



Department of the Environment,
Heritage and Climate Change

HM Government of Gibraltar



PLANNING FOR BIODIVERSITY

Urban Wildlife Conservation Guide

Version 1

Contents

Urban Wildlife Conservation.....	4
Swifts & Bats in our Community	6
Our Swifts.....	8
Our Bats	12
Protected by Law	20
Planning Applications.....	21
Creating Homes for Swifts	23
Built-in Nesting Places – Solid Walls	23
Built-in Nesting Places – Existing ‘open’ eaves	27
Built-in Nesting Places – New eaves	28
Retro-Fit Nesting Boxes.....	30
Nests for Swifts	31
Swifts – Nesting Conditions: Key Considerations & Requirements.....	32
Department’s Wildlife Cameras.....	34
Other Bird Species.....	35
Starlings.....	35
Blue Tits.....	37
Great Tits.....	39
Sparrows	40
Blackbirds.....	41

Provision of Bird Feeders and Baths	42
Bird Feeders	44
Birdbaths	44
Creating Homes for Bats	46
Ready Assembled Boxes	47
Woodcrete Boxes	47
Wooden Boxes	49
Integrated Bat Boxes	50
Roosting Conditions	52
Crevice-Dwelling Bats – Considerations & Key Requirements	54
Where could bats be roosting?	55
How much provision is enough?	56
Importance of Insects	57
Insect Boxes	58
Green roofs, brown roofs and living walls	60
Green roofs	60
Benefits of green roofs	63
Brown roofs	64
Solar Panels and Green Roofs	66
Benefits of living walls	68
Types of living wall	69
Considerations in the use of living walls	70
Ladder planters, pots and hanging plants	72

Benefits of installing nest boxes & creating green spaces....	74
Bibliography	76

Urban Wildlife Conservation

Historically, cities and urban areas have been perceived as places for people and not animals. Paradoxically, though, many species of wildlife thrive in built environments. More recently, growing interest in urban wildlife has inspired many studies on the subject; proposing means to create physical and social environments that are mutually beneficial for both humans and wildlife.

Protecting and restoring wildlife habitat in our cities is a vital component of wildlife conservation and there are lots of reasons why we should support urban biodiversity. On a practical side, these plants and animals provide ecosystem services like photosynthesis, decomposition, control of pests, and the processing of air and water pollution. They also provide recreational, aesthetic, and spiritual value; many city dwellers appreciate living within a greener environment. There's also something to be said for the intrinsic rights of these living creatures to exist in these places; especially considering they were here before we were.

People in much of the world live in cities or on the fringes of development. In these heavily modified landscapes, it can be challenging for people to experience more pristine ecosystems. Public parks and open spaces not only support habitat connectivity within ecological landscapes and serve as a refuge for species impacted by urbanisation, but also expose people to nature in their own backyards, potentially broadening support for conservation on a much larger scale.

Swifts & Bats in our Community

Swifts and bats are an important part of Gibraltar's urban wildlife and local environment. Unfortunately, local populations have declined as a result of habitat loss, fragmentation and degradation.

This guide aims to raise awareness about their plight, their importance and value to our environment and how we can help protect them, as well as, our other urban wildlife, including species such as Starlings, Blue-tits and invertebrates; and how to improve our urban environment through the creation of green roofs and living walls.

So why conserve swifts and bats? First and foremost, for a reason we do not see stated as often as we should in conservation arguments: simply because they are, like all other organisms, part of our rich environment. They are part of our global ecosystem, with a part to play in its continuing evolution and it is our responsibility to conserve them.

As a bonus, unknown to many, swifts and bats provide us

with many valuable ecosystems services, including pest control. One bat can eat between 600-1000 mosquitos and other insects in just one hour and just one pair of adult swifts and their young can consume over 12,000 insects in a day!



Our Swifts

Belonging to the extensive Apodidae family, two species of swifts can be found locally in urban areas; the dark, almost black Common Swift *Apus apus* and the paler, dark brown Pallid Swift *Apus pallidus*.

Another difference to help distinguish them is the Pallid Swift's larger white throat patch.



Swift *Apus apus*



Pallid Swift *Apus pallidus*

The pallid swift is a small, highly aerial bird with a forked tail and crescent-shaped wings. Its name comes from the Latin word 'apous' meaning 'without feet', which actually refers to its very short legs, and the word 'pallidus' meaning 'pale', in reference to the greyish buff-brown plumage.

The most aerial of birds, the common swift (*Apus apus*) is renowned for its amazing flying ability, with a life spent almost entirely on the wing. Swifts are unique in their ability to stay airborne for extended periods, spending up to nine months aloft outside the breeding season. Swifts perform most activities in the air, including feeding, preening,

sleeping and mating and, in fact, only land to feed their young or roost.

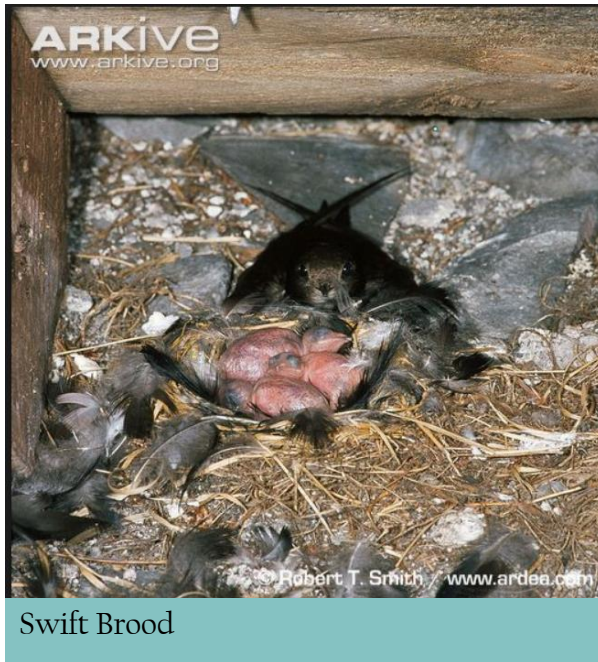
Both species spend the winter in Africa. The Pallid Swifts return to Gibraltar as early as February, whilst the Common Swifts return in April.

Swifts are naturally cliff species but they have adapted to living in our urban environment, occupying roofs, eaves and other crevices of existing buildings. The Pallid Swift can also establish nests in cliffs and caves; whereas the Common Swift is restricted to human structures and rarely trees.

Older, traditional buildings were largely comprised of materials such as timber beams. These structures are popular among Swifts, because gaps can be found underneath the eaves, and wear and tear on the building makes the presence of holes and openings for them to nest in more likely.

However, the modernisation of building design, with sealed roofs and walls, is having a significant impact on population numbers as a result of the loss of suitable nesting sites.

Common Swifts raise one brood of 2-3 young and have left Gibraltar by mid-July; whereas Pallid Swifts generally raise two broods and may still be around in October.



Our Bats

There are over 1,200 species of bats worldwide; which make up a fifth of all mammal species. Globally, bats play a vital role in our environment, being responsible for seed dispersal, pollination and pest control. Sadly, approximately 25% of the world's bats are threatened with extinction.

Bats, order Chiroptera, are truly unique species being the only flying mammals in the world. Around 70% of bats are insectivores (eat insects), with the remainder being made up of frugivores (fruit eaters), fish eaters and the well-known vampire bats, that are hematophagous and feed on blood. All bats in Gibraltar are insectivores; feeding on mosquitoes, moths and other flying invertebrates.

Gibraltar's location at the south-western tip of Europe, means it is ideally situated to have both European and African bat species; which are present at different times of the year.

As of 2017 there are eight different species of bats known to

occur in Gibraltar:

- Common Pipistrelle Bat (*Pipistrellus Pipistrellus*).
- Soprano Pipistrelle Bat (*Pipistrellus pygmaeus*).
- Kuhl's Pipistrelle Bat (*Pipistrellus kuhlii*).
- Schreiber's Bat (*Miniopterus schreibersii*).
- Isabelline Serotine Bat (*Eptesicus isabellinus*).
- Greater Horseshoe Bat (*Rhinolophus ferrumequinum*).
- European Free-tailed Bat (*Tadarida teniotis*).
- Greater Noctule Bat (*Nyctalus lasiopterus*).

Pipistrelle Bats

Locally we have three species: the Soprano Pipistrelle, the Common Pipistrelle and the Kuhl's Pipistrelle. These are our smallest bats, weighing only 4-7g, with a wingspan of around 18-22cm.



(c) 2006 <http://markus.nolf.org>

Common Pipistrelle *Pipistrellus pipistellus*

Mainly found in urban environments, pipistrelles are considered to be quite an adaptable species, often found in a wide variety of areas within built up environments. Pipistrelles are the most abundant group of bats in Gibraltar, with the Soprano Pipistrelle being the most common; their numbers peaking during the summer months.

The Schreibers Bat

This bat is one of our rarest bats and is considered Near Threatened under the IUCN Red List of Threatened Species. They are found in caves and

have a wingspan of around 25-30cm.



They forage in a variety of open and semi-open natural and artificial habitats, including suburban areas. They feed mainly on moths, and occasionally on flies and spiders. It is a colonial species that roosts almost exclusively in caves and tunnels. They're known to be long distance travellers with typical migration ranges of 40-100 km.

Isabelline Serotine Bat

In 2013 a new species of bat was identified in Gibraltar, the Isabelline Serotine Bat. The discovery

of this bat is great news and opens the possibility for other unrecorded species of bats residing locally.



Isabelline Serotine Bat *Eptesicus Isabellinus*

Although considered a crevice dweller, it can also be found roosting in buildings. The species favours habitats with dense vegetation and access to areas of water.

European Free Tailed Bat

The European Free-Tailed Bat is a fairly common bat in Gibraltar. It is the second largest bat in Europe and lives in cracks within our limestone cliffs and caves.



European Free-Tailed Bat *Tadarida teniotis*

It is thought they arrive on the Rock around February, spending the spring and summer months for the maternity season and leaving again in September/October.

Greater Noctule Bat

The Greater Noctule Bat is Europe's largest and rarest bat, considered Vulnerable under the IUCN Red List of threatened species. It is primarily an arboreal species and is one of the few bat species to feed on passerine birds.



Greater Noctule Bat *Nyctalus Lasiopterus*

Bats are intelligent, social mammals, with some species often gathering together in groups to roost and can live for up to 30 years. They sleep in the day and feed during the night, locating their prey by echolocation.

Unfortunately, recent research has shown a huge plummet in bat numbers using the Rock since the 1960's; as well as the disappearance of certain species including *Myotis myotis*, *Plecotus auritus*, *Barbastella barbastellus* and *Rhinolophus sp.* This has been attributed to factors such as urbanisation, light pollution, habitat loss, lack of adequate roosts, overgrown vegetation, loss of water sources and human

disturbance.

This guide aims to stem the loss of nest sites, for both swifts and bats, and other local species, by providing guidance on ways in which we can incorporate nest boxes both into the building design and retrospectively, and improve their urban habitat.

Protected by Law

Swifts and bats are protected by law under the Nature Protection Act 1991; **it is an offence to kill, injure, take or destroy nests/ roosts and their eggs/ young, or to deliberately disturb** them particularly during the period of breeding and rearing. Offences under this Act are liable to a maximum £10,000 fine and/or 2 year's imprisonment.

If protected species are known (or suspected) to use a building (even occasionally) where refurbishment is to take place then the Department of the Environment and Climate Change must be consulted regarding the need to survey the premises **prior** to the commencement of any works.

If a protected species is discovered during building works, then work must stop **immediately** and the Department of the Environment and Climate Change must be consulted at Tel. 20048450 or info.environment@gibraltar.gov.gi for advice prior to the re-commencement of any works. In the event of an emergency or after hours contact Tel: 58009620.

Planning Applications

The construction of new buildings or alterations to existing buildings provide the opportunity to implement many of the measures outlined in this guide. As new buildings and alterations will normally need planning permission, a planning application needs to be submitted to obtain planning permission before any works can commence.

The information in this guide should be considered by applicants and their architects at the earliest possible opportunity in the development of their designs to ensure that biodiversity is planned into their developments. This is important because the Development and Planning Commission (DPC), the decision making body for planning applications, encourages appropriate provision to be made in developments for biodiversity and will expect to see this when an application is submitted.

Even if applicants and architects do not include any provision, or do not include sufficient provision, the DPC is likely to require it before granting planning permission or by including

it as a planning condition. The DPC will frequently require the provision of green or brown roofs, the need for bat and swift surveys to be carried out, the provision of bat and swift boxes or nesting boxes for other bird species.

By taking account of the guidance in this guide and including details of the provision to be made in the plans they submit for planning permission, applicants and architects can reduce the chance of their applications being delayed due to a failure to meet the DPC's expectations in relation to making suitable provision for biodiversity.

Creating Homes for Swifts

In order to breed, Swifts need access to a space within buildings where they can construct their simple nest.

Built-in Nesting Places – Solid Walls

When creating the perfect nesting site for Swifts, the most recommended approach to do this, is the “in built” approach. This method involves the creation of nesting places within the walls of buildings. This technique helps to ensure longevity of the nest site, as it is sheltered from the weather, offers safety for Swifts from predators and requires minimal maintenance if any.

© Northern Ireland Swift Group



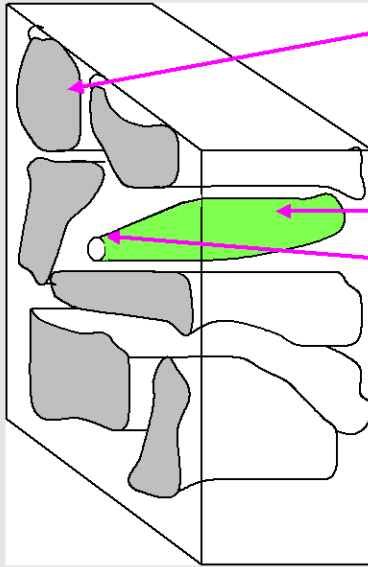
© Action for Swifts



Solid walls are typically built of stones, rubble and mortar, or reinforced concrete, which is sometimes finished with a coat of mortar on the façade. Drilling out spaces, within these walls, however, could be a perfect place to home some Swifts in the local area.

As depicted in the following diagrams and instructions, nesting cavities can be created through the insertion of polystyrene plugs, terracotta or plastic pipes, and brick facings. When doing this however, the strict instructions outlined should be adhered to ensure health and safety standards are met, as well as creating appealing nest sites for Swifts.

Using polystyrene plugs to create nest cavities



This wall is made of large stones and mortar. Swifts nest naturally in crevices and holes in these sort of walls.

Engineering advice will be needed before commencing work to ensure that the wall's strength remains adequate.

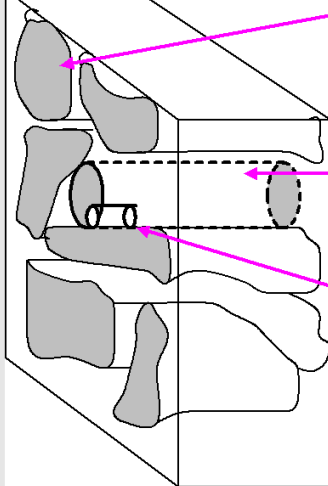
To create a nest space a polystyrene "bottle" or plug is cemented in to the wall under a load bearing stone. Minimum size is 30cm long, 15cm wide with a 5 cm "neck" entrance.

The plug is cemented in, and after setting is completely removed with a drill, and the hole then becomes available to Swifts as a nest space.

The plug should be inserted slightly "uphill" to permit natural drainage of any rain that might enter during storms.

Using terracotta or plastic pipes to create nest places

© Swift Conservation



This wall is made of large stones and mortar. Swifts nest naturally in crevices and holes in these sort of walls.

Engineering advice will be needed before commencing work to ensure that the wall's strength remains adequate.

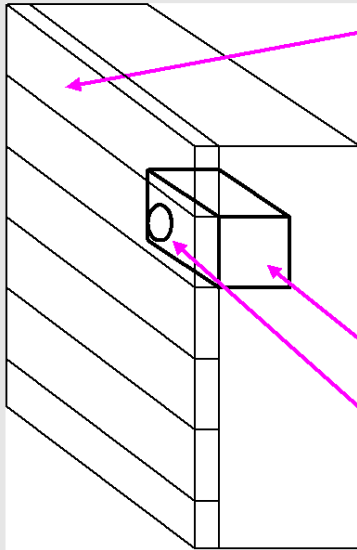
To create a nest space a hole is drilled deep into the wall, and a terracotta or plastic pipe, minimum dimensions 15cm wide x 30 to 40cm long, is cemented in.

The pipe should be inserted slightly "uphill" to permit natural drainage of any rain that might enter during storms.

A short piece of pipe, 5 - 6cm wide, and up to 10cm long, may be inserted into the entrance and the rest blanked off with cement or a piece of tile, to exclude pigeons.

This sort of installation can also be considered for concrete walls.

Making a nest space behind stone or brick facings



This wall is made of a rubble or brick or concrete core with a stone sheet (it could be fine brick) facing.

Swifts will nest naturally in this sort of wall only if it is in very poor condition, with holes and crevices they can access.

Engineering advice will be needed before commencing work to ensure that the wall's strength remains adequate.

To create a nest space, a hole (size 30 to 40cm wide x 15 to 20cm deep) is cut into the wall, before the facing sheet or brick is fitted, and then either left as it is, or else a Swift Brick is installed, flush with the underlying surface.

The next step is to cut a 5 to 6cm hole in the facing piece with a diamond core drill, and then fit it as shown over the hole, or else in line with the entrance hole to the Swift Brick.

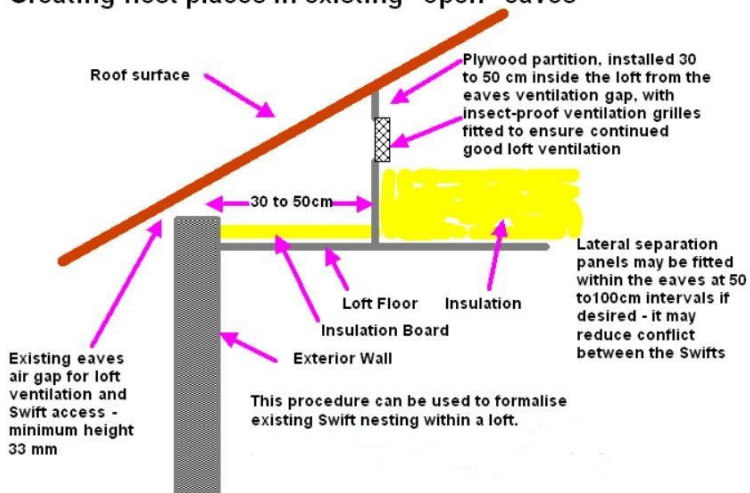
Built-in Nesting Places – Existing ‘open’ eaves

When looking to adopt a built-in approach for the creation of Swift nesting places, one of the ways this can be done is through the use of existing “open” eaves which are either already being occupied by Swifts or have the potential to be in future.

This method is ideal as it allows existing areas to be adapted to make them more effective and efficient for both humans and Swifts.

As demonstrated in the following diagram, the process would involve the implementation of a simple plywood partition, along with insect-proof ventilation grille, which will limit access of Swifts to only a small area of the loft space, whilst still providing healthy ventilation and insulation to make it comfortable for them to create a nest in.

Creating nest places in existing "open" eaves



© Swift Conservation

It is vital that the Swifts do not come into contact with any form of loose fibre or particulate insulation material as this is known to injure them and may prove fatal.

Built-in Nesting Places – New eaves

For the creation of boxed eaves as nesting places, materials such as timber metal, plastic or wood, can all be easily used to do this and, where it is practical to do so, this is always a cheaper and better option to fitting in commercial nest boxes.



Eaves nest box – offering multiple nest places.

© Swift Conservation

Holes can be drilled along the underside or front face of these boxed eaves to allow access for swifts. However partitions should always be incorporated within this to section off entry points and prevent Swifts fighting.

This approach offers the benefit that it can be easily adapted to suit a very wide range of pitched and flat-roofed buildings, provided they have overhanging eaves and these are 5 metres or more above ground.

Retro-Fit Nesting Boxes

Alternatively, it is also possible to create nesting places through the retro-fitting of Swift boxes, which are commercially available in a variety of materials. These can be installed in a number of ways and offer a simple solution that requires no changes to the existing building.

Although both approaches are different, the conditions required to make these nesting places attractive to Swifts are the same in order to help ensure success.

Examples of Swift boxes installed by the Department of the Environment and Climate Change at St. Bernard's Hospital and Duke of Kent House.





Nests for Swifts

As discussed Swift nests can be built into both existing and new buildings or installed in the form of ready-made nest boxes. Whichever approach you decide to take there are a number of factors to consider when assessing potential nesting sites.

Swifts – Nesting Conditions: Key Considerations & Requirements

Consideration	Solution
Where in a development	Anywhere high, preferably shaded and away from disturbance and obstructions to their flight paths.
Where in a building	<p>Out of direct sunlight, such as under deep eaves or an aspect of the building that does not receive much direct sunlight, in order to avoid overheating.</p> <p>Not adjacent to climbing plants or walls that may give predators, such as rats or cats, access to the nest.</p> <p>Where the swifts will have clear airspace into which they can fly from their nests.</p> <p>Preferably integral to the building, but where this is not possible, external under the eaves, under roof edges and gables. It is important to have several potential nest sites for swifts in one area.</p> <p>Levels of insulation and ventilation when considering a built in solution should be assessed to make sure conditions are favourable.</p>
Height	At least 5m.
Dimensions	400mm (w) x 200mm (d) x 175mm (h) ideally, but can be smaller (minimum 300mm wide by 400mm long by 150- 200 mm high).
Access Dimensions	Entrance hole 65mm (w) x 33mm (h) oval or rectangle. The bottom of the hole should be no

	more than 5cm from base of box.
Numbers	<p>Swifts are colonial nesters, so, where room allows, it is preferable to have more than one swift nest incorporated into a building. As a starting guide:</p> <ul style="list-style-type: none"> ● 2 to 4 nest provisions on a house. ● 4 to 10 on a small block of flats. ● 10 to 20 on a larger building, e.g. offices or industrial site. <p>These figures may vary on a site-by-site basis, dependent on site-specific constraints and criteria. To help establish a new colony, playing recorded swift calls can attract them to the new nest sites.</p>

As swifts like to nest within a space or cavity, their presence as a nesting bird is not always obvious; therefore it is important that those involved in the building's maintenance are aware of areas used for nesting.

Further reading:

<http://actionforswifts.blogspot.co.uk/>

<http://www.swift-conservation.org/>

Department's Wildlife Cameras

If interested in learning more about the fascinating lives of these birds and their nesting habitats, log on to our live-feed cameras at the DEHCC's Thinking Green website www.thinkinggreen.gov.gj; where you'll be able to follow the development of these swifts from eggs to fledging, during the nesting season.



Other Bird Species

Gibraltar boasts an impressive diversity of birds; largely as a result of its geographical position which is an important area for migrating birds in Western Europe.

Other than Swifts, we can help protect other local species, including Spotless Starlings, Blue Tits, Blackbirds, Sparrows, etc., by providing nest boxes and feeders for them also.

Starlings

Starlings are adept at exploiting urban, suburban and agricultural settings. They are one of only a few birds that tolerate areas of high population density and disturbance.

The Spotless Starling (*Sturnus unicolor*) found locally is closely related to the Common Starling (*S. vulgaris*) but has a much more restricted range, confined to the Iberian Peninsula, northwest Africa, southernmost France, and on the islands of Sicily, Sardinia and Corsica; and is largely non-migratory.



The Spotless Starling is an omnivore, feeding on a wide variety of invertebrates, berries and human-provided scraps. Like most starlings, it is a hole-nesting species, breeding in tree holes, buildings and in cliff crevices. It typically lays three to five eggs and has 1-2 broods per year.

As its name implies, it has less spotting on its plumage, and darker oily-looking black plumage, slightly purple- or green-glossed in bright light. Juveniles are dull brown.



Starling boxes installed by the Department of the Environment and Climate Change at the Dementia Care Centre.

Blue Tits



© Francis C. Franklin

Blue tits range throughout Europe. They inhabit deciduous and mixed woodland, gardens and parks. They nest within holes in trees and buildings and readily use nest boxes.

They feed on small insects, spiders, fruits, seeds and nectar. The female lays 7-13 eggs in April-May, which she incubates for 12-16 days and the chicks fledge after 19 days.



Blue tit boxes installed by the Department of the Environment and Climate Change on the fringe of Commonwealth Park.

Great Tits



Great tits are green and yellow with a striking glossy black head and white cheeks. It is a woodland bird which has adapted to man-made habitats. They are rarer in Gibraltar than Blue Tits and some what larger but share similar habits.

Sparrows



The ubiquitous House Sparrow is the most common bird associated with urban areas. Sparrows are small passerine birds. They tend to be small, plump, brown or grey birds with short tails and short powerful beaks. Sparrows are seed-eaters but they also consume small insects.

There are 35 species worldwide; 3 of which occur in Gibraltar: the House Sparrow, the Spanish Sparrow and the Eurasian Tree Sparrow. Only the House Sparrow nests in Gibraltar; the other two species occur occasionally.

Blackbirds

The Common blackbird (*Turdus merula*) is omnivorous, eating a wide range of insects, earthworms, seeds and berries.

In urban areas the main predator of the common blackbird is the domestic cat, with newly fledged young especially vulnerable.



© PierreSelim

Provision of Bird Feeders and Baths

This guide has highlighted just a few bird species that are present in Gibraltar but there are hundreds more which would benefit from additional sources of food and drinking water, especially, wintering birds such as Robins, Green Finches, Chiffchaffs, Blackcaps, Siskins and Chaffinches.



© Emy J Skylark

Robin



© David Chapman

Greenfinch



© Clive Finlayson

Chiffchaff



Blackcap



© John Caddick

Siskin



gray clements

Chaffinch

Bird Feeders

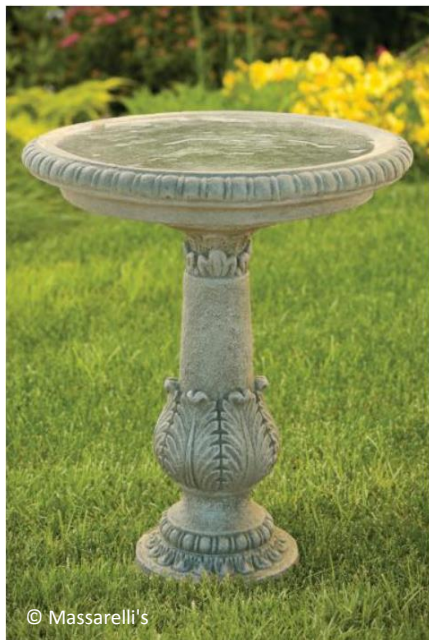
Feeders can help birds survive, especially when food is scarce. They can help compensate for habitat loss and climate change and can also help birds during migration.



Birdbaths

Birdbaths provide a safe place for wild birds to bathe and keep their feathers clean, helping to maintain healthy skin and plumage; as well as a reliable source of clean drinking water. This is especially important in Gibraltar's dry summers.

They have the added benefit of drawing a variety of birds to your garden or terrace!



© Massarelli's

Creating Homes for Bats

In Gibraltar, natural bat roosts can vary extensively in location from caves and crevices in the limestone cliffs, to tree holes and gaps in buildings. Bats have been well known to occupy roof spaces in buildings, as long as they offer a suitable environment, i.e. protection from light, noise and changing weather conditions.

As is the case with Swifts, changes in construction practices and development, have resulted in a gradual loss of suitable sites. The installation of bat boxes can offer a solution for the creation of roosts.

Bats need different roosting conditions at different times of the year and they will often move around to find a roost that meets their needs. For several weeks in summer, female bats gather in a maternity roost to have their babies. In winter, bats use hibernation roosts.

Bat boxes are made of numerous materials as required; such as untreated wood, woodcrete, brick or stone. Popular

choices are wood and woodcrete and these are typically mounted on either walls or trees in areas. Alternatively, integrated bat boxes can also be built into the walls and facade of a building.

Bats are biodiversity indicators. Having a bat roost in your building or surrounding area is a sign of a healthy green environment. Making space for bats is an important conservation action.

Ready Assembled Boxes

Woodcrete Boxes

Woodcrete is a mixture of wood and concrete typically used in the construction of bat boxes because of the thermally stable properties it has to offer for occupying roosts. It is a durable material providing longevity and requiring little maintenance. Bat boxes such as these are often available in two forms;

1. Cylindrical with an access hole in the front and designed to be hung on a tree branch with a wire loop.
2. Brick-shaped, usually with narrow roosting crevices

inside and an entry slit at the bottom, designed to be fixed to trees or flat surfaces such as walls of buildings.



When purchasing boxes such as these, it is recommended that one with an entrance slit along the bottom be bought so that accumulated bat waste can drop out of the box or be pushed out as bats emerge. Otherwise, bat boxes with entrance holes in the middle will need to be cleaned regularly.

Wooden Boxes

Wooden bat boxes have always been the most popular types of boxes used when trying to attract a roost to your local area. Typically cubic or wedged in shape, these boxes can last up to ten years, be bought ready-made, or made from scratch.



Key design requirements for these boxes to be attractive to bats include the following:

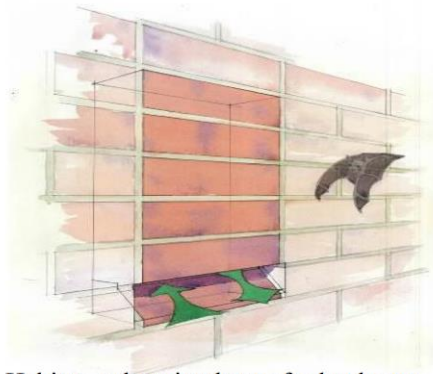
- A grooved 'bat ladder' and a narrow entrance slit at the bottom. The slit should be **no more than 15-20mm wide**, and there should be no gaps where the

sides and top join.

- It should be made from rough sawn wood for grip and should remain untreated on the inside.
- Ideally one coat of primer should be applied to outer surfaces, including vent openings, landings and entry areas of the bat box to protect against moisture, air leaks and wood deterioration. In addition two coats of water-based paint or stain should be painted onto the flat exterior. Do not use oil-based products.
- Boxes ideally should not be able to open from the top as it will have fewer gaps for draughts, and will lessen the chances of the bats being disturbed.

Integrated Bat Boxes

It is also possible to install integral or integrated bat boxes. Embedded into solid walls or the masonry of houses and other buildings during their assembly, these structures are built in such a way as to not impair the air-tightness of the building, whilst also considering the roosting conditions bats need.



Habitat, enhancing home for bat boxes.
© Ecosurv

Available in a number of designs and materials, examples of these can be seen illustrated on this page and can be purchased online.





Photos © Bat Conservation Trust 2012

Roosting Conditions

During the selection process of a potential roosting site, some of the most critical conditions that should be kept in mind to increase uptake by bats include:

- Ideally bat boxes should be partitioned into a number of chambers so that bats can move around according to their needs.
- Access to bat boxes should be **small gaps from 15-20mm high**. Landing perches should be avoided as these may encourage birds to nest within the bat box. In addition to this, access points should be unobstructed but close to sizeable vegetation and flight lines which allows bats to emerge earlier and forage longer.
- Artificial light sources should not be directed onto

bat boxes or flight paths as most bat species find artificial lighting very disturbing.

The main cause of light pollution is badly aimed lights. Poor design or misdirected light, can shine into the sky rather than onto the ground or object it is supposed to illuminate, contributing to light pollution. To reduce this, aim outside lights down, fit security lights with motion sensors and use outside light sparingly. For further information on how to avoid lighting disturbing bats visit the Bat Conservation Trust at:

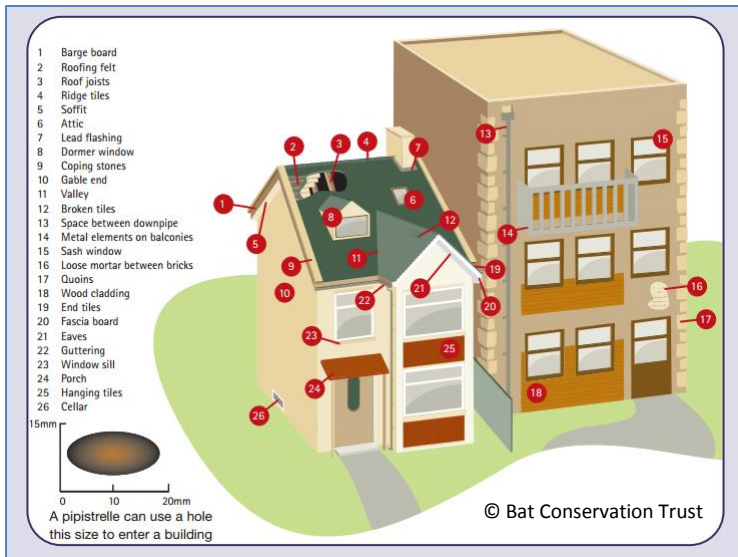
http://www.bats.org.uk/pages/bats_and_lighting.html

Crevice-Dwelling Bats – Considerations & Key Requirements

Consideration	Solution
Where in a development	Anywhere that the access is preferably not illuminated by artificial lighting.
Where in a building	Preferably in areas less likely to be disturbed.
Height	2-7 m.
Dimensions	Any size as long as some components of the area are crevices in the region of 20-30 mm wide. Greater total area of this crevice provision of something like 1 sq m would be useful for nursery (summer) roosts. Male roosts contain a smaller number of bats or even individual bats.
Access Dimensions	20-50 mm (w) x 15-20mm (h)
Other considerations	Rough (for grip). Non-toxic and non-corrosive. No risk of entanglement. Suitable thermal properties.

Where could bats be roosting?

Any structure is a potential bat roost, provided there is sufficient access – bats need only a 20mm gap. The following illustration highlights where they might be roosting or access points into your home.



How much provision is enough?

There is never going to be a ‘one-size-fits-all’ answer to this question. Every building should be reviewed for its potential for built-in roosting/ nesting opportunities. However, some locations in the development might be more suitable than others and provision could be more concentrated on appropriate structures. It is a case of taking the advice of an experienced ecologist who has carried out a survey of the site in question and its surroundings, and who can advise on the species for which it is appropriate to make provision and on how, where and how many potential roosts/ nesting sites should be incorporated.

The latest guidance from the UK Town and Country Planning Association and The Wildlife Trusts, *Planning for a Healthy Environment: Good Practice for Green Infrastructure and Biodiversity (2012)*, uses guidelines from Exeter City Council’s Supplementary Planning Document Residential Design. It recommends that nesting and roosting boxes be included as part of the fabric of the building for building-reliant birds, such as swifts and for bats associated with urban areas.

Importance of Insects

Recent studies show insect populations are declining dramatically in many parts of the world. Insects are a critically important part of our environment and are vital to all life on Earth. Although often considered pests or not thought of at all, insects are of great value to the environment and to people for numerous reasons, including:

1. Pollination & Food Agriculture

About 80% of the flowering plants on Earth are pollinated by insects and approximately 1/3 of the world's crop production depends directly or indirectly on pollination by insects.

2. Decomposition and nutrient cycling

Insects are responsible for much of the nutrient cycling, conditioning and aeration of the soil.

3. Food for wildlife

Many animals eat insects making them an essential part of the food chain.

4. Predators & Parasites

Some insects provide natural population control of other insects.

5. Medicine

Insects have been invaluable as research models to discover key scientific principles.

6. Ecological Monitoring

Insects are excellent indicators of ecosystem health.

To promote a healthier urban environment and provide a food source for species such as bats and swifts, we must ensure we have a diverse insect fauna.

Small green spaces, including planted areas and roadside verges, incorporating native flora, are vital for local insect fauna.

Insect Boxes

Insect nest boxes, towers, biomes and bee logs, etc., provide valuable habitat for invertebrates.

The different sections of an Insect Tower, for instance, have been designed to provide a habitat for a variety of insect species, including butterflies, solitary bees, lacewings and ladybirds.



Installation of an insect tower by the Department of the Environment and Climate Change at the Gibraltar Law Courts.

Green roofs, brown roofs and living walls

Green and living walls can form important elements of sustainable building by reducing the risk of flooding, reducing the extremes of temperature fluctuation in a building and providing enhancement for biodiversity.

Green roofs

The area of roofs in the urban environment is considerable and it tends to be a sterile environment, largely uninviting for biodiversity and not pleasant to look at. Green roofs can support a wide range of plant diversity and invertebrates.

There will be generalist invertebrates such as spiders, beetles and bees, but there is also the possibility of supporting more species, including moths and butterflies. The array of insects and the seeds produced by the flowering plants all provide good feeding opportunities to a range of birds and foraging

bats. Adding more plant species to these systems can increase ecosystem service provisioning.

A range of green roofs are available, which fall under three broad categories.

1. **Extensive green roofs** tend to be shallow, self-supporting systems that are vegetated with drought tolerant plants typical of harsh environments, such as cliffs and mountains – they require little maintenance and are not irrigated.



2. **Intensive green roofs**, or roof gardens, due to the deeper growing substrate, allow a greater range of plants to be grown, which in turn can support a wide range of species. However, they do need to be

planted appropriately and require irrigation and regular maintenance.



3. **Very deep roofs** have a depth of substrate sufficient to allow even trees to be grown.



A green roof is made up of a number of layers, generally comprising a waterproof layer, a root barrier, a drainage/reservoir layer, a water reservoir board, a filter blanket, a growing medium substrate layer and the vegetation.

Where can they be used?

Provided the structure is capable of supporting the additional weight associated with a green roof (a structural engineer must confirm this), any roof, including a sloped roof, has the potential to be greened.

Benefits of green roofs

The concept of green roofs has surged in popularity in recent years due to the wide range of benefits they provide; including:

- Reduced rainwater runoff,
- Enhanced roof insulation properties,
- Attractive visual appearance,
- Reduction in urban heat island effect,
- Enhances roof lifespan by protecting underlying waterproofing system,
- Provide green space in urban areas,

- Encourage biodiversity.

Brown roofs

Brown roofs are similar to green roofs in that they share many of the same benefits and construction methods. However, when a brown roof is designed, the overriding aim is to encourage biodiversity.

Brown roofs usually utilise local soil and spoil to provide the substrate for the roof, the roof will often initially be brown in colour. However, over time plant species will grow over this substrate and the end result will be a green-coloured roof – albeit one that nature has had a large hand in ‘designing’.



Brown roof during construction



Brown roof after two years of natural colonisation.

It should be noted, that all brown roof systems should use a high percentage of recycled products. Most materials used in the implementation of a brown roof can be up to 100% recycled; however if this is not possible you should expect at the very minimum 40% recycled products.

Solar Panels and Green Roofs

A 'living' roof can offer many benefits, a natural habitat, insulation, waterproofing, a way to cut energy bills, something wonderful to look at and it can also be a great place for solar panels! Both are energy saving, sustainable, efficient and environmentally friendly – a great match.

Solar photovoltaic (PV) or solar thermal panels can complement the benefits of a green roof by supplying a renewable energy source for the building. Furthermore, the evaporation produced by the plant-life on a green roof reduces the air temperature, allowing solar PV panels to work much more efficiently than those placed on a standard rooftop. When solar thermal technology is installed positive benefits can follow for the ecosystem and plant life. The shade provided beneath the panels can be beneficial to the growth of new plants; as can the tubes used in the thermal system, which help to allow added moisture in the form of rainwater to pass into the ground and create green vegetation.



Greenscape green roofs with solar panels

Benefits of living walls



Whereas roofs are often not a visible feature from the ground level, we are more aware of walls in our towns and cities. Living walls utilise plants in order to derive benefits, not only in visual terms, but also in regard to biodiversity, thermal efficiency and the reduction of pollutants. By providing shading from the sun, living walls can significantly reduce the external temperature of a building. Living walls

can also provide a certain amount of insulation. Living walls also help reduce the urban heat island effect by intercepting heat which would otherwise be largely absorbed and radiated by the building surfaces back into the surroundings. They help to shield the surface from ultra-violet light, which could be an important consideration for some modern cladding materials.

Plants on buildings can potentially provide a food source for invertebrates on which, in turn, other invertebrates, bats and birds may feed. They also provide a breeding and nesting habitat for invertebrates and birds, and are ideal for including ready-made nest boxes. It is important that box entrances are kept clear of vegetation.

Types of living wall

As with living roofs, there is nothing new in the concept of using plants to green buildings, but in recent years a variety of modern designs and techniques have been developed. Living walls can be separated into a number of categories that include:

- Supported by a wall – self-supporting climbers;
- Supported by a structure on a wall – climbers on a trellis or wires;
- Purpose-made modules or blankets which are irrigated and which support a wide range of plants.

Considerations in the use of living walls

The use of planted climbers, either self-supporting or in some way trained against a wall or similar structure, is not a new idea and, as long as the choice of plant is wise for the position and soil type, then it is a tried and tested and relatively inexpensive way of greening a wall. Irrigated modular or blanket walls can be spectacular. They are more expensive and require frequent maintenance if they are to look their best. Include native species planted in natural associations and plants that attract pollinators in order to benefit biodiversity.

Beneficial microclimates can be created against facades via living walls. Living walls reduce the maximum temperatures of a building by shading walls from the sun. They also provide protection from rain and reduce frost vulnerability,

and evergreen climbers provide winter insulation, not only by maintaining a pillow of air between the plant and the wall, but by reducing wind chill on the wall surface.

Numerous wall-mounted growing trough systems of green walls are available on the market. They often need pumped irrigation which adds to running costs. Indigenous, nectar rich, berry bearing and drought tolerant species supporting indigenous species and pollinators should be encouraged. For true sustainability irrigation should be via rain or grey water systems.

Design, installation and maintenance considerations for green facades and living walls will vary by system type selected and the conditions of the built and natural environment.

For more information check out the following webpages:

- www.livingroofs.org
- www.london.gov.uk (search for 'living roofs' and 'walls pdf')
- <http://naturalengland.etraderstores.com> (search for living roofs)
- www.greenroofconsultancy.com

- <http://www.greenroofcode.co.uk/>
- Design Guidance for Biodiverse Green Roofs
http://www.thegreenroofcentre.co.uk/Library/Default/Documents/GRC%20Biodiverse%20Design%20small_634147160617860000.pdf
- Landscape and Urban Design for Bats and Biodiversity – Bat Conservation Trust

Ladder planters, pots and hanging plants

If you don't have a large garden or the space for a green roof or living wall, you can still create a green space in your own patio or balcony, large or small. Even when space is at a premium you can set up a small green area which can benefit insects and the birds and bats which feed on them; not to mention creating a greener atmosphere in your home, office or school.

Simply start with some pots to liven up the area. Consider using deep pots and adding tall plants, even small trees, which provide more vertical green.



A ladder planter is a great way to plant numerous plants in a small footprint. Hanging baskets also maximise vertical space.



Benefits of installing nest boxes & creating green spaces



Bats, swifts and other insect eaters, eliminate the need for the use of harsh chemical insecticides in your home or garden.



Spending time in nature has been proven to have numerous health benefits including stress relief, improved eye health, concentration, sleep and mental health, Vitamin D from sunshine, boosts to your immune system, etc.



By providing green spaces and nest opportunities for bats and birds, you will not only help minimise their declining populations and increase their food sources, but also fulfil your stewardship responsibility towards a more sustainable future - making you feel good!

Bibliography

- BAT CONSERVATION TRUST (2015). *About Bats*. [Online]. Available from http://www.bats.org.uk/pages/about_bats.html
- BAT CONSERVATION TRUST (2014). *Bat Box Information Pack*. [Online]. Available from: http://www.bats.org.uk/pages/bat_boxes.html
- BAT CONSERVATION TRUST (2012). *Bat Product List*. [Online]. Available from: http://www.bats.org.uk/pages/bat_boxes.html
- E MAYER & SWIFT CONSERVATION (2013). *Creating Swift Nest Places in Old & New Soffits*. [Online]. Available from [http://www.swift-conservation.org/Creating%20Swift%20Nest%20Places%20in%20Old%20and%20New%20Soffits%20\(small\).pdf](http://www.swift-conservation.org/Creating%20Swift%20Nest%20Places%20in%20Old%20and%20New%20Soffits%20(small).pdf)
- GIB-BATS, et al., (no date). The Gibraltar Bats Project. *Our Amazing Bats: A short introduction to the Bats*

of Gibraltar. Gibraltar, Gibraltar Chronicle Printing Ltd.

- GONHS (1996). *Bats and Swifts in Buildings*. Gibraltar, 123 Printers.
- SWIFT CONSERVATION (2015). *Fitting Swift Nest-Places*. [Online]. Available from <http://www.swift-conservation.org/Nestboxes&Attraction.html>
- Wildscreen arkive. *Pallid swift (Apus pallidus)*. Available from: <http://www.arkive.org/pallid-swift/apus-pallidus/>
- James Shipman, Stewart Finlayson, Tyson L. Homes & Giovanni Santini. 2015. *A study of Gibraltar's Bat Populations for Their Protection and Conservation of Their Habitats—Project Report*. GIB-BATS.
- Kelly Gunnell, Brian Murphy and Dr Carol Williams. 2013. *Designing for Biodiversity: A technical guide for new and existing buildings*. Second Edition. London. RIBA Publishing.

- GONHS. *Bats and Swifts in Buildings*. The Gibraltar Ornithological & Natural History Society 1996. 123 Printers.

- Brownroofs.co.uk. Green Roofs and Brown Roofs. 2015. Available from: <http://brownroofs.co.uk/>

- Lauren F. Friedman and Kevin Loira. Business Insider. 11 Scientific reasons you should be spending more time outside. Available from: <http://www.businessinsider.com/scientific-benefits-of-nature-outdoors-2016-4/#1-improved-short-term-memory-1>

- Discover Wildlife. *6 starling facts you need to know*. Immediate Media Company Ltd 2017. Available from: <http://www.discoverwildlife.com/blog/6-starling-facts-you-need-know>

- The BirdBox Project. *Common facts about blue tits*. SEGfL. Available from:

<http://birdbox.segfl.org.uk/news/article-1-Common-facts-about-blue-tits.html>

- McCleery, Robert A., Moorman, Christopher, Peterson, M. Nils (Eds.) *Urban Wildlife Conservation. Theory and Practice*. Springer. Available from: <http://www.springer.com/us/book/9781489974990>
- The Urban Wildlife Working Group. *Urban Wildlife Basics*. Available from: <http://urbanwildlifegroup.org/urban-wildlife-information/>
- SaveNature.Org Fact Sheets. Importance of Insects and Their Arthropod Relatives. Available from: www.savenature.org/grabfile/424.pdf
- Recycle solar, complete the cycle. Solar Panels and Green Roofs: The New Renewable Power Couple. Recycle Solar Technologies. Available

from: <https://recyclesolar.co.uk/solar-panels-and-green-roofs-the-new-renewable-power-couple>

- The Nature of Cities. Valuing Urban Wildlife: Critical Partners in the Urban System or Scary, Disgusting Nuisances? Matt Palmer, New York City. 2013. Available from: <https://www.thenatureofcities.com/2013/06/16/valuing-urban-wildlife-critical-partners-in-the-urban-system-or-scary-disgusting-nuisances/>

- USDA United States Department of Agriculture. Forest Service. *Urban Wildlife*. Available from: <https://www.fs.fed.us/research/urban/wildlife/>