

Conservation of a unique fauna on the Greek Island of Milos



Habitat of the Milos viper, *Macrovipera schweizeri*, with a mosaic of bushes and bare patches of ground on a southerly slope in western Milos.



Extensive kaolin quarries affect the Milos viper's habitat and survival.



The Milos viper, *Macrovipera schweizeri*, in hunting stance in a tree.



Land grazed heavily by goats is a threat to the Milos viper's survival.



Claes Andrén and Nikolai Orlov (from Russia) tag a Milos viper with a microchip.



The Milos frog, a unique form of marsh frog found on Milos.

Four million years ago Gibraltar and North Africa were joined together. What today is the Mediterranean Sea was a mountainous steppe region. Movements in the earth's crust and violent volcanic activity broke down the land connection and the waters poured in and formed the Mediterranean Sea. Most animal life died out or became isolated on the summits of the mountains that became the islands of the Mediterranean. Land-living mammals, reptiles and amphibians were hard-hit and many of these species did not survive the dramatic change. In the middle of the Mediterranean lie the Cyclades islands and one of them, Milos, has an interesting tale to tell.

In addition to its unusually complex geology, the island has a large number of endemic species. One of these is the large **Milos viper** (*Macrovipera schweizeri*), that has survived until our times despite all the small mammals, its most important diet, dying out with the formation of the Mediterranean. How the Milos viper has managed to survive was still a mystery to scientists. Milos also has an endemic water snake, the **Milos water snake** (*Natrix n. milensis*), several endemic lizards, among them the **Milos Wall Lizard** (*Podarcis milensis*), and an endemic population of marsh frog in the *Rana ridibunda* complex. Of a total of 11 species of amphibians and reptiles on Milos 5, or about half, are endemic to the island.

Conservation project on Milos

According to the Berne Convention and the IUCN's European amphibian and reptile specialist group, the Milos viper was judged to be one of the ten most vital species of vertebrates to preserve because of its endangered status and unique evolutionary history. The Council of Europe commissioned researchers Claes Andrén and Göran Nilson at Göteborg University to assess the status of the remaining population, identify the most important threats and propose measures that would preserve a viable population in the long term. Intensive field studies were conducted on Milos between 1993 and 1997. A total of 186 vipers were captured and all were individually tagged with a microchip to enable the researchers to monitor their growth, survival, etc. 17 of the vipers were recaptured during the period in question. A total of 70 vipers were discovered on roads and of these 56 had been run over by cars. In addition, active radio transmitters were implanted in 7 individuals, which gave the researchers a unique opportunity to follow the different individuals by means of telemetry over the whole year and describe movement patterns and identify important habitats, hibernating places and the size of both sexes' home territories. The field work resulted in a report to the Council of Europe and a scientific publication (Nilson *et al*, 1999), that among other things describes their habitat preferences, the movement patterns of both sexes, estimates of the size of the population, their hunting strategies and behaviour, reproduction and mortality,

and the threats they are under. The report also included a list of recommendations and measures for the long-term preservation of the species.

Life habits of the Milos viper

The Milos viper is a mainly nocturnal animal and is active from the end of April until the middle of September. Its typical habitat is "maqia", stony ground with a mosaic of large and small bushes with open spaces between them where sunlight reaches the ground. Of all observations made using telemetry, 25% were of snakes basking "cryptically", i.e. they lay in the ground vegetation and were impossible to detect without the help of their radio transmitters and most lay on the edge under the larger bushes. The males' home territories covered between 10 and 20 ha and the females' were a little smaller. On average the male animals moved approx. 30 m a day. Their hibernating places were on southerly slopes, often in the middle of their home territories. In optimal habitats the population density was approximately 50 adult individuals per km². The total population on Milos in 1998 was estimated to be approximately 3,000 adult individuals, of which 2,500 were to be found in the less developed western parts of the island. The female has a two-year reproductive cycle while the male can reproduce every year. The sex ratio for adult animals was about 1:1.

The threat to the Milos viper

600 new adult animals were estimated to participate in reproduction every year. Mortality (loss) in adult animals due to human activity, for example through being run over or beaten to death, illegal trade and mining, was estimated to be between 500 and 600 adult animals. Other factors that affect their survival include overgrazing, fires, and other changes in their habitat and more "natural" mortality such as becoming prey to predatory birds. This means that the recruitment of adult animals to the population and mortality are not in balance. In our judgment, total mortality including predation and starvation was causing a continuous reduction in the population. One important survival factor proved to be the availability of migratory birds in spring and autumn. Some years, unfavourable weather, for example strong winds, may cause the birds' path to be shifted and not pass Milos. The Milos viper is highly dependent on this source of nutrition that passes the island in spring and autumn. It is one of three known species of viper in the world whose main source of food is migratory birds (Duarte *et al* 1995, Ermi 1980). If this source is not available the snakes have difficulty building up sufficient reserves of energy to be able to produce a new brood of young. It had not previously been known that the Milos viper lives of migratory birds, including our own Swedish birds.

Conservation of a unique fauna

Action to save the Milos viper

The field work also resulted in a long list of “measures to be taken”, necessary changes to improve the survival rate of the adult animals. The most important measure was to create a large protected area that included the snakes’ optimal habitats and the paths they followed between them. To limit the number of vipers killed on roads during the summer nights, a ban on heavy traffic between the mines at night during the summer months was proposed. The spread of new, large quarries must be restricted in western Milos, as must the grazing of sheep and goats. Fires occur every summer and sufficient resources must exist to contain and extinguish them. It is also important to educate the local inhabitants so that they understand and accept the measures that are taken. In some areas, feral cats are a problem because they kill many young snakes. Illegal capture to supply the animal trade used to be a major problem, but a committed mayor and police force have helped to limit such activities. The Council of Europe has drawn up a set of recommendations in line with the proposals in the report and the Greek government has agreed to implement them.

The project is accepted at the local level

In order to achieve the desired result, the Berne Convention made an “On-the-spot appraisal” on Milos in September 2000 (Andrén & Nilson 2000). The intention was to review the measures that needed to be implemented and try to realise them together with the responsible authorities at the local, regional and national level. The two researchers, Claes Andrén and Göran Nilson, carried out their assignment together with the head of the Council of Europe’s Natural Heritage and Biological Diversity Division, Eladio Fernández-Galiano, and representatives of the Greek authorities concerned. The point of departure for their discussions was that the conservation and protection of the unique fauna and the countryside of Milos will be positive for the local inhabitants and will become an increasingly sought-after resource in the future. Among other things, it will give the island’s population the chance to develop valuable eco-tourism. In order to implement these important conservation measures, Greek law required that Greek researchers and authorities be involved in a more concrete way. The work of mapping the ecology of the Milos viper and its endangered status has therefore continued with two Greek researchers: Yannis Ioannides and Maria Dimaki from the Goulandris Museum in Athens. The field work will be completed in 2008 and the practical preservation measures undertaken will then be followed up.

A successful conservation project

Many important results have already been achieved. A large part of western Milos has been designated a Natura 2000 area and has been given greater protection against exploitation. Night traffic to and from the mines is now very restricted. In those places where most snakes cross major roads, snake tunnels have been constructed with long “arms” in both directions to force

the snakes to use the tunnels under the roads. The problem previously was that the snakes stayed on the roads during the night to take advantage of the heat that built up in the roads during the day. The tunnels are Europe’s first snake tunnels and with the help of a Greek student, Kelly Kostoulia, we have been able to keep a daily record of all animals moving in the tunnels. We have also observed a sharp decline in viper mortality in areas with snake tunnels.

The Milos frog

A great deal of work and attention has been devoted to the viper, but as mentioned earlier there are several other species that are unique and also under serious threat. These include the **Milos water snake**, the **green lizard** (*Lacerta trilineata hansschweizeri*) an isolated population of **caspiian pond turtle** (*Mauremys caspica*) and, first and foremost, a unique population of green frogs (marsh frogs in the *ridibunda* complex. For now we can call the population the Milos frog. The Milos frog is facing the greatest immediate threat of extinction. In recent years, there has been unusually little precipitation and all ponds have been dried up for long periods. In autumn 2007, there was no water anywhere on Milos; all the small ponds had dried up, even the important brickworks pond in the centre of the island, something that had never happened before, not even during dry years.

A rescue attempt was undertaken in September 2007, when the brickworks pond was filled with about 100,000 litres of water (ten tankers), with the support of the mayor of Milos. We managed to recreate a small part of the pond, but no frogs were found on the island during the autumn and it is likely that this unique population is very close to extinction. The large brickworks pond is also vital for many migratory birds that pass Milos in the spring and autumn on their way to and from their breeding locations in northern Europe and their wintering areas in Africa.

Together with the Göteborg Natural History Museum (Göran Nilson) and the two Greek biologists Yannis Ioannides and Maria Dimaki at the Goulandris Museum in Athens, Nordens Ark (Claes Andrén) is now initiating an appeal for money to purchase this vital pond and its surroundings and turn it into a reserve for the Milos frog, the Milos water snake, the Milos viper and the migratory birds that are entirely dependent on its existence. A special fund will be set up with the sole aim of protecting and preserving the brickworks pond and its surroundings. Nordens Ark is also planning to keep a reserve Milos frog population at its breeding facility as a “backup”. Anyone who would like to join in and support this project can find more information on Nordens Ark’s web-site (www.nordensark.se) or contact the author directly (claes.andren@nordensark.se).

For those who are interested there is also a 50-minute film made by Claes Andrén and Ulf Jonasson available on DVD that describes the work being done to rescue the Milos viper and the Milos frog. The film was made for Swedish National



Göran Nilson tracking a Milos viper using telemetry.



Several hundred adult Milos vipers fall victim to road traffic every year.

Television and was televised in spring 2008. For each film sold 50 SEK is donated to the project to save the Milos frog, i.e. the purchase of the brickworks pond on Milos. Nordens Ark's new Amphibian house and wetlands will open in June 2008. Exhibitions with live amphibians and reptiles will illustrate Nordens Ark's conservation project. Next to the building are

outdoor facilities with live amphibians, reptiles, fish and birds. We will also be demonstrating a practical measure to avoid frogs being run over: a "frog tunnel" linking a wetland with the the frogs' hibernating places. There are many reasons to visit Nordens Ark this summer.

References

- ANDRÉN, C., G. NILSON, A. DIMITROPOULOS & Y. IOANNIDES (1994): Conservation of the Milos viper (*Macrovipera schweizeri*, syn. *Vipera lebetina schweizeri*). Preliminary report. *Ann., Musei Goulandris* 9: 245–252.
- ANDRÉN, C. & G. NILSON (2000): On-the-spot-appraisal on the Milos' viper *Macrovipera schweizeri* (Greece). Council of Europe Report T-PVS (2000) 51.
- ANDRÉN, C. & G. NILSON (2007): The Milos Viper – a conservation project in Greece. Nordens Ark Research School 2007 "Conservation Biology" report.
- ANDRÉN, C. & U. JONASSON (2008): Survive (DVD, 50 min, a film about the research and conservation project on Milos). A Nature/SVT production.
- DUARTE, M. R., G. PUORTO, FI L. FRANCO (1995): A biological survey of the pit viper *Bothrops insularis Amaral* (serpents, Viperidae): an endemic and offshore island snake of southeast Brazil. *Neotropical Fauna and Environment* 30: 1–13.
- ERMI, Z. (1980): Taxonomic study of pit viper Shedao (Snake island), by morphological and experimental methods and a preliminary discussion on the origin of Snake-Island pit-viper on Shedao. *Acta Herpetologica Sinica* 1: 1–16 (In Chinese).
- IOANNIDES, Y., M. DIMAKI, G. NILSON & C. ANDRÉN (2007): Conservation of Milos Viper, *Macrovipera schweizeri* (Werner, 1935) on Milos Island: A review of the last 15 years. SEH 14th European Congress of Herpetology, Porto 2007.
- IOANNIDES, Y., M. DIMAKI, G. NILSON, C. ANDRÉN & K. KOSTOULIA (2007): Road mortality of Milos viper (*Macrovipera schweizeri*) and the efficiency of underpasses. SEH 14th European Congress of Herpetology, Porto 2007.
- NILSON, G., C. ANDRÉN, Y. IOANNIDES & M. DIMAKI (1999): Ecology and conservation of the Milos viper, *Macrovipera schweizeri* (Werner, 1935). *Amphibia-Reptilia* 20: 355–375.
- SCHWEIZER, H. (1932): Über *Vipera lebetina lebetina* and *Natrix natrix schweizeri* der Zykladeninsel Milos. *Bl. Aquar. Terrar. Kunde*, Stuttgart 43: 358–364.
- STUBBS, D. (1985): Biogenetic Reserve Assessment *Vipera lebetina schweizeri* and *Podarcis milensis milensis*, Western Cyclades, Council of Europe report by the Societas Europaea Herpetologica.