Review

A look at the Chiropteran Fauna of the Maltese Islands: Towards an effective Action Plan for their conservation

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Summary. The Maltese Islands are home to ten microchiropteran species, which cover a good proportion of micro-bat diversity. However, very little is currently known about the local ecology and requirements of these species. This review is intended to give an overview of the local bat scene with respect to biology and protection and goes on to present some recommendations which would help in the drawing up of an action plan that is specific to Maltese bats. By emphasising local research and legal obligations throughout this work it is hoped that the multitude of gaps in the available data and protection become obvious and encourages further work. The overall aim is to have enough reliable data to be able to produce an action plan with a solid foundation of local knowledge. Such a document is urgently required, before the present populations decline beyond a point of recovery.

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Introduction

Bats are classified in a single order, the Chiroptera, with over 1000 recorded species worldwide. This order is split into two sub-orders, the Megachiroptera (consisting of the Old World fruit bats) and the Microchiroptera (all other bat species).

In general, microchiropterans are more diverse in form than megachiropterans due to the variety of habitats and food sources they have taken advantage of. Around three quarters of microchiropterans are insectivorous (feeding on insects and other arthropods), and yet there are some that feed on amphibians, fish, small birds or mammals, blood, fruit or nectar. Similarly, they take advantage of a number of different habitats ranging from trees to caves and even human structures. Because of this great diversity they have a global distribution (excluded the Arctic, Antarctic and a few oceanic islands). According to 'The 2000 IUCN Red List of Threatened Species', over 21% of michrochiropterans are threatened and a further 23% are considered Near Threatened and are thus of conservation concern.

Taking a look at Europe, 45 species of bats have been identified so far. Of these, 44 are insectivorous michrochiropterans, while the last one is a fruit-eating megachiropteran (the Egyptian fruit bat, *Rousettus aegyptiacus*). Presently in Malta there is a total of 10 microchiropteran species, five residents and five rare or irregular migrants. The resident species are: *Rhinolophus hipposideros minimus*, *Myotis punicus*, *Plecotus austriacus*, *Pipistrellus pygmaeus* and *Pipistrellus kuhlii*. The rare migrant species are: *Rhinolophus ferrumequinum*, *Eptesicus serotinus*, *Nyctalus noctula* and *Miniopterus schreibersi; Tadarida teniotis* is a rare winter visitor (Borg *et al.*, 1997; Falzon, 1999; Jones, 1999; Baron and Vella, 2007).

Ecology

Habitat Selection for Roosting and Feeding

Microchiropteran bats use a variety of habitats for roosting and feeding. The ones which are of greatest relevance to the Maltese Islands are the garigue, maquis and aquatic habitats. The garigue and maquis are characterised by sparse vegetation, aromatic shrubs and small trees, which offer open spaces for hunting. Aquatic habitats such as streams and water pools are favoured as feeding areas because they sustain a variety of insects. Some bat species have adapted well to urban environments and feed under light sources which also attract many insects.

Certain landscape features such as tree lines, hedgerows, and canals are used regularly by bats when moving between roosts and feeding grounds (Verboom, 1998). The abundance of flight paths is proportional to the amount of landscape features, with species such as *Myotis daubentonii* and *Rhinolophus hipposideros* taking detours to follow hedgerows rather than cross open areas while travelling to a feeding area (Racey, 1998). Such behaviour is thought to act as an anti-predator strategy as well as allowing feeding on the way, since windbreakers may provide shelter for insects (Gaisler and Kolibac, 1992).

In Malta, a multitude of sites are used by bats for roosting ranging from caves to man-made structures namely water-tunnels, catacombs, Second World War underground shelters, bastions, fortification walls and in-use and abandoned residences. In a study covering 10 years and including 28 roosting sites for *Myotis punicus* it was found that caves were the only type of roost used throughout the year (Borg, 1998). Other studies (Jones, 1999; Baron, 2006) have described the habitats

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surrounding some of the 28 roosts mentioned above. Although caves provide ideal natural conditions for hibernation and nursing, some species such as *Pipistellus pygmaeus* in Malta rely almost exclusively on man-made sites for roosting and breeding.

Bats tend to migrate to meet their roosting or feeding requirements. These migrations can vary from daily movements between the roosts and foraging areas to longer migrations for over-wintering or having young. In Malta the recorded migrations associated with both roosting and feeding are relatively short compared to other European countries, where bats may cover thousands of kilometres and even cross borders. For the local *Myotis punicus* it is only the females that annually migrate long distances, to the nursery for hibernation, giving birth and rearing young. However, a male covered the longest recorded distance for this species in Malta from Chadwick Lakes, Malta (trapped in November 1993) to Ghar Siekel, Gozo (September, 1996) (Borg, 1998).

The diet of insectivorous bats consists of a multitude of insects, including Coleoptera, Diptera, Ephemeroptera, Lepidoptera, Neuroptera, and Trichoptera (Best *et al.*, 1997). In the Maltese Islands, a study of the diet of *Myotis punicus*, carried out using faecal material from below feeding perches, showed that the main prey species were of three insect orders: Orthoptera, Coleoptera and Lepidoptera (Borg, 1998). Many bats use echolocation to locate their prey although some take advantage of the sounds made by their prey as the means of locating them. Certain bats catch their prey in flight, while others called gleaning bats take their prey from surfaces such as foliage or the ground. Prey may be eaten on the wing or from a perch.

Reproductive biology

Maltese bats, like all other European bats are monoestrous. This is due to the adverse winter conditions in the region, when food is scarce and temperatures are low. To cope with such conditions these bats have evolved an interrupted reproductive cycle where females are in oestrous from late summer to the end of autumn with copulation also starting in late summer and may even continue into winter. Then, depending on the species, fertilisation, implantation or post-implantation development are delayed until spring (Altringham, 1996). As for other temperate bats, local bats species usually give birth to a single young each year in spring, which develop during the early summer months (June and July), when temperatures are high and food is plentiful (Racey, 1982). For the first couple of weeks young bats are carried by their mothers during feeding forages, and when they are over three weeks old that they are left in the nurseries until old enough to hunt by themselves. They then return with the mother to the summer roosts. These juveniles then reproduce after one or two years. Bats are relatively long-lived and in Malta, for example, the longest-lived recorded *Myotis punicus* male was first ringed in 1988 and last re-trapped in 2000 (i.e. over 12 years of age) (Borg, 2002).

With respect to the local nurseries, very little is as yet known. A couple of nurseries are known for *Pipistellus pigmaeus*. The only known nursery for *Myotis punicus*, which was Ghar il-Friefet (limits of Birzebbuga), has been abandoned by the resident bats and till now the location of the present nursery is unknown. This is because the low numbers make it impossible to follow swarming bats into the nursery. A nursery may eventually be found by chance as has happened with the discovery of a *Myotis punicus* roost in a complex of World War II shelters in Gozo during some excavations during November 2007. This discovery points towards the need of continued research, monitoring and conservation (MEPA, 2007).

Importance of bats

There are several ways in which various species of bats can be considered to be of economic importance. Pollination and seed dispersal, especially in the tropics, are major ecological services. Insectivorous bats are the primary consumers of nocturnal insects and many species feed on medical or agricultural pests. Guano (bat droppings) is considered to be an economically important product as it is a highly prized fertiliser in developing countries that can not rely on chemical fertilisers.

Insectivorous species consume large quantities of a variety of insects including a number of important agricultural pests on crops such as vines, cucurbits and potatoes (Whitaker, 1993). In the Maltese Islands, *Plecotus austriacus* was found to feed on at least 23 different moth species of which at least 8 are known pests. Pest species identified included *Autographa gamma*, *Chrysodeixis chalcites* and *Spodoptera exigua*, which feed on a variety of wild and cultivated plants and *Galleria mellonella*, a pest in apiculture (Borg and Sammut, 2002).

Threats to Maltese Bats and their habitats

One of the best documented declines in Europe is that of its five *Rhinolophus* species, which has been attributed to increased disturbance to their roost sites (mainly caves) and to changes to their foraging habitats over the past years (Ransome and Hutson 2000). While in some countries only a restricted distribution with a handful of bats remains, in others they have gone extinct (EUROBATS National Reports; Ransome and Hutson 2000). Interestingly, the dramatic decline in *Rhinolophus hipposideros* populations may have been a result of competition rather than direct human impact. This is due to the almost complete overlap in the diet (same type and size range of prey) of this bat with that of *Pipistrellus pipistrellus* where these two species are found sympatrically (Arlettaz *et al.*, 2000).

In their natural habitat, bats do fall prey to a number of species, the most noteworthy being birds of prey (such as

owls, hawks and falcons) and snakes. However, they are not generally the main prey species of these animals as has been shown for owls with only few individuals taken (Baker, 1962; Barclay *et al.*, 1982; Speakman, 1991; Borg, 1998). Of interest is the fact that the decline or extinction of certain bat populations has been brought about by introduced predators such as cats and rats as well as certain invasive plant species (O'Donnell, 2000; Gerlach and Taylor, 2006) which leads again to human interference with natural systems.

Locally, the best documented decline is that of *Myotis punicus* over the past 30 years. Although a decline has been observed in roosts all over the Maltese Islands (Borg, 1998), the worst case was that at Ghar il-Friefet, (limits of Birzebbugia) which resulted in a complete abandonment of the only known nursery in Malta. Between March and September of the early years in which the use of this cave was recorded (between 1987 and 1996) up to 89% of the 80 to 100 individuals present were females (Borg, 1998). Numbers fell from 200 to just 12 individuals in 1990 (Borg, 1998). Recent studies have also recorded this abandonment (Jones, 1999; Baron and Vella, 2007).

Although bats face a multitude of threats, most can be linked to human activities as shown by the above declines. Bats are exceptionally vulnerable to human disturbance in their nursery and hibernation roosts because it leads to their arousal, often at great energetic cost (Thomas *et al.*, 1990), which may be fatal (Tuttle, 1991). In Malta, as in most other countries, land is taken for development to accommodate a growing human population. According to the IUCN, "*In Malta, bats are threatened through increasing urbanisation coupled with tourist development schemes*" (Hutson *et al.*, 2001). This results in the degradation and destruction of habitats such as garigue and maquis which offer bats ideal sites for both roosting and feeding (Jones, 1999).

As illustrated by a CORINE 2000 land cover map in the MEPA's State of the Environment Report 2005, 23% of the Maltese Islands are urbanised while another 49% are occupied by agriculture. Although species such as pipistrelles can take advantage of urban and open habitat such as arable land and degraded habitats, gleaners such as *Myotis punicus* and *Rhinolophus hipposideros* tend to prefer hunting over dense vegetation and woodland edges in preference to degraded or modified terrains (Borg, 1998; Falzon, 1999; Jones, 1999; Bontadina *et al.*, 2002; Motte and Libois, 2002; Beuneux, 2004; Aulagnier and Juste, 2004; Jacobs *et al.*, 2004; Aulagnier and Benda, 2004). Arable land in Malta, being not so intensively cultivated offers bats a number of linear landscape elements. However, the percentage of arable land keeps decreasing, as more land is taken up for developments and the agricultural land that remains is cultivated more intensively with greater amounts of chemical fertilisers and pesticides used. Although there is as yet little information on the effects of pesticides on bats, the effects can be divided into reduction of insect numbers and diversity (affecting diet) and accumulation of sub-lethal doses in fat, which during periods of use of these reserves such as hibernation or migration are released at lethal doses (Ducummon, 2000).

Walsh and Harris (1996a) have shown that insect decline occurs where there is reduction in area of water bodies which is the case when these are drained, obstructed or modified to fit some embellishment project. Studies on other species suggest that there is a decline in prey species because pesticides indiscriminately kill all insects including species fed upon by bats. Among such studies are Aebischer (1991), Feber *et al*. (1997), Chamberlain, Wilson & Fuller (1999), Ormerod & Watkinson (2000), Ambrosini *et al*. (2002), Benton *et al*. (2002), and di Giulio, Edwards & Meister (2001). Even British authors, with a wealth of data to draw upon due to the efforts of the BCT and DEFRA in the form of projects and surveys state "However, there are few data to show the impact of agricultural intensification on bat numbers" (Wickramasinghe *et al.* 2003). These authors showed the negative impact of pesticides by comparing abundances (through flight passes) between organic and conventional farming. Because bats tend to have a regional diet and having no quantitative or even qualitative Maltese data concerning the use of pesticides and their effects on animals, it is difficult to tackle this issue and thus such a local study should be given priority because it has an impact on all biodiversity.

Underground sites, both natural (e.g. caves) and man-made (e.g. shelters and fortifications), are crucial to the survival of many bat species since they provide conditions suitable for hibernation and breeding. Caves are a delicate and essential part of the bats' habitat. In fact, 8 out of the 10 recorded Maltese species roost in caves and these are being threatened by a number of human activities including limestone quarrying and road building (Borg, 1998; Jones, 1999; Baron, 2006). The former has great bearing in Malta and is responsible for both disturbance and destruction of key roosting caves. The damage is not only caused by blasting and transit of heavy machinery used, that send shockwaves throughout the cave and may lead to the collapse of certain overhangs or entrances, but also through settling of fine dust throughout the cave including resting bats.

Cave disturbance may also take other forms. Some caves are used by farmers as storage areas and are closed or modified by means of lights, stonework, doors, gates, etc. Such modifications lead to exclusion of bats through the presence of a physical barrier or changes in the internal environment. Concerns over public safety have led to the sealing of underground sites (e.g. the shelters in Zebbug, Gozo). In most cases, such action is not a deliberate attempt to exclude bats since their presence may not be known. On odd occasions bats may be disturbed by tourists or amateur explorations as well as cook-outs where fires are lit in the caves.

Deliberate disturbance is usually due to fear or prejudice due to a combination of inaccurate information coupled with perceived risks of damage or disease, which trigger eradication campaigns. Worst of all is disturbance by vandals who burn caves, spray or paint graffiti on the walls, throw objects at the bats or in rare cases even set caves on fire. Although such acts are infrequent, they can be very destructive.

Besides caves, residential buildings together with churches and historical buildings in Malta are important roosting sites for *Rhinolophus hipposideros minimus*, *Myotis punicus* and pipistrelles especially where these have underground extensions dug in rock or offer high, deep cavities which mimic natural structures and can offer a constant environment (Borg, 1998; Jones, 1999; Baron and Vella, 2007). In some cases there may be conflicts between the owners and bats. Renovation of buildings can lead to the loss of these roost sites. In Malta, a number of historical buildings with bat colonies have been restored and the bats excluded. The number of large, undisturbed rooms in houses is declining because of the trend towards improved use of space and the demolishing of old buildings. Occupancy of public buildings, including churches, should be the least problematic since they fall under a central entity. Many such buildings are considerably old and often house long-established populations and possibly maternity roosts.

Legislation, Protection and Conservation

Legal protection for bats can be of two forms, international or national. International treaties which include bats and their habitats are not usually specific to them but include them together with other flora and fauna such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora 1973 (CITES), the Convention on the Conservation of Migratory Species of Wild Animals 1979 (Bonn Convention), the Convention on the Conservation of European Wildlife and Natural Habitats 1979 (Bern Convention), the European Communities Council Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora 1992 (The EEC Habitats and Species Directive) and the Convention on Biological Diversity 1992 (The Rio Convention). Maltese bats are included in the latter four conventions and thus Malta endorses these international agreements.

The Bonn Convention provides protection for Malta's five migrant chiropterans (listed in Appendix II since they would 'significantly benefit from the international co-operation that could be achieved by an international agreement'). The Bern Convention provides protection for all of Malta's bats under Appendix II as 'strictly protected fauna species'. The EEC Habitats and Species Directive includes three of Malta's chiropterans in Annex II as 'species of community interest and in need of strict protection', while including all Maltese bats in Annex IV as 'species of community interest whose taking in the wild and exploitation may be subject to management measures and the populations of which should be maintained at a "favourable" status'. The Rio Convention helps Maltese bats by imposing measures for the rehabilitation and restoration of degraded ecosystems and promoting the recovery of threatened species through appropriate legislation and management plans.

The Agreement on the Conservation of Bats in Europe (EUROBATS) was created under the Bonn Convention and is the only specific convention for European bats and thus includes all of Malta's species. It covers 48 Range States in Europe and through its conservation and management plan, aims towards bat conservation through legislation, education, conservation measures and international co-operation.

Although upon signing EUROBATS each country is bound to protect the listed bat species, there is no strict rules as to how this should be done and national legal protection for bats varies greatly between the EU member states such that while in some countries bats are well cared for and integrated into action plans, in others they receive no tangible protection. In some cases, the bats themselves may be protected but their roosting or feeding habitats are not. In others, though legislation may in theory be adequate, often the resources are not available to ensure proper enforcement.

The first hint of protecting bats through local legislation in Malta came in the Environment Protection Act of 1991 and then in the Environment Protection Act of 2001. From these came the following legal notices, which offer specific protection. The Flora and Fauna Protection Regulations, 1993 (Legal Notice 49 of 1993) specifically mentions all local microchiroptera as being protected in Schedule II. It clearly states all the prohibitions and repercussions of such actions i.e. it is illegal to take, kill, possess, sell, exchange, import or export any specimens of bats as well as disturb them particularly during periods of breeding, rearing or hibernation. Fines and imprisonment are the penalties set for breaking this law (MEPA, 1993). The Flora and Fauna Protection (Amendment) Regulations of 1999 (Legal Notice 161 of 1999) maintain the status of local bat species as in L.N. 49 of 1993 (MEPA, 1999). The Flora, Fauna and Natural Habitats Protection Regulations of 2003 (Legal Notice 257 of 2003) not only recognises local bat species as being in need of protection but also as requiring particular areas as part of their conservation. Thus it provides for the protection of habitats that are important for bats, including caves and other roosts (MEPA, 2003). Permits issued for research on local bat species cite this legal notice as their main basis such that both the species and its habitat are disturbed as little as possible. The next step in such legislation is the protection of areas known to be important feeding sites. Presently these three legal notices have been incorporated into L.N. 311 of 2006 (MEPA, 2006).

Recommendations for a local Action Plan

In order to better safeguard Malta's chiroptera and make sure that they are not lost in the near future it is essential to draw up and implement an action plan on a national level. The creation of such an action plan is in line with the Rio Convention, which requires the preparation of a national biodiversity strategy. To aid in the preparation of an effective action plan, in which each species gets the conservation attention it requires, it is useful to take example from other countries and use their successes as a basis for local action.

Although the details of this action plan must be drawn up with the participation and co-operation of all experts in the concerned fields, a few essential recommendations will be listed below based on what has been noted during local studies and what essential information still needs to be collected. The action plan should focus on three main areas namely research, legislation and management, and education.

Research

Although 10 species have been recorded in the Maltese Islands (Borg *et al.*, 1997; Falzon, 1999; Jones, 1999; Baron and Vella, 2007), there are still a number of gaps in the known biology and ecology of a number of these. Without basic local knowledge regarding each species, including its genetic diversity, ecology, feeding, it is very difficult to draw up legislation and a management plan to effectively protect bats, their roosts and foraging habitats. Funds should be allocated for research into population studies, habitat requirements and diet.

Population studies should be carried out to determine the status and distribution of each species including any seasonal movements. The primary target should be to review the systematics and determine which sub-species actually inhabit the Maltese Islands using morphometrics, echolocation calls and molecular techniques. The variety of markers and studies that can be carried out on bats has been outlined by Burland and Worthington Wilmer (2001). The importance of an integrated approach can be seen in studies where the use of mitochondrial DNA and echolocation calls in determining that individuals classified as *Pipistrellus pipistrellus* in fact constituted two cryptic species namely *P. pipistrellus* and *P. pygmaeus* (Jones and Van Parijs, 1993; Barrett *et al.*, 1997). Population studies of Maltese microchiropterans include an investigation of the seasonal changes in abundance, roosting and feeding (through faecal analysis) habits of pipistrelles (Falzon, 1999). Another study analysed the distribution, abundance, behaviours and habitat associations of bat species in Malta using various survey techniques, roost counts and mist netting which recorded *Rhinolophus hipposideros*, *Myotis punicus* and pipistrelles (Jones, 1999). A study to determine the population structure of the local *Myotis punicus* was carried out using cellulose acetate allozyme electrophoresis using a non-lethal sampling technique. Results showed that the Maltese population of *Myotis punicus* is a single breeding population with an indication of inbreeding (Baron and Vella, 2007). Such studies offer valuable and relevant knowledge to update the status of each bat species in the Maltese Red Data Book. The collected data from any of these studies should be considered and forwarded to the IUCN/SSC Chiroptera Specialist Group by local authorities acting as national contacts to improve the evaluation of the status of threat of the local species. Also such research centres focusing on conservation biology research should be funded to increase its effort toward providing the necessary knowledge for effective conservation management.

Further bat species research on roosting habits locally should include the determination of desired characteristics of caves, buildings and other hypogea together with those of their surrounding habitats that are important to each species. This involves the compilation of an inventory of underground habitats used by each species indicating the condition of each roost, key roosts and the current or potential threats faced by such sites. It is also important to have long-term monitoring programmes for key roosts and the legally protected species that inhabit them.

Further bat species research on foraging habits and requirements should focus on the specificity of bat feeding habits and the changes in diet throughout the year. The studies should also be extended to include the importance of linear landscape elements for local bat species, the effect of agriculture and related chemicals on Maltese bats and the adaptation of local bats to changes in landscape if possible.

Detailed nationwide bat population surveys which show how bat species conservation is developed abroad include the 'Action Plan for the Conservation of Bats in the United Kingdom' (Hutson, 1993), 'The status and conservation of horseshoe bats in Britain' (Mitchell-Jones, 1995), **'**Foraging Habitat Preferences of Vespertilionid Bats in Britain' (Walsh and Harris, 1996a), 'Factors Determining the Abundance of Vespertilionid Bats in Britain: Geographical, Land Class and Local Habitat Relationships' (Walsh and Harris, 1996b) and 'the UK's National Bat Monitoring Programme: Final Report' (Walsh, 2001). These works include detailed investigations of large areas and analyse foraging habits, breeding, hibernation, and other roost sites, and population numbers. They then provide recommendations for improved monitoring, protection and conservation.

At an international level, the relevant example of a species action plan is that for the greater horseshoe bat (*Rhinolophus ferrumequinum*) in Europe, which gives detailed information about all aspects of this bat and puts forward a number of conservation actions (Ransome and Hutson 2000).

Legislation and management

Although all bat species in Malta are protected by law, there is as yet inadequate protection of roosts and their surrounding habitat especially when it comes to man-made structures which might be occupied or in regular use (such as churches or government buildings). At present only 2 caves in the Maltese Islands are to some extent protected in relation to bats: Ghar Hasan and Ghar il-Friefet. In both cases they are protected on paper and have been fitted with bat grilles. However the erection of bat grilles is not enough to safeguard such sites especially if these aren't even properly maintained.

The nurseries or key roosts of *Myotis punicus* and *Rhinolophus hipposideros minimus* could be established as Special Areas of Conservation (SACs) since they are 2 of the 13 bat species listed in Annex II of the EEC Habitat Directive.

Since bats use a range of feeding sites and habitats at different times of the year, it is not enough to protect individual roost but it is equally important to protect foraging habitats and the landscape elements used by bats for commuting (Racey, 1998; Jones, 1999).

Implementation and enforcement are also lacking. If damage to a roost is reported, immediate action is required before that particular roost is lost. In order to be able to detect such threats as soon as they manifest themselves it is essential for roosts to be monitored regularly and checked for signs of disturbance. Besides protective legislation, it is important that there is a speeding up of procedures related to the removal of illegal obstructions to cave entrances (such as meshes or gates) and retraction of quarrying permits.

Education

Education is of the utmost importance and the desired educational programme should be primarily aimed at the general public in such a way that it can be applicable to both children and professionals alike. It should encourage an understanding of bats by including various aspects such as their biology, importance to humans, role in the environment, roosting and foraging requirements, use of man-made structures as roosts, major threats, need for protection and the present legal protection provided. There is a vast amount of information regarding bats, available in the form of leaflets and other educational material that can be used as a basis for local awareness programmes.

The other aspect of education that needs to be considered is formal education, which can be divided into two. The first is to include bats into undergraduate lectures about local ecology and conservation. The other would be to specifically train local bat and conservation experts. The latter would be an investment for the future and should be opted for. Despite its small size, Malta has the human resources to train people who can work on protecting the rich local biodiversity at all levels. It is never feasible in the long run to have foreign professionals coming for short-term projects when the country already has people and facilities to train the future generation of conservation scientists. All that is needed is funding to push forward and improve the process that is already in progress.

The single most important awareness event is the 'European Bat Night', an international public-awareness event organised by EUROBATS that has taken place every year for the past 10 years, with the participation of over 30 countries. During this activity the public is informed about bats through bat walks, leaflets, talks, presentations, workshops and exhibitions. This event is usually planned for the last weekend of August, although the date may vary from one country to another. Malta has taken part in this event in previous years and it can be a very educational event if well-promoted.

Conclusion

The Maltese Islands have a diversity of bat species which should be taken care of in the best interest of the nation and the world since some are species restricted to this geographical area. In order to achieve this, an action plan is urgently required, which by implementing the above recommendations and much more can first of all fill in the gaps in the present knowledgebase and ultimately offer local bats and the habitats they require, adequate protection. To reap the maximum benefits from preparing such an action plan it is important to integrate ideas from all participating parties and set up clear, attainable check-points and goals in the form of stages to meet both national and international requirements and standards. The goals should be adaptable to ensure that as the local picture improves, with the completion of each checkpoint within the action plan, the new information is channelled towards refining and better targeting future goals. With such an action plan in place, the framework for better bat research and conservation would have been set. It might also be used as a pilot project for application to other Maltese species requiring critical attention.

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