# A preliminary study on the abundance and distribution of the *Podarcis filfolensis maltensis* on the island of Comino

## Declaration of Authenticity

I hereby declare that this project entitled 'The abundance and distribution of the *Podarcis filfolensis maltensis* on the island of Comino' is truly my original work and it contains no plagiarised material.

Sign: _____ Date: __/____/_____.

## Dedication and acknowledgements

**I dedicate this research project to my parents David and Dorothy, without whom none of my achievements would be possible.**

**I would like to thank my tutor Mr. Timothy Pace Lupi who has been a constant source of knowledge and support throughout the process of carrying out this research project.**

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## 1. Abstract

This research project has been conducted to determine the abundance and distribution of the Maltese wall lizard *ssp. Maltensis* on the island of Comino. Four subspecies of the *Podarcis* wall lizard are endemic to the Maltese archipelago. Hence, this research project can provide further information to aid in the conservation of this reptile in Malta. At present, Comino is one of summer's top destination for tourists and it is constantly filled with crowds of people each summer. This island has been granted legal protection for conservation of its biodiversity. This research project is based on human interference with the survival of this subspecies and the distribution of this reptile in different areas around the island. The abundance of this subspecies is determined by the evaluation of five main disturbed areas and existing paths. The abundance in each area directly links to the distribution of this reptile throughout the island, leading to the preference and nature of the disturbance done on this species and its survival. Signs of habitat destruction and human interference have been noted from the results of this research project. The distribution of the wall lizard on Comino is highly dependent on human presence. These results show that further protection is required to completely conserve this subspecies and other fauna present on this island.

Chapter 1

## 2. Introduction

Malta and its surrounding islets serve as a habitat for the four of five named subspecies of the *Podarcis filfolensi*s. This lizard is restricted to the Pelagian and Maltese islands. Due to this it is highly protected by the law and its habitats have also been designated as protected areas. The Maltese wall lizard is a generalist species, meaning it feeds on different types of feed, including, insects, fruits and vegetable matter. The male contains speckled colours, changing slightly under the chin in the mating season. The female lizard is smaller than the male and generally contains dull colours. The male is known for its high territorial behaviour against other males. This behaviour is shown by the male puffing up and raising its head, a similar behaviour is also done to attract females. Mating season for these reptiles occurs in spring. After successful copulation the female lays two eggs which will hatch in June and mid-August. These reptiles spend most of the day basking in the sun, however, they can also be extremely active.

This research project is focused on one of these four subspecies restricted to the Maltese archipelago, the *Podarcis filfolensis maltensis.* This subspecies is present in Malta, Gozo and Comino, however, this research project is based on its presence on the islet of Comino. Unfortunately, very few research has been carried out on this subspecies in particular. Hence, this project will provide more information that might aid in the protection and conservation of this reptile.

### 2.1 Rational

This research project is essential as it furthers one's knowledge on this subspecies and other fauna present on the island of Comino. It is also important as very little is known regarding this subspecies on Comino. This project could also bring to light other factors which might be of critical importance to help conserve this species and its habitat.

## 2.2 Research questions

I. What is the abundance and distribution of this subspecies *Podarcis filfolensis maltensis*?

II. What type of habitat is preferred?

III. Does human activity interfere with the survival of this subspecies?

IV. Are populations of *P. filfolensis maltensis* in Comino more abundant in areas where there is more human activity?

## 2.3 Literature review

Comino is one of the Maltese islets which is situated in line between Gozo and Malta. When compared with other islands in the Maltese archipelago it places the third in size, covering 2.76 $km^2$ in area (including another related islet called Kemmunett). Comino also consists of three other islets which surrounds its western coast area. These islets include, Cominotto and another two relatively small rocks, which are composed of upper coralline limestone cap. (Potamon, 1982). Comino has a great history of human interference, which dates back centuries ago. The first recorded activity on Comino was the building of Santa Marija tower, which was built in 1618 under the orders of Vittorio Cassar, a military engineer. Throughout the years, more buildings were built, which include: Santa Marija battery, isolation hospital, cemetery and pig farm. In addition, Comino was also used as a target practice in 1925 and as a 'concentration camp' during the French period between the years 1798 - 1800. Falzon (2004) states that till 1800, Comino was still inhabited by a small amount of people.

Comino serves as a crucial habitat for several different species of flora and fauna. Its habitat may be described as garigue ranging to parts of pockets of macquis. Other parts of Comino started being used for agriculture by its inhabitants. Although these three characteristics are important, there are other specific places in Comino which are more important and must be conserved at all cost. Santa Marija is one of these locations. This area consists of a unique sand dune system which serves as a habitat for different flora and fauna. Certain flora of particular importance found in this area include: the rare Sea knot-grass (*Polygonum maritimum*), the native species of the Tamarisk (Tamarix Africana), and the Chaste-tree (*Vitex gnus-castus*). The area also consists of a saline marsh which is dominated by the Common Reed (*Pharagmites Australis).* Santa Marija also serves as a habitat for certain dune animals, which include: Sphecid wasp (*Philantus Triangulum*), the Mutillid Wasp (*Smicromyrme viduata*) and the Carabid beetle (*Acinopus picipes*). In addition, this bay also serves as a habitat for the endemic marine snail, The Maltese Top-shell (*Gibbula nivosa*). The Ghemieri Penisula is also of great ecological importance and must be protected at all cost. This area holds the last small population of the extremely rare crucoferous herb (*Hymenolobus ravellieri*). This race is probably an endemic local race. However, further studies need to be carried out. In addition, this herb is also accompanied by another two Hbleo-Maltese endemics: The pygmy Ragwort (*Senecio Pygmaeus*) (which is also extremely rare) and the last remaining population of the grass *Desemazeria pigattii.* Moreover, this area is also a habitat for the endemic snail *(Trochoidea spratti perplanta*) as all the rest of Comino is inhabited by another type of endemic land snail which is the *Trochoidea Schembrii.* Another area of ecological importance is the Redoubt area which is found in the southern part of the island. This area serves as a habitat for the species of Wolfbane (*periploca angustifolia*). The Comino tower also holds several endemic species of flora and fauna. An endemic plant, the Maltese toadflax (*Linaria Pseudolaxiflora*), also grows in this area. Furthermore, the rare ant (*Lepthhthorax recedens*) is found in the

area surrounding the Comino tower. Another area found in the northern part of Comino called il-Mazz', which consists of a valley, also serves as a habitat for different flora and fauna. This area is also of crucial importance for several endemic species which include: The *Daucus rupester* and the *Crucianella rupestris*. In addition, the Maltese salt-tree (*Darniella Maltensis*) is also present in this area. Comino must all be conserved as it serves as a great habitat for different species. In addition, the whole of Comino is a bird sanctuary as different species of birds nest there. According to Schembri, Lanfranco et al in 1983 a pair of Short eared owls have been reported that they had been nesting on Comino. This island acts as a funnel for migrating birds as trapping and/or hunting is prohibited and this makes Comino an ideal place for ringing of birds. In fact, Birdlife Malta has been holding this activity annually since 1991. This project is carried out twice a year, one month in spring and two weeks in autumn. During this period hundreds of birds have migrated to Comino. About 1500 birds are captured and released in spring while an average of another 800 birds are captured and released in autumn. Birdlife rings all the birds captured and therefore they are able to note changes from year to year. (Birdlife, 2008)

Before 1925, little was known about the fauna on these islets. However, Busutill and Borg (1925) have recorded a number of different species of animals on Comino. They produced a list of mammals which they have observed, however, due to lacking scientific names the list was not quite useful. Another attempt was then repeated by Lanfranco (1969). Seven different species were recorded to inhabit Comino and the surrounding islets. Together with the list of Busuttil and Borg (1925), the recorded species include, Wild rabbit (Oryctolagus cuniculus), House mouse (Mus musculus), Brown and black rat (Rattus), Algerian hedgehog (Aethechinus algirus) and the Bat (Pipistrellus pipistrellus). In addition, a pair of gazelles were also reported by Busuttil and Borg. However, the gazelles were later killed by the prisoners on Comino. This list produced is incomplete and the Potamon (1982) stated that further studies have to be carried out in order to bring to light other species. The recorded fauna included, the wild rabbit (*Oryctolagus cuniculus)*, House mouse (*Mus musculus)*, Brown rat/ black rat (*Rattus)* and Algerian hedgehog (*Aethechinus algiru)*. In addition, the presence of a bat (*pipistrellus pipistrellus*) was also recorded. Nevertheless, the species was not identified. (Potamon, 1982). Years later, two different species of bats were identified by J.J Borg.The Kuhl's pipistrelle (*pipistrellus kuhli*), was recorded in 1997 and the Soprano pipistrello (*Pipistrellus pygmaeus*) was noted in the year 2000. (Borg, 1997), (Borg, 2000). Other vertebrates and invertebrates were later recorded throughout the years. These include reptiles, such as the Moorish (*Tarentola mauritanica*) and Turkish gecko (*Hemidactylus turcicus*), Mediterranean chameleon (*Chamaeleo Chamaeleon*), Western whip snake (Coluber Viridiflavus), Algerian whip snake (Coluber algirus), Cat snake (telescopus fallax), Leopard snake (Elaphe situla), Ocellated skink (Chalcides ocellatus) and the Wall lizard (*Podarcis filfolensis*).

The *Podarcis filofensis* is an endemic species which can only be found in Malta and Italy. Fossil records show that the two species (both from Malta and Italy) have a common ancestor which has been extinct for centuries. Experts declare that these ancestors have probably reached Malta from Sicily when the two islands were still

connected. It is suspected that when the islands somehow were separated, the wall lizards in Malta and Sicily have evolved into separate species. (Times of Malta, 2012). In the Maltese islands there are four subspecies of the Filfola lizard, the Filfolensis, Kieselbachi, Generalensis and Maltensis. These subspecies are found in Malta and Gozo and on the islets of Filfla, Fungus rock, Comino and St. Paul's. The Filfolenis, Kieselbachi and Generalensis are threatened due to lack of distribution and population. The Kieselbachi is particularly the most threatened subspecies due to a rat invasion that occurred on the island of St Paul. However, some researchers strongly believe that the Kieselbachi is already extinct. Despite their belief, further research might prove otherwise. Other complications which may be a threat to these reptiles include, habitat erosion, natural threats and predation. All four subspecies are protected with the law and their habitat are also protected. However, human interference may still cause complications, especially for the Maltensis which is found on Comino. The wall lizard feeds mostly on insects, fruit and vegetable matter. Others which are found in areas frequented by people may also feed on food waste which is left behind. The wall lizard varies colours as it depends on the species and sex. Young and female lizards lack the bright colours of the male as they show a brownish dull colour. The males are very territorial. When another male enters another's territory the male will puff up and show a yellow bright colour under the chin. A similar move is also performed when the male attempts to attract the female. The wall lizard is able to shed its tail when threatened. This is done in order to destruct its predator until it flees. (MEPA, 2014).

Several studies have been carried out on the *Podarcis filfolensis*. One of these studies includes the investigation of the phylogeography and historical demography of the Filfola lizard. This study was done by using mitochondrial and nuclear genetic markers. Samples were included from all the islets and rocks of the Maltese archipelago. By comparing today's genetics with previous genetics which have been found through studies, the genetic diversity and changes throughout time have been found. Two main types of mitochondrial phylogroups have been discovered. One was found distributed on the island of Malta and the islet of Filfla, while the other was found distributed on Gozo and Comino and on the surrounding islets and rocks. (Sciberras, 2013). Another study of the genetics, population structure and conservation of the *Podarcis filfolensis laurentiimuelleri* was carried out on the Italian islands of Linosa and Lampione. The study was performed by two sampling seasons using the capture/recapture method. This was done in order to obtain good results and identifying the habitat distribution, conservation status and ecological parameters. Once the population density was calculated it was found that it is particularly high. Molecular and electrophoretic analyses were carried out including the subspecies of Malta. The results show that the subspecies on the Maltese archipelago have related genes. While the Laurentiimuelleri is relatively genetically different from the ones found in the Maltese islands. Recent observations also show that the species on Lampione islet is abundant and is distributed throughout the island. However, frequent monitoring of the islands are crucial to preserve the population. Species on an Islet are more vulnerable to changes and extinction when compared with others living on mainland. (Scalera, Capula et. Al, 2004)

Another study was carried out in California to investigate the abundance and distribution of the flat tailed Horned lizard *(Phyrnosoma mcallii)*. This research project was done on 458 sections throughout the area of California, investigating each area and comparing them. These results were compared with previous studies which were carried out in 1980. Results included the comparison of the flat tailed horned lizard with ant density (food resource). Once these were compared, the results show that the Horned lizard has been diminished in certain areas and it is not as abundant as it once was. Researchers have come to conclusion that the reason of being diminished through time is due to human interference which result in habitat destruction. Although not listed as threatened by extinction the Horned lizard is still in jeopardy of continuing to diminish through time due to loss of habitat and other human activities. (Turner, Medica, 1982).

The wall lizard's abundance and distribution can easily be affected by several factors. For instance, the wall lizard is a reptile and therefore it is a cold blooded animal. It requires an external source of heat in order to maintain its body temperature. In the wild these creatures obtain heat from the sun. Without a source of heat reptiles cannot obtain any energy and as a result they will not be able to digest their food. Therefore, in winter, these reptiles will have to hibernate in a safe place away from predators. This will obviously affect their abundance as no one will be able to spot a wall lizard out of its hiding place. In addition, if the weather stays cold almost all year round this can also affect the mortality rate within these species as they might not be able to bear with the cold and hibernation will not sustain them. In addition, food availability is another factor which affects their abundance and distribution. For instance, if the food is abundant these creatures will continue to reproduce and the mortality rate might drop. Their distribution will also be affected as they will be more abundant in areas where food is available. However, this also depends on their behaviour as males are very territorial. Another factor is predation, when predators increase the mortality rate will also increase. A good example is what happened to the Kieselbachi on St Paul's islands. This lizard has been extinct or threatened with extinction after a rat invasion. Therefore, an increase in predators will obviously affect the abundance of a species. Competition is also another factor which can critically affect the abundance of a species. If for instance, on Comino there will be an increase in the population of hedgehogs this can easily affect the abundance of the wall lizard. Apart from the fact that hedgehogs are predators to the wall lizard, they also eat insects and fruit or vegetable matter, which is also the same food source of the wall lizard. Therefore, it will affect the food availability for the wall lizard which might cause an increase in its mortality rate. Human interference might also affect the abundance and distribution of this species. However, it is difficult to determine in which way it is affected. For instance, food left by individuals after a picnic can serve as a food source for the wall lizard. On the other hand, human activities such as picnics can cause habitat destruction. This is therefore one of the reasons why the project is being held. Other factors that may affect the abundance of the wall lizard include the abiotic factors surrounding them, such as shelter, nesting sites, nesting materials and space. If these abiotic factors are absent, the mortality rate of the species might increase. The population of the same species can also affect their distribution and abundance. Distribution can be affected by the territorial behaviour of the males. This is because males do not live closely to one another. In

addition, the abundance of the species can be affected through fights amongst males. Ecological factors, such as natural disasters can also affect this. (NSB biology, 2011).

The study will be carried out to note the abundance and distribution of the wall lizard on Comino. At the moment, there is only one species of lizard living in Comino and that is the *Podarcis Filfolensis Maltensis*. Comino has been becoming more popular throughout the years with visitors and therefore, human activities have increased. The study will give a good view of whether or not human activities have been disturbing this species. Five main areas, which are mostly frequented by people, will be studied. To go from one main area to another, less frequented paths will be chosen. The main areas include; Blue Lagoon, San Niklaw, Bird Life Observatory, St' Mary's Battery and the Isolation Hospital. Record sheets were prepared in order to keep a record of every wall lizard encountered. This record sheet includes details such as, time, date, season, weather, area, co-ordinates, species, colour, sex, activity and comments. The study will be repeated once a month for 12 consecutive months. Given that a record of the sex of every wall lizard will be taken, predominance can also be determined. This research project will be done in order to broaden one's knowledge regarding this species which might help increase the chance to conserve it.

## 3. Methodology

This research project was conducted in order to determine the incidence and distribution of the Maltese wall lizard (*Podarcis filfolensis maltensis)* on the island of Comino. In order to obtain accurate results, certain measures were taken.

Initially, a plan was designed based on the geographical and topographic features of the field study area. A map of Comino was plotted, where in, 5 main points of interest were identified and marked. The points identified correspond to zones on Comino which are known to be the most disturbed by people. In addition, existing paths were also marked which link one area to another. Following observations in was noted that the paths, however, are the least frequented by people. This map was then used to distinguish between and compare the abundance and distribution of the wall lizard from areas which are less frequented to areas which are mostly frequented. Record sheets were used in order to gather and maintain information on lizards encountered. Since Comino is mostly frequented by people in the summer season, the plan included to visit Comino twice every season in order to eliminate such limitations.

The research project commenced in spring of 2015 and ended in winter of 2016. On every visit, each area was critically evaluated and records of each and every wall lizard encountered were kept. The records included colour, sex, and types of activity noticed. Also, the area in which the lizard was encountered in, was also recorded. The process was repeated for each point and path every season. The walk around each area took approximately 4 hours.

Once the project was concluded, the record sheets were compiled and evaluated.

Chapter 2

## 4. Results and statistics

Areas:

A – San Niklaw

B – Birdlife observatory

C - St Mary's Battery

D – Isolation Hospital

E – Blue lagoon

AB – San Niklaw to Birdlife observatory

BC - Birdlife observatory to St Mary's Battery

CD– St Mary's Battery to Isolation hospital

DE – Isolation Hospital to Blue lagoon

EA – Blue lagoon to San Niklaw

**Spring**

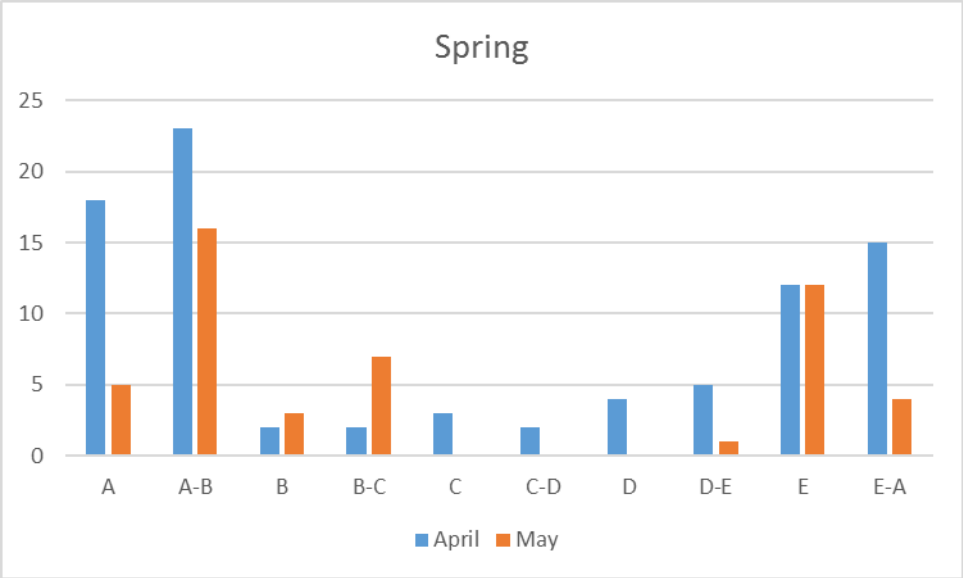


*Figure 1*

The majority of the lizards recorded in spring were encountered in April. In fact, 86 lizards were recorded in April while as only 48 were noted in May. This was unexpected as in April the weather was partly cloudy while in May the tempreture was higher and the day was sunny. Moreover, in May, human activity was higher when compared with

April. Most of the lizards in this season were recorded from area E to area A-B. Some of the males encountered had the breeding colours, a yellow chin and underside.

A total amount of 134 lizards were encountered in Spring.

## Summer

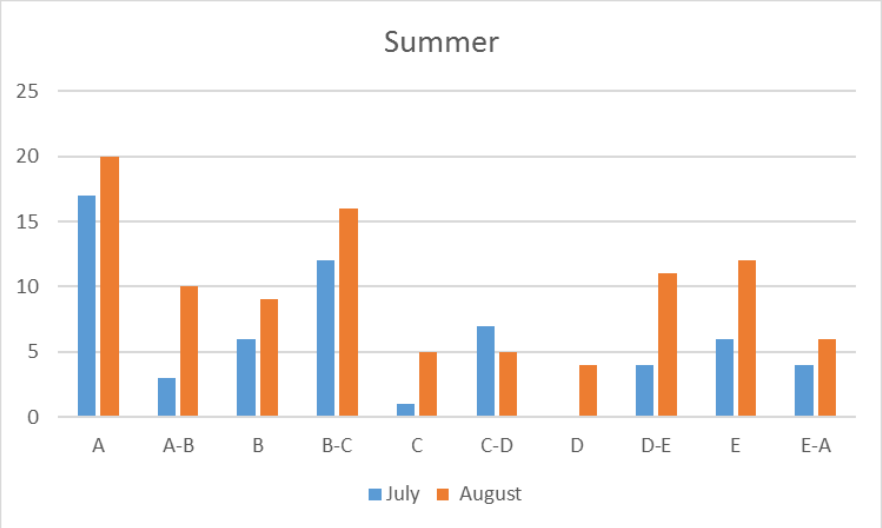


*Figure 2*

In summer, the total amount of lizards recorded were 158, 60 in July and 98 in August. On both dates the tempreture was above 30ºC and almost all of the lizards encountered were busking in the sun. The majority of the lizards encountered was from point E to point BC, the least being point C to point D.

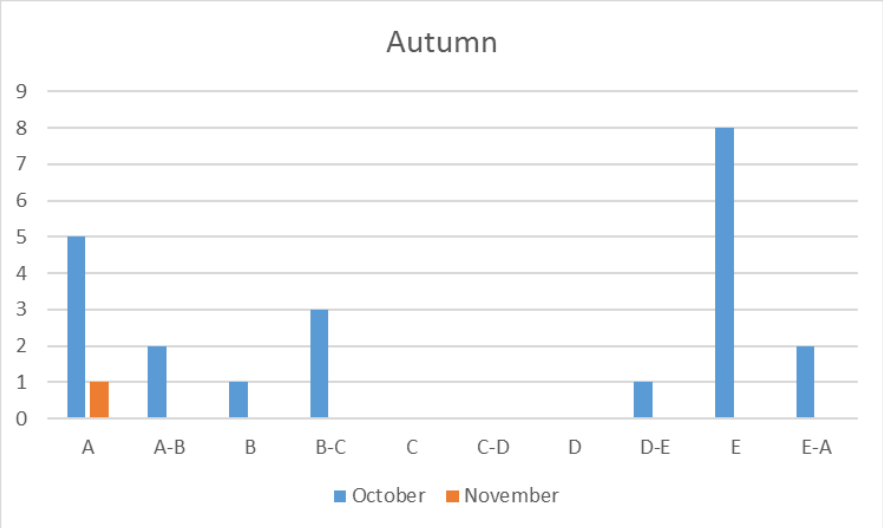


*Figure 3*

In Autumn, as expected, very few lizards were encountered, in early October, 22 were encountered while in late November only 1 lizard, probably a female, was encountered on the garigue in area A. On both days in Autumn the weather was cloudy and in late November it also rained. Therefore, since these reptiles are cold blooded, most of them were sheltering and either in hibernation or preparing for hibernation.

## Winter

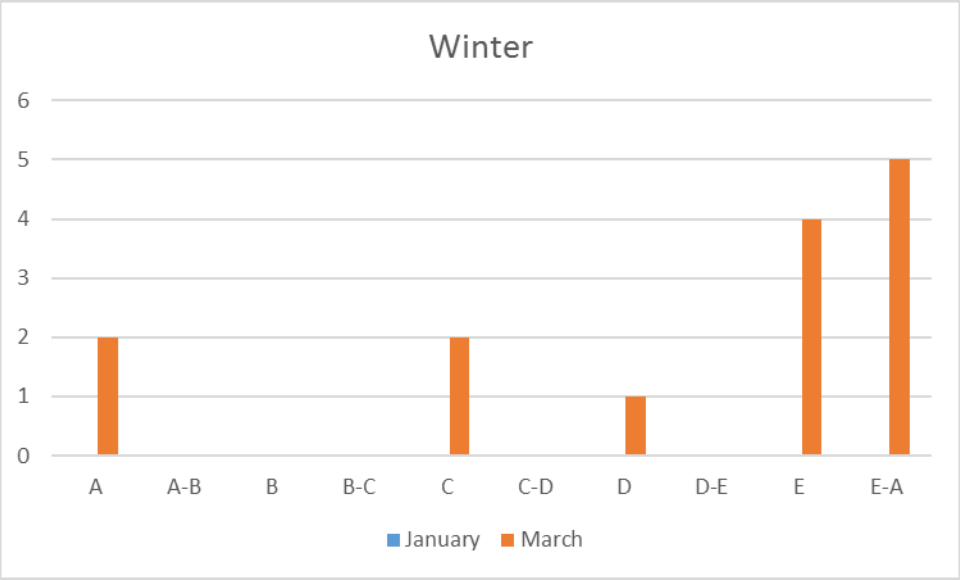


*Figure 4*

In winter, the total amount of lizards encountered was 14, all of which were recorded in Mid-March and none were recorded in early January. In addition, in January the weather was windy, cloudy and with frequent showers. Most of the lizards in March were encountered in point E and E-A, meaning in the area of Blue lagoon.

Distribution of the wall lizard on Comino

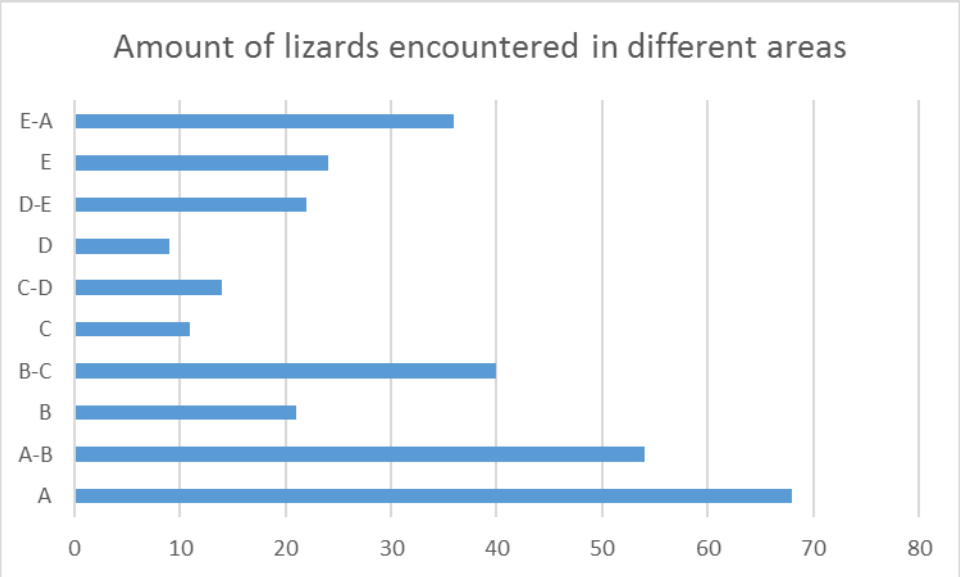


*Figure 5*

As the bar chart shows the wall lizard is distributed throughout the marked areas. However, they are more abundant in point A, A-B, BC and E-A. Meaning in San Niklaw(A), Blue lagoon to San Niklaw (E-A), Camp site and path to Birdlife observatory (A-B) and the path from the observatory to St Mary's battery.

## 5. Discussion and conclusion

As the records show, the amount of lizards encountered and listed in different seasons vary. This was expected since lizards are cold blooded and therefore, seek shelter for hibernation in winter. In Summer, a total of 158 lizards were recorded, this being the highest amount when compared with other seasons. The second highest amount of lizards recoded was in Spring, with a total amount of 134. Spring is the mating season for these lizards, and therefore, the majority of the males had breeding colours to attract a mate (The Magic of Nature, n.d). There are two possible reasons why less lizards were encountered in Spring. The first one being the weather, as the research project was initiated on the 26$^{th}$ of April, 2015 and that particular day was partly cloudy with a temperature of approximately 20$^{o}$C. As a result, the majority of the lizards might have been seeking shelter rather than basking in areas where they can be spotted. The second reason might be that in summer human activity increases and this might have a direct effect on their abundance. However, this will be discussed later on in the evaluation of results. Autumn had a total amount of 23 lizards recorded. The depletion in the amount of lizards recorded in this month is due to the weather, especially on the 29$^{th}$ of November as it was raining. The least amount of recorded lizards took place in winter, with a total amount of 14 lizards encountered in mid-March. However, this was quite expected due to the weather. This concludes therefore, that its abundance is highly dependent on the climate.

As the last bar graph shows, most of the lizards were found in area A, meaning in the San Niklaw area. The second area containing the highest amount of lizards is area A-B which is the path that starts from San Niklaw, to the bungalows in Santa Marija, to the campsite and finally to the Birdlife observatory. This path includes areas which are highly disturbed by people (Such as the campsite) and other areas which are rarely ever disturbed by visitors on Comino. However, the lizards were mostly recorded in the campsite area rather than in the area least disturbed. The area having the third highest amount of lizards recorded in, is area B-C, which includes the path from the birdlife

observatory to St Mary's battery. The forth area includes area E-A, which is the path that leads from Blue lagoon to San Niklaw.

The areas that are mostly disturbed by people are Blue lagoon and San Niklaw. In Blue lagoon, in summer it was somehow difficult to properly record each and every individual lizard encountered as most of the area was covered with sunbeds and deckchairs. However, when evaluating the San Niklaw area next to the hotel, it was easy to note that it is highly abundant in these reptiles. In addition, point A-B includes areas such as Santa Marija and the campsite which are also highly disturbed by people. Near the campsite, a high amount of lizards was encountered. In addition, the path from the camp site to the Birdlife observatory is not quite disturbed and it also contains a good number of lizards. As the bar graphs show, the least amount of lizards encountered was in point C, C-D and point D. Very few people walk up to these areas and therefore, it is rarely disturbed. As one can note therefore, human activity might attract lizards due to the leftover food waste. On the other hand, Blue Lagoon area does not contain an abundance of lizards when compared to San Niklaw, this might be due to the extreme human interference and disturbance that goes on every summer. The vast amount of people causes habitat destruction and therefore, makes it harder for the wall lizards to thrive in. In fact, in the Blue Lagoon area, most of the lizards recorded were noted higher up the hill away from crowded area where there are no sunbeds or deckchairs. In areas such as from point B to C, the lizards are more dependent on wildlife rather than human food leftovers, in fact, they were noted several times hunting for insects. The habitat preferred by these lizards is not quite clear as the abundance in an area is more based on the feed source rather than on the habitat itself.

Predominance could also be noted from the information kept on each individual. In Spring, the majority of the lizards recorded were females. While in summer, there was a much less difference in numbers of males and females recorded, however, more young lizards were noted. In fact, approximately 15 out of the 60 lizards encountered in July were offsprings. In addition, the predominance also varies from one area to another, for instance, in May, the lizards encountered in point B were all females, while the majority of lizards encountered in point E-A were males.

To bring this discussion into conclusion, the record sheets show that human activity does attract wall lizards as they provide a source of food and areas that were frequented by people contained the highest abundance of these wall lizards. On the other hand, as already mentioned, high disturbance and interference (as seen in blue lagoon) does cause habitat destruction which may interfere with the survival of this species.

## 5.1 Improvements

Although the research project was done with great care and attention to detail, there were still areas within the study where improvements could have been made in order to

yield more accurate results. For instance, the trip to Comino could have been done more frequent than twice per season in order to eliminate certain limitations such as the weather on certain days. In addition, another improvement that could have been done is to cover more area on Comino to take a better picture of the abundance and distribution of this reptile on the whole island. However, this required much more work, time and effort, as the trip around the marked areas already required a four hour walk. Moreover, photographic evidence could also have been presented in order to improve the research and provide a better picture of what has been done for this study to be carried out. The weather data of each day could have also been maintained and presented in order to correlate with the data collected. In addition, the study could also have been performed on other areas where this subspecies is present, such as in Gozo and Malta.

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# Appendices


San Niklaw
Blue lagoon
COMINOTO
COMINO
Birdlife observatory
Kemmuna
Isolation hospital
St Mary's battery

*Figure 6*