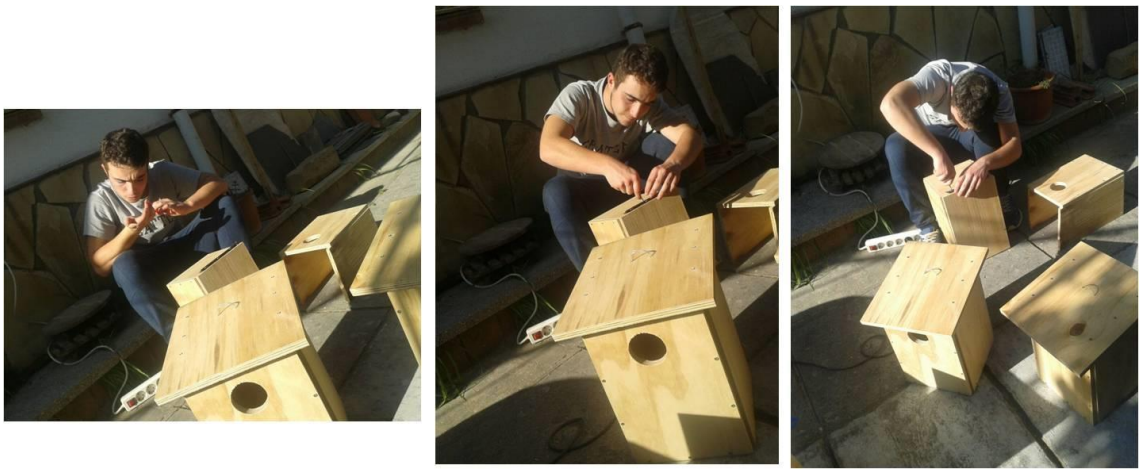


Figure 1: Operating diagram of the IP cameras

5.2 Types of nest boxes

Taking into account bird's features (size and nesting conditions), 10 nest boxes that are *a priori* optimal for the selected birds were constructed (picture 4).



Picture nº 4: *Images of me building the nest boxes.*

As shown on figure 2, requirements for building a nest box we need wood ~10-15 mm thick, a piano hinge, 20 screws of 3.5x25, 8 screws of 3.5x10, a radial of 6.5 cm and a saw. First, I had to cut several pieces of wood in different parts: I cut 10 pieces of 28 cm wide by 32 cm for the caps, 10 pieces of 22 cm wide by 32 cm long for the fronts, 20 pieces of 20 cm wide by 34.5 long for the sides, 10 pieces of 22 cm wide by 34.5 cm long for the rears and finally 10 pieces of 20 cm wide by 20 cm longer for the bases. With this material I made the nest boxes. I began cutting horizontally with a saw the upper side of the 20 pieces, as shown the figure 2 and 3. Then, we made a hole of 6.5 cm in the 10 frontal pieces with the radial, adequate in size for the perfect entry of the birds. Finally, we hooked the different parts with screws and we put a piano hinge linking the base with the rear so that the box could be opened easily from behind removing just two screws.

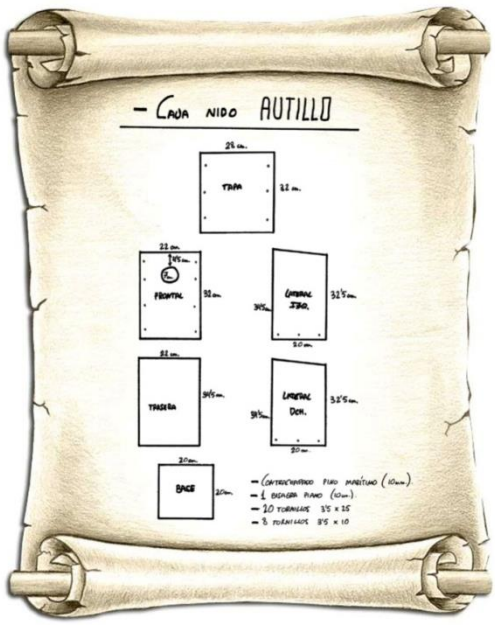


Figure 2: Diagram of a nest box for the box for the European roller

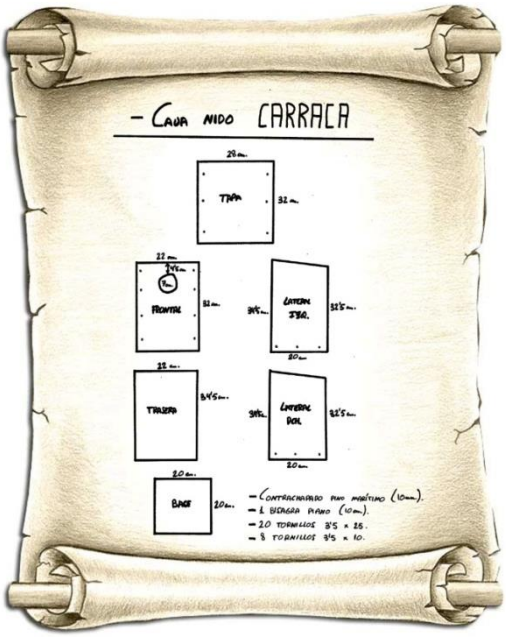


Figure 3: Identical diagram of a nest Eurasian scops owl

5.3 Selection and location of the nest boxes

I selected two different locations for the placement of the nest boxes, in two areas where these species are known to nest, having similar latitude and slightly different climates but different characteristics. The region on the Somontano county of Aragon is mostly rural, with small villages and multiple trees far from inhabited areas, and the

Baix Llobregat region with several small forest pine trees within or close to two populated towns (Castelldefels and Gavà). Both locations were also selected based on the feasibility to complete the tasks: my brother lives in Barbastro (in the Somontano country) and the Catalonian locations are near home. Thus, I could follow the project on both locations (at home and with visits and stays in my brother's house).

5.3.1 Catalonia

Half of the boxes were placed in 5 different points in the Baix Llobregat county. As shown on figure 4, points were located in the cities Castelldefels and Gavà (both with a population of more than 50000 inhabitants). All locations were selected taking into account different aspects; all locations had water and the possibility of food nearby, and were relatively quiet areas. Given the main forests in the region, 4 boxes were located in pine trees and one in an oak tree.

Figure 4: Maps with the location of the 5 nests-boxes in the Castelldefels-Gavà areas. 1) Nest box in the Sentiu area, located on a pine trunk. 2) Nest box in the UPC campus, located on an oak tree. 3) Nest box in a pine forest close to the verger. 4) Nest box on a pine next to "la Murtra" reservoir. 5) Nest box on a pine forest close to the beach in Gavà Mar.

5.3.2 Aragon

The other 5 nest boxes were located in the Somontano country of Aragon (figure 5). As locations in Catalonia, places were selected taking into account the same aspects (water, food, tree type and quiet areas).

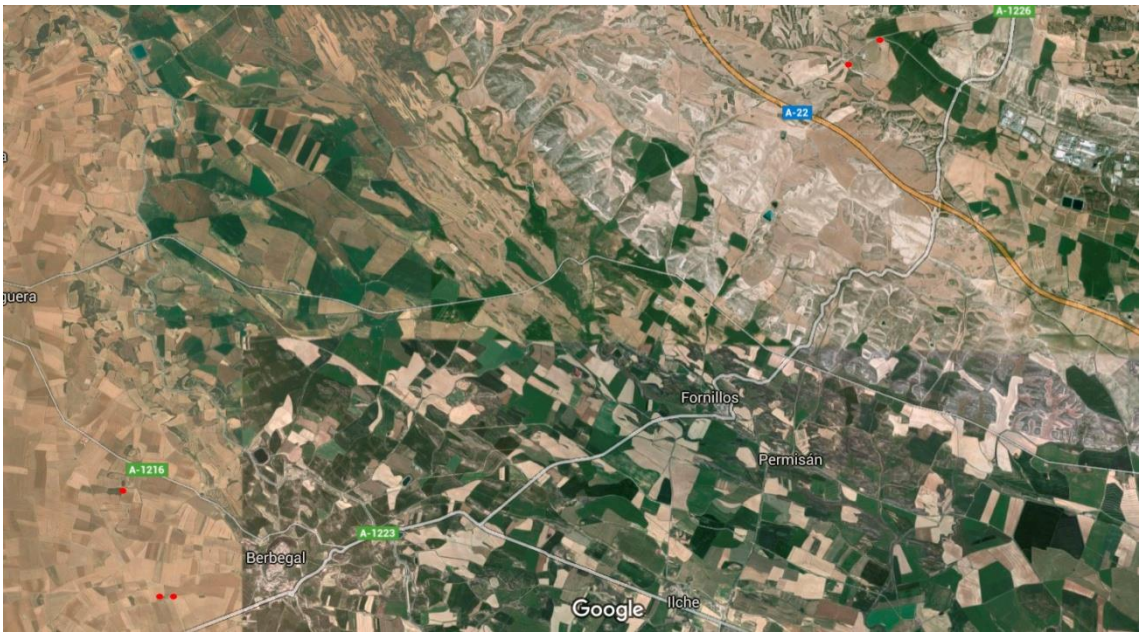


Figure 5: Map of the nest boxes located in Aragon (red points)

In the Somontano, two of the nest boxes were close but outside the village to Barbastro (16.000 inhabitants) (figure 6).

Figure 6: Map of the nest boxes located in Barbastro

The other 3 nest boxes were located close to Berbegal (figure 7), a small town with a population of 450 inhabitants.

Figure 7: Map of the nest boxes located in Berbegal

6 Results and discussion

6.1 Unsuccessful nesting

The nesting process there has been 4 of 10 unsuccessful nesting, three in Catalonia and one in Aragon

- Two abandoned nests by the Eurasian scops owl

In Gavà Mar, an Eurasian scops owl entered the box but left it without nesting. There could be two reasons why this bird did not nest in the box. We realized that the box was in a windy area and the bird could feel unsafe for nesting if the box moved. Anyway, the animal did not like the place or found a better or safer place to nest.

The first visit was on May 3rdbut with no sign that any bird could had entered, two weeks later I deduced that an Eurasian scops owl had entered because the ground inside the box was moved and the hole that he left was similar to the size of this bird. When I visited the box several times later no birds or additional activity were found. This nest box was abandoned.

***Picture nº 5**: Image of an abandoned nest in my nest box in the pine forest of Gavà Mar.*

Another unsuccessful nesting was the nest box of the UPC, in which an Eurasian scops owl abandoned 5 eggs at least partially incubated. Although the actual results

unknown, we suspect a major event had to occur for the parents to leave the nest after mating. Either the high activity of people in the park disturbing the animals or, more likely, any other direct threat or invasion of the nest would have scared the birds away, leaving their eggs behind. As mentioned bellow, many ants were found surrounding the nest and tree.

Nesting in this box occurred late, on May 31st when I found an Eurasian scops owl already incubating. I couldn't explore how many eggs were incubated at that time. The next two visits on June I saw five eggs alone in the box and the mother wasn't there. I thought that the eggs could be abandoned, reaffirmed when the five small abandoned eggs were in the same place two weeks later.

Picture nº 6: *Image of an abandoned nest with 5 eggs in my nest box in the UPC campus.*

- One nest with no visits documented

The nest box that was situated in the pine of La Sentiu, Castelldefels, had no documented bird visits during all the process. This could be due to the location of the box, which was in a difficult area to access and with low bird activity. This box was the only one of my 10 boxes that had no bird visits during all the period, I made five visits approximately every 15 days with no signal of nesting at any point.

***Picture nº 7**: Image of the unused bottom of my nest box in La Sentiu.*

- One abandoned nest by the Western jackdaw

In Barbastro, a jackdaw entered a nest box on an oak tree and probably tried to nest, since I found the box filled with pine leaves (needles). Probably the jackdaw leaved because the opening of the nest box was too small, and the pine needles prevented another bird nest.

The first visit was on June 6th, when the Western jackdaw was found in the box. During the second visit on June 17th, the bird had left the box with novel material inside. I did two more visits to verify that the box was not nested by any other bird.

6.1.1 Parasites of the boxes

There have been three parasitized boxes, despite there was nesting in two of them. The nest box at the UPC was abandoned by an Eurasian scops owl that with 5 eggs showed a large number of one of surrounding the nest box. These insects might have caused difficulties during difficult the nesting and incubation period of this nocturnal bird.

Another parasitized nest box was the on the oak in Berbegal 1, where despite a plague of red giant ants that bothered her nesting process, five European rollers have survived.

The last nest box and the one that showed worst results was the one in the Almond-tree of Berbegal nested by the European roller. The box was full of small insects like earwig, ants and white bugs. Only two eggs were found and just one could be incubated and the chick survived.

6.2 Successful nesting

There have been a total of 6 of 10 successful nesting, four in Aragon and two in Catalonia.

- Three nesting of the European roller

- **Almond-tree of Berbegal**

I began to visit this box on June 6th and it was occupied by a female of an European roller. On June 17th, I saw 2 eggs, what is a small number of eggs for this type of bird. On June 24th, I saw a well-fed chick and a small brown egg, with the tree full of parasites as previously explained. The insects likely precluded the birth of the second egg. On June 30th, the chick was already fledged and the egg was equal, on July 3rd the fledged roller was about to leave and one week later there was only the egg with no progression.

Picture nº 8: *Image of a newborn chick and a deteriorated egg of an European roller.*

- **Holm oak of Berbegal 1**

On June 6th, this box was already occupied by an European roller, two weeks later five white perfect eggs were found and four days later there was just one egg and four

recently born chicks. On June 30th I saw four fledged and a small chick born later, but on June 7th four fledged rollers were still in the nest, all about to leave.

Picture nº 9: *Image of five fledged European rollers.*

- **Holm oak of Berbegal 2**

On June 15th, an European roller was found for the first time in the nest box, while five days later there were five eggs. On June 24th, I saw five newborns chicks that later became fledged , one of them much smaller, and finally on July 4th the five rollers were fledged.

Picture nº 10: *Image of 3 fledged European rollers and one chick.*

- Two nesting of the Eurasian scops owl

● **Forest close to the verger in Gava mar**

On May 3rd there wasn't anything in the nest box, but after three visits on the following weeks, I saw an Eurasian scops owl incubating. On June 29th, I found one chick and two nearly fledged, and on July 4th there was still a fledged scops owl that I could touch, while the other two were already gone.

Picture nº 11: *Image of an Eurasian scops owl in my nest box in the forest close to the verger in Gavà Mar.*

- **Almond-tree of Barbastro**

On July 15th I found five little eggs of an Eurasian scops owl, then I went back two days later and I saw four eggs and a newborn chick. On July 24th only there was only one egg remaining along with one chick and three fledged, one week later there was just a chick and four fledged, and finally on July 3rd I found five big fledged Eurasian scops owls and some of them about to leave, already gone on July 7th.

Picture nº 12: *Image of an Eurasian scops owl and her chicks.*

- One nesting by an unexpected host: the Coal tit

● **Murtra of Gava mar**

After two inspections with no nesting, on May 17th I found a female of Coal tit in the nest box, a bird that uses much smaller boxes. Thus, the Coal tit was an unexpected host for my nest boxes. On May 31st I saw that the birds had prepared their own litter within the box bringing additional branches, and he had four newborn chicks and two eggs. On July 6th there were five fledged coal tits, and I am not sure whether an egg has disappeared or one of the fledged had already gone away. One week later I returned but they were all gone.

Picture nº 13: *Image of the chicks of a Coal tit in one of my nest boxes in Catalonia.*

6.2.1 Feeding

The nutrition of the European roller is based on medium sized terrestrial invertebrates. The bird uses a clear vantage point, such as electric cables, to detect the preys. The areas where they catch their prey are at a relatively short distance from the nests. The average distance of alimentation from the nest is 165 meters and most feeding flights occur in an area of less than 100 meters radius around the nest.

The species of insects that that contribute to the nest are mostly beetles, but I have also observed that they also fed the chicks with crickets, grasshoppers or centipedes.

The diet of the Eurasian scops owl is very similar to that of the roller, although the scops owl also attacks tawny passerine birds like goldfinches and chickadees and eats larger insects and small rodents.

From the pellets that expel these two types of birds that can be analyzed inside the boxes, one can easily infer their diet.

6.2.2 Amount of eggs and final individuals

The number of eggs detected and the actual births and maturing individuals achieved were very positive. Both types of birds placed a number of eggs similar to the expected average.

The roller often puts between 4 and 5 eggs, but rarely all the chicks get to fly. Incubation lasts between 17 and 20 days and the newborn chicks don't have any feather. They leave the nest at between 25 and 30 days of age, but they are still fed by their parents for at least three more weeks.

In two of my three nest boxes where the European roller nested the results were similar to the provisions. There were 5 eggs in both and all individuals matured until could fly. Only in one box, likely due to the excessive amount of parasites, there were only two eggs nest and just one of them gave rise to a mature fledged.

The scops owl usually puts between 3 and 6 eggs, and the incubation lasts 21 to 29 days. They also leave the nest at around 25 to 30 days of age, but they also continue to be fed by their parents for more than three weeks. In the two nest boxes in which the Eurasian scops owl nested, there were a total of 5 eggs. While the entire process was

completed in one of the nests with normal growth and maturation until leaving the nest of all the chicks, all the eggs were abandoned without completing the incubation in the other nest box for unknown reasons.

Picture nº 14: *Image of the eggs of an European roller in one of my nest boxes in Aragon.*

Picture nº 15: *Image of the fledged coal tits.*

6.2.3 Competitors for the nests

During the needing process there were two competitors. One is the coal that has nested in one of the boxes in Catalonia at the murtra. The other competitor is the Western Jackdaw that hasn't nested in one of the boxes located at Barbastro in Aragon and had prevented the entry of another bird.

Coal tit	Western jackdaw

Picture nº 16: *Image of a coal tit*

Picture nº 17: *Image of a western jackdaw*

6.2.3.1 Coal tit

- **Description**

The Coal Tit is a small tit, in fact the smallest European tit. His upper parts are a olive-grey, the under parts buff colored. The crown and large bib are black, while the cheeks and nape are white and the legs are blue-grey.

The younger ones are browner above, and the under parts, cheeks, nape and wing bars are more yellow.

- **Habitat**

Coal Tits occur in all habitat types throughout Europe, however they do prefer conifers, pines, spruce woodlands, parks, gardens, farmland, hedgerows indeed any open country habitat with suitable scrub.

- **Reproduction**

The Coal Tit's small (15 mm by 12 mm) eggs are smooth and glossy, and white with reddish-brown speckles. The female incubates the eggs by herself. After the young hatch, they are fed by both parents.

Breeding Data				
Breeding Starts	Number of Clutches	Number of Eggs	Incubation (days)	Fledge (days)
mid-April	1-2	7-12	14-16	16-19

- **Diet**

Insects, beech mast and conifer seeds are among the Coal Tit's natural diet.

6.2.3.2 Western jackdaw

- **Description**

The western jackdaw (Corvus monedula), also known as the Eurasian jackdaw, European jackdaw, or simply jackdaw, is the smallest of all crows, measuring between 13 - 15 inches (34–39 centimeters) in length (including the tail).

The plumage is black or grayish black, except for the cheeks, neck and nape, which are light grey to grayish silver.

The adults have greyish white or silvery white eyes. The younger ones have light blue eyes.

- **Habitat**

Found across Europe, western Asia and North Africa, it is mostly resident, although northern and eastern populations migrate south in winter.

- **Reproduction**

Nests are constructed in holes in rocks, trees or building.

The average clutch consists of 4 - 5 eggs which are incubated for 17 - 18 days. The young fledge when they are about 30 - 35 days old.

- **Diet**

They mostly take food from the ground but also forage in trees. They feed on insects and other invertebrates, weed seeds and grain, scraps of human food, stranded fish on the shore, and will also take food from bird tables.

6.3 Comparison of the two geographical areas

According to previous reports on the behavior of these bird species, the global results of my project were very good at both geographic zones. As expected given that it is the most abundant bird of the appropriate size in that area, the European roller was the bird that successfully nested in more nest boxes.

In Aragon, the European roller nested in 60% (3/5) of the boxes. However in Catalonia, no European roller entered in any of the boxes. This is due to the fact that the European Roller does not usually nest in humid territories and that is why we could not find it in the Baix Llobregat county of Catalonia.

In Catalonia, the Eurasian scops owl was the most abundant bird because it entered in three of the boxes. However, it nested in two of them but completed the process only in one due to the reasons commented above. The scops owl also nested in one of the boxes in Aragon. The difference might be due to the decreased competition for nest boxes in the region of Catalonia in the absence of European rollers compared to the region of Aragon.

In both regions there was a box occupied by another unexpected bird, a Western jackdaw in Barbastro, Aragon, and a Coal tit in Gavá, Catalonia. Therefore, in both zones there are additional bird species of appropriate size and skills to compete against the European roller and the Eurasian scops owl for the nest boxes, able to complete the nesting, mating and chick growing processes.

Finally, the global use of the nest boxes in Aragon was slightly higher than in Catalonia, where a higher rate or exploration without completing the nesting was observed. A possible reason for that small difference is the fact that boxes in Aragon were mainly placed in unpopulated field areas, quiet and relatively free of human activity, while boxes in Catalonia were placed in pine forests or parks inside cities where birds could more easily feel disturbed and try to escape to more quiet places.

7 Factual information

A factual sheet as the one below was filled out for each nest box:

FACTUAL INFORMATION				
NEST	**YEAR**	**ACTIVITY**	**LOCATION**	**SPECIES**
	2015	□NO □YES		

LOCATION AND DESCRIPTION OF THE NEST		
SITUATION	**COOR**	**ORIENTED TO**
	□Artificial	□ NW □ W □ SW □ N □ NE □ E □ SW □ S

OBSERVATION			ACTIVITY					NUMBER			
Nº	**DATE**	**TIME**	**OCCUPIED**	**EGGS**	**CHICKS**	**FLEDGED**	**NOTHING**	**EGGS**	**ALIVE CHICKS**	**DEAD CHICKS**	**FLEDGED**
1			□	□	□	□	□				
2			□	□	□	□	□				
3			□	□	□	□	□				
4			□	□	□	□	□				
5			□	□	□	□	□				
6			□	□	□	□	□				

NESTS RESULTS	
GOOD	**BAD**
□ there is fledged	□parasitized nest □abandoned nest

7.1 Catalonia

FACTUAL INFORMATION				
NEST	**YEAR**	**ACTIVITY**	**LOCATION**	**SPECIES**
1	2015	□NO ☒YES	**Murtra of Gava Mar**	Coal tit

LOCATION AND DESCRIPTION OF THE NEST		
SITUATION	**COOR**	**ORIENTED TO**
Pine tree	☒Artificial	☒NW □ W □ SW □ N □ NE □ E □ SW □ S

OBSERVATION			ACTIVITY					NUMBER			
Nº	**DATE**	**TIME**	**OCCUPIED**	**EGGS**	**CHICKS**	**FLEDGED**	**NOTHING**	**EGGS**	**ALIVE CHICKS**	**DEAD CHICKS**	**FLEDGED**
1	3/5		□	□	□	□	☒				
2	17/5		☒	□	□	□	□				
3	31/5		□	☒	☒	□	□	2	4		
4	18/6		□	□	□	☒	□				5
5	4/7	13:45	□	□	□	□	☒				
6			□	□	□	□	□				

NESTS RESULTS	
GOOD	**BAD**
☒there is fledged	□ parasitized nest □ abandoned nest

FACTUAL INFORMATION				
NEST	**YEAR**	**ACTIVITY**	**LOCATION**	**SPECIES**
2	2015	☒NO □YES	**Pine Forest of Gavà Mar**	Eurasian scops owl

LOCATION AND DESCRIPTION OF THE NEST		
SITUATION	**COOR**	**ORIENTED TO**
Pine tree	☒Artificial	☒NW □ W □ SW □ N □ NE □ E □ SW □ S

OBSERVATION			ACTIVITY					NUMBER			
Nº	**DATE**	**TIME**	**OCCUPIED**	**EGGS**	**CHICKS**	**FLEDGED**	**NOTHING**	**EGGS**	**ALIVE CHICKS**	**DEAD CHICKS**	**FLEDGED**
1	3/5		□	□	□	□	☒				
2	17/5		☒	□	□	□	□				
3	31/5		□	□	□	□	☒				
4	4/7	14:20	□	□	□	□	☒				
5			□	□	□	□	□				
6			□	□	□	□	□				

NESTS RESULTS	
GOOD	**BAD**
□ there is fledged	□ parasitized nest ☒ abandoned nest

FACTUAL INFORMATION				
NEST	**YEAR**	**ACTIVITY**	**LOCATION**	**SPECIES**
3	2015	□NO ☒YES	**Forest close to the venger in Gavà Mar**	Eurasian scops owl

LOCATION AND DESCRIPTION OF THE NEST		
SITUATION	**COOR**	**ORIENTED TO**
Pine tree	☒Artificial	☒NW □ W □ SW □ N □ NE □ E □ SW □ S

OBSERVATION			ACTIVITY					NUMBER			
Nº	**DATE**	**TIME**	**OCCUPIED**	**EGGS**	**CHICKS**	**FLEDGED**	**NOTHING**	**EGGS**	**ALIVE CHICKS**	**DEAD CHICKS**	**FLEDGED**
1	3/5		□	□	□	□	☒				
2	17/5		☒	□	□	□	□				
3	31/5		☒	□	□	□	□				
4	18/6		☒	□	□	□	□				
5	29/6		□	□	☒	☒	□		1		2
6	4/7	13:15	□	□	□	☒	□				1

NESTS RESULTS	
GOOD	**BAD**
☒there is fledged	□ parasitized nest □ abandoned nest

FACTUAL INFORMATION				
NEST	**YEAR**	**ACTIVITY**	**LOCATION**	**SPECIES**
4	2015	☒NO □YES	**Sentiu of Castelldefels**	

LOCATION AND DESCRIPTION OF THE NEST		
SITUATION	**COOR**	**ORIENTED TO**
Pine tree	☒Artificial	□ NW ☒W □ SW □ N □ NE □ E □ SW □ S

OBSERVATION			ACTIVITY					NUMBER			
Nº	**DATE**	**TIME**	**OCCUPIED**	**EGGS**	**CHICKS**	**FLEDGED**	**NOTHING**	**EGGS**	**ALIVE CHICKS**	**DEAD CHICKS**	**FLEDGED**
1	3/5		□	□	□	□	☒				
2	17/5		□	□	□	□	☒				
3	31/5		□	□	□	□	☒				
4	18/6		□	□	□	□	☒				
5	6/7		□	□	□	□	☒				
6			□	□	□	□	□				

NESTS RESULTS	
GOOD	**BAD**
□ there is fledged	□ parasitized nest ☒ abandoned nest

FACTUAL INFORMATION				
NEST	**YEAR**	**ACTIVITY**	**LOCATION**	**SPECIES**
5	2015	□NO ☒YES	**Polytechnic university of Catalonia**	Eurasian scops owl

LOCATION AND DESCRIPTION OF THE NEST		
SITUATION	**COOR**	**ORIENTED TO**
Oak tree	☒Artificial	□ NW □ W □ SW ☒ N □ NE □ E □ SW □ S

OBSERVATION			ACTIVITY					NUMBER			
Nº	**DATE**	**TIME**	**OCCUPIED**	**EGGS**	**CHICKS**	**FLEDGED**	**NOTHING**	**EGGS**	**ALIVE CHICKS**	**DEAD CHICKS**	**FLEDGED**
1	3/5		□	□	□	□	☒				
2	17/5		□	□	□	□	□				
3	31/5		☒	□	□	□	□				
4	29/6		□	☒	□	□	□	5			
5	6/7		□	☒	□	□	□	5			
6			□	□	□	□	□				

NESTS RESULTS	
GOOD	**BAD**
□ there is fledged	□ parasitized nest ☒ abandoned nest

7.2 Aragon

FACTUAL INFORMATION				
NEST	**YEAR**	**ACTIVITY**	**LOCATION**	**SPECIES**
1	2015	□NO ☒YES	**Almond-tree of Barbastro**	Eurasian scops owl

LOCATION AND DESCRIPTION OF THE NEST		
SITUATION	**COOR**	**ORIENTED TO**
Almond tree	☒Artificial	☒ NW □ W □ SW □ N □ NE □ E □ SW □ S

OBSERVATION			ACTIVITY					NUMBER			
Nº	**DATE**	**TIME**	**OCCUPIED**	**EGGS**	**CHICKS**	**FLEDGED**	**NOTHING**	**EGGS**	**ALIVE CHICKS**	**DEAD CHICKS**	**FLEDGED**
1	15/6		□	☒	□	□	□	5			
2	17/6		□	☒	□	□	□	4	1		
3	24/6		□	☒	☒	☒	□	1	1		3
4	30/6		□	□	☒	☒	□		1		4
5	3/7		□	□	□	☒	□				5
6	10/7		□	□	□	□	☒				0

NESTS RESULTS	
GOOD	**BAD**
☒ there is fledged	□ parasitized nest □ abandoned nest

FACTUAL INFORMATION				
NEST	**YEAR**	**ACTIVITY**	**LOCATION**	**SPECIES**
2	2015	□NO ☒YES	**Oak-tree of Barbastro**	Western jackdaw

LOCATION AND DESCRIPTION OF THE NEST		
SITUATION	**COOR**	**ORIENTED TO**
Oak tree	☒Artificial	□ NW ☒ W □ SW □ N □ NE □ E □ SW □ S

OBSERVATION			ACTIVITY					NUMBER			
Nº	**DATE**	**TIME**	**OCCUPIED**	**EGGS**	**CHICKS**	**FLEDGED**	**NOTHING**	**EGGS**	**ALIVE CHICKS**	**DEAD CHICKS**	**FLEDGED**
1	6/6		☒	□	□	□	□				
2	17/6		□	□	□	□	☒				
3	23/6		□	□	□	□	☒				
4	30/6		□	□	□	□	☒				
5			□	□	□	□	□				
6			□	□	□	□	□				

NESTS RESULTS	
GOOD	**BAD**
□ there is fledged	□ parasitized nest ☒ abandoned nest

FACTUAL INFORMATION				
NEST	**YEAR**	**ACTIVITY**	**LOCATION**	**SPECIES**
3	2015	□NO ☒YES	**Almond-tree of Berbegal**	European roller

LOCATION AND DESCRIPTION OF THE NEST		
SITUATION	**COOR**	**ORIENTED TO**
Almond tree	☒Artificial	□ NW □ W □ SW ☒N □ NE □ E □ SW □ S

OBSERVATION			ACTIVITY					NUMBER			
Nº	**DATE**	**TIME**	**OCCUPIED**	**EGGS**	**CHICKS**	**FLEDGED**	**NOTHING**	**EGGS**	**ALIVE CHICKS**	**DEAD CHICKS**	**FLEDGED**
1	6/6		☒	□	□	□	□				
2	17/6		□	☒	□	□	□	2			
3	24/6		□	☒	☒	□	□	1	1		
4	30/6		□	☒	□	☒	□	1			1
5	3/7		□	☒	□	☒	□	1			1
6	10/7		□	☒	□	□	□	1			0

NESTS RESULTS	
GOOD	**BAD**
☒ there is fledged	☒ parasitized nest □ abandoned nest

FACTUAL INFORMATION				
NEST	**YEAR**	**ACTIVITY**	**LOCATION**	**SPECIES**
4	2015	□NO ☒YES	**Holm oak of Berbegal 1**	European roller

LOCATION AND DESCRIPTION OF THE NEST		
SITUATION	**COOR**	**ORIENTED TO**
Holm tree	☒Artificial	☒ NW □ W □ SW □ N □ NE □ E □ SW □ S

OBSERVATION			ACTIVITY					NUMBER			
Nº	**DATE**	**TIME**	**OCCUPIED**	**EGGS**	**CHICKS**	**FLEDGED**	**NOTHING**	**EGGS**	**ALIVE CHICKS**	**DEAD CHICKS**	**FLEDGED**
1	6/6		☒	□	□	□	□				
2	20/6		□	☒	□	□	□	5			
3	24/6		□	☒	☒	□	□	1	4		
4	30/6		□	□	☒	☒	□		1		4
5	3/7		□	□	□	☒	□				5
6	10/7		□	□	□	☒	□				4

NESTS RESULTS	
GOOD	**BAD**
☒ there is fledged	□ parasitized nest □ abandoned nest

FACTUAL INFORMATION				
NEST	**YEAR**	**ACTIVITY**	**LOCATION**	**SPECIES**
5	2015	□NO ☒YES	**Holm oak of Berbegal 2**	European roller

LOCATION AND DESCRIPTION OF THE NEST		
SITUATION	**COOR**	**ORIENTED TO**
Holm oak	☒Artificial	☒ NW □ W □ SW □ N □ NE □ E □ SW □ S

OBSERVATION			ACTIVITY					NUMBER			
Nº	**DATE**	**TIME**	**OCCUPIED**	**EGGS**	**CHICKS**	**FLEDGED**	**NOTHING**	**EGGS**	**ALIVE CHICKS**	**DEAD CHICKS**	**FLEDGED**
1	15/6	18	☒	□	□	□	□				
2	20/6		□	☒	□	□	□	5			
3	24/6		□	□	☒	□	□		5		
4	30/6		□	□	☒	☒	□		1		4
5	4/7		□	□	□	☒	□				5
6			□	□	□	□	□				

NESTS RESULTS	
GOOD	**BAD**
☒ there is fledged	☒ parasitized nest □ abandoned nest

8 Conclusions

A review of the published information indicates that the European roller and the Eurasian scops owl are endangered species that migrate for nesting to similar latitudes of the Iberian peninsula (among other countries) and that share features that could benefit from programs helping with the nesting process, such as the use of nest boxes.

A high success rate has been obtained using nest boxes in two selected geographical areas during the spring and summer season. The occupancy has been high and the nesting process has been observed for the two expected and desired bird species (three nests with European rollers and two with Eurasian scops owls) as well as for two additional unexpected species (one Western jackdaw and one Coal tit). The data generated, along with the intensive monitoring during egg incubation and early postnatal development, contribute to the knowledge of the behavior and life cycle of these species.

Some parasites, mostly large insects with saprophagous feeding (waste from other sources, such as leaves, dead bodies or excrements) that usually lives in the bark of trees, can affect bird nesting, egg incubation, chick growing and maturation. At least three nest boxes were significantly affected by parasites (30%), causing relevant troubles in two of them.

The data clearly suggest that nest boxes, such as the ones used in this project, are very useful and easy to provide tools to facilitate the adaptation to the current environment for these bird species, then helping in the preservation of endangered species and providing important information for research.

A comparison in nesting and occupancy between the two different areas revealed significant differences, despite the small numbers. These differences can be mostly due to the weather and humidity conditions (with the presence of the European roller only in drier environments of Aragon), the presence of other birds acting as competitors for the nests, and to the variable safety and quietness of the environment in rural or closer to populated areas. The difference in human activity in the areas where the boxes were located might have led to interruptions of the nesting process more often in Catalonia.

Finally, nest boxes are also an excellent tool to explore the alimentation of the different birds and their chicks in the two geographical areas. From the pellets that expel and can be analyzed inside the boxes, one can easily infer their diet. Although the diets of the Eurasian scops owl and the European roller are similar, the remains of the scops owl also detect larger insects and other animals such as mice. The comparison of the scops owls in the areas of Aragon and Catalonia suggested a higher variety of foods in Aragon than in Catalonia.

9 Bibliography

Asociación de estudios ornitológicos de El Bierzo. Tyto Alba. <http://www.tytoalba.es>, {20.06.2015}

Enciclopedia virtual de los vertebrados españoles. Carraca europea - Coracias garrulus <http://www.vertebradosibericos.org/aves/trofico/corgartr.html>,{30.10.2015}

Fichas de aves del parque natural "sierra de baza". La carraca (Coracias garrulus) <http://www.sierradebaza.org/Fichas_fauna/00_Aves/07-12_carraca/carraca.htm>, {30.10.2015}

Migracion de las aves. La carraca europea. <http://www.migraciondeaves.org/datos_especie.php?open=3710>, {20.06.2015}

Quercus. Ventajas e inconvenientes de las cajas-nido para las carracas <http://www.revistaquercus.es/noticia/5378/articulos-de-fondo/ventajas-e-inconvenientes-de--las-cajas-nido-para-las-carracas-.html>,{30.10.2015}

SEO/BirdLife. Cajas Nido. <http://www.seo.org/media/docs/cajasnido2.pdf>, {08.07.2015}

SEO/BirdLife. Autillo Europeo.<http://www.seo.org/ave/autillo-europeo>,{08.07.2015}

The Cornell Lab of Ornithology. All About Birds. http://www.allaboutbirds.org, {05.09.2015}

The Cornell Lab of Ornithology. *Nest Watch*. < http://nestwatch.org>,{05.09.2015}

TORRE, Ignasi. *Els ocells de l'Olla del Rei*. Castelldefels: Campus Universitari del Baix Llobregat, desembre 2011

Wikipedia. Coracias Garrulus .https://es.wikipedia.org/wiki/Coracias_garrulus, {20.06.2015}

Wikipedia. Otus Scops. https://es.wikipedia.org/wiki/Otus_scops,{20.06.2015}

10 Annex

Picture nº 18: *Image of the fledged Eurasian scops owls.*

Picture nº 19: *Image of me looking in the nest box situated in the murtra.*

Picture nº 20: *Image of fledged European rollers with the big red ants.*

Picture nº 21: *Image of me looking the fledged European rollers.*

Picture nº 22: *Image of the chicks and the egg of an European roller in the holm oak of Berbergal.1*

Picture nº 23: *Image of the chicks of an Eurasian scops owl.*