

The herpetofauna of the isolated Island of Gavdos (Greece)

Zur Herpetofauna der isolierten Insel Gavdos (Griechenland)

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KURZFASSUNG

Von der Südkreta vorgelagerten griechischen Insel Gavdos kennt man sechs Reptilienarten. Unklar bleibt, wie diese auf die nie mit dem Festland oder Kreta verbundene Insel gekommen sind. *Mauremys rivulata* dürfte den Weg auf die Insel selbständig gefunden haben, die vorhandene Population ist allerdings sehr klein und stark gefährdet. Bei den übrigen Arten wird passiver (z. B. *Hemidactylus turcicus*) oder aktiver (z. B. *Testudo graeca*) Transport vermutet. Für zwei Reptilienformen (*Mediodactylus kotschyi kalypsae* und *Telescopus fallax pallidus*) erfolgte die Erstbeschreibung nach Exemplaren von Gavdos. Aufgrund späterer genetischer Analysen ist der taxonomische Status von *M. kotschyi kalypsae* allerdings zu überprüfen. Bei *T. fallax pallidus* wird die Hypothese einer aktiven Verschleppung in Diskussion gebracht. Weitere genetische Abklärungen sind nötig, um die Herkunft der Reptilien von Gavdos zu erhellen.

ABSTRACT

The Island of Gavdos off the south coast of Crete (Greece) was never connected to the mainland or Crete and yet is home to six reptile species. This paper speculates about how they got there. *Mauremys rivulata* probably arrived at the island unaided, but the population there is now very small and endangered. With regard to the other species, the mechanisms are likely to have been passive (e. g., *Hemidactylus turcicus*) or active (e. g., *Testudo graeca*) transport. The original description of two reptile forms (*Mediodactylus kotschyi kalypsae* and *Telescopus fallax pallidus*) is based on specimens from Gavdos. However, subsequent genetic analysis suggests that the taxonomic status of *M. kotschyi kalypsae* needs to be reassessed. In the case of *T. fallax pallidus*, active transport has been hypothesised. Further genetic investigations are needed to shed light on the origin of the reptiles of the Island of Gavdos.

KEY WORDS

Reptilia; Island of Gavdos (Greece), herpetology, isolation, human introduction, colonization, active and passive transport

INTRODUCTION

Gavdos, the southernmost island of Europe, is located about 40 kilometers off the southwest coast of Crete and 250 km from the northern coast of Africa. The island (Fig. 1) covers an area of 32 km² with the highest elevation at 368 m above sea-level. Only a few dozen people live on the island all year round. In the south, the island is rocky and bare; in the middle there are extensive forests of *Pinus brutia*, the northern coast has steep cliffs as well as sand dunes with juniper populations. The island is terraced throughout, suggesting that it was more densely populated in an earlier period (FOHRER 2009). The author visited Gavdos on 12-19 April 2012.

Outstanding natural assets

Gavdos and the small neighboring island of Gavdopoula comprise both the NATURA 2000 object GR 4340013 and the IBA object (Important Bird Area) GR 181. Bird migration and a lagoon near the southern cape of Tripiti are of particular ornithological interest. An assessment of the vascular plant species on the island was done by BERGMEIER et al. (1997). Gavdos holds two natural phenomena of outstanding significance, which are also subject to two EU-funded Life Projects, namely "Junicoast – Actions for the Conservation of Coastal Dunes with *Juniperus* spp., in Crete and the south Aegean (Greece)" on the beaches of

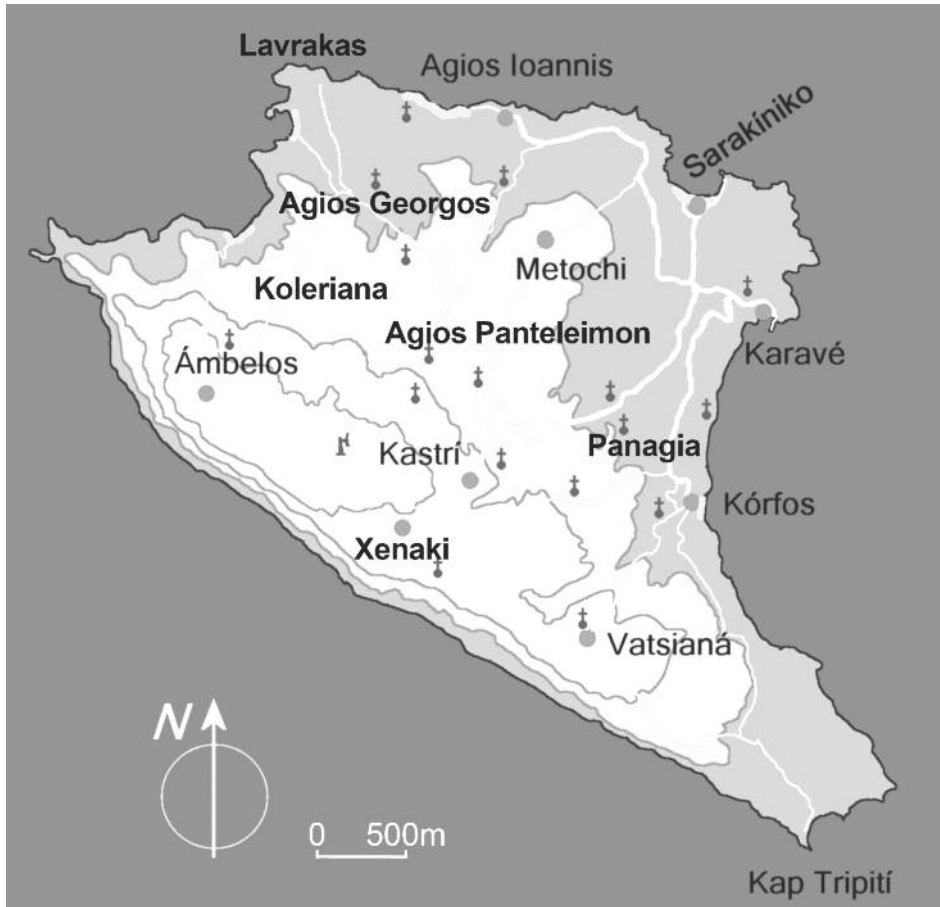


Fig. 1: The Greek Island of Gavdos off the southern coast of Crete (map modified from Wikipedia[®]).

Abb. 1: Karte der griechischen Insel Gavdos vor der Südküste Kretas (aus Wikipedia[®], vom Autor verändert).

Agios Ioannis (Fig. 2), Sarakiniko and Lavrakas (total area 102 ha) and “Medponds – Actions for the Conservation of Mediterranean temporary ponds” (five centers with approximately 100 temporary ponds, Fig. 3).

Among others, they are home to *Callitriche pulchra*, an African water starwort, occupying just this one habitat in Europe (LANS-DOWN 2012).

THE HERPETOFAUNA

The formerly continental Aegean region began to break up some 13 million years ago. It is located in a geologically active region, with the African plate subducting underneath the Eurasian plate. In

the Pliocene, the land masses of the South Aegean Arch including the Island of Crete, were separated by independent movements towards Anatolia in the east (about 12 my ago) and the Peloponnese in the northwest

(about 5 myr ago) (LYMBERAKIS & POULAKAKIS 2010). This isolation of Crete is reflected in its depauperate herpetofauna, now limited to 14 species (KASAPIDIS et al. 2005). The Island of Gavdos emerged from the sea in the course of the Pliocene or Early Pleistocene; the island was never connected to Crete or other land masses (KASAPIDIS et al. 2005). Today the sea between these two islands is up to 1,500 meters deep. Crete is nevertheless the most probable source of animal colonization of Gavdos. With six identified species, the reptilian fauna of that island is clearly less diverse than of Crete and the absence of lacertid lizards (compared to three on Crete) is reflective of its isolation (PIEPER 1970). Hypothesising early colonization from Crete, one would expect local reptilian subspecies to have developed on Gavdos in view of the island's long isolation. The following analysis of the herpetofauna of Gavdos however, suggests that some species reached the island comparatively short time ago through human passive or active introduction. There is little information on Gavdos in the literature, and the little there is is summarized below.

Mediodactylus kotschyi kalypsae
(ŠTĚPÁNEK, 1939)

This bent-toed gecko is common on this as on all smaller Aegean islands (KASAPIDIS et al. 2005) and the most common reptile species on Gavdos. It received particular attention in the literature for its subspecies status (ŠTĚPÁNEK, 1939). According to BEUTLER & GRUBER (1977), the interesting feature of this subspecies from the *oertzeni* group is its morphological equidistance to the populations on Crete and the Cyclades. Otto WETTSTEIN visited the island of Gavdos on June 1, 1941, and reported 25 finds: "Not uncommon under stones on Gavdos, i.e., one specimen under every 30th-50th stone" (WETTSTEIN 1953: 661).

KASAPIDIS et al. (2005) mention 16 subspecies of *M. kotschyi* for the Aegean islands; there is however no general consensus on their taxonomic status. In their genetic investigations, these authors include the specimens found on Gavdos in a phylo-

genetic cluster labelled "Gavdos-Kastello-rizo-Akşehir (Anatolia)". This link to the Anatolian populations is surprising as it presupposes an unusual long-distance migration. KASAPIDIS et al. (2005) also state that the taxonomic classifications proposed to date on morphological grounds are not in agreement with the molecular phylogeny of the *M. kotschyi* subspecies. An examination and reassessment is therefore called for which is also the opinion of LYMBERAKIS & POULAKAKIS (2010). *Mediodactylus kotschyi* could have been introduced to Gavdos through East Mediterranean sea traffic that was already common practice 10,000 years ago (LYMBERAKIS & POULAKAKIS 2010).

Hemidactylus turcicus
(LINNAEUS, 1758)

VALAKOS et al. (2008) and the data sheet for NATURA 2000 GR no. 434 0013, report the Turkish Gecko to be present on Gavdos. From the author's experience, this gecko rarely shows up in the cool April weather, when it can be found in wells and buildings rather than exposed to the open air. In spite of intensive searches, no sighting was made on Gavdos. A landlord mentioned, however, that in summer geckos are to be seen on the walls of the bungalows at the village of Kastri suggesting the presence of *Hemidactylus*. In many parts of the Mediterranean, this species is considered a newcomer arrived by passive human introduction.

Mauremys rivulata
(VALENCIENNES, 1833)

The four-line reference to a first sighting by VALAKOS (1987), who spoke of four adult and five to six juvenile *M. rivulata* near the church of Agios Pavlos, aroused special interest, bearing in mind the island's isolated location in the Aegean. The Gavdos population is reported in the Crete guidebook as follows (FOHRER 2009, p. 773): "In the north there are oasis-like freshwater biotopes and waterfalls. On the boggy ground near the Agios Georgios church, there are even some little freshwater turtles." In the Aegean, *Mauremys* had never respected the Mid-Aegean Trench, a

most effective sea barrier to land animals, that has been in place for more than five million years (LYMBERAKIS & POULAKAKIS 2010). *Mauremys* probably found its own way to Gavdos in the process of colonizing the Aegean archipelago. In genetic studies performed by MANTZIOU et al. (2004), the Gavdos specimens were shown to belong to these authors' haplotype group "n1", which they also report for the islands of Samos, Kos, Akrotiri and the village of Krya Vrysi on Crete.

At present, Gavdos has only a few small freshwater spring habitats with little water supply, e.g., at Korfos, Agios Pavlos and Agios Georgios. During the visit, the author found an aquiferous stream section at Agios Pavlos but no Balkan Terrapins. Perhaps the location given by VALAKOS (1987) is the result of confusion between homonymous churches. In the still unpublished supplement to the WWF wetland inventory of the Greek Aegean, the habitat at Agios Georgios is listed under GAV004 (CATSADORAKIS & PARAGAMIAN 2007, personal communication by Thanos GIANNAKAKIS, September 22, 2011). The catchment of this stream was subjected to a thorough search. In the area of the mouth of the stream at Lavrakas, a 50-meter-long impounded portion was found that would be suitable for *Mauremys*, but no sightings were made. However, in a section of the stream above the church of Agios Georgios, about 1.5 km from the sea, there were several hundred meters of slightly wet stream structures (Fig. 4) where two specimens of *M. rivulata* (carapace lengths of approx. 14

and 10 cm) were found on April 11, and a juvenile (carapace length 6 cm) on April 16 (Fig. 5). In a meeting in Kastri, Professor Apostolos ALEXOPOULOS, geologist at the University of Athens who supervises various projects of the local authorities (see ALEXOPOULOS 1999), explained that the prolonged presence of water in the stream above Agios Georgios is caused by the less permeable flysch strata there. He estimated the *M. rivulata* population at a maximum of 10-12 specimens and said they were mainly to be seen in winter.

In the Aegean, *Mauremys* is also found in marginal and temporary wet habitats, unlike the European Pond Terrapin *Emys orbicularis* (LINNAEUS, 1758), which requires bigger and permanent water bodies (BROGGI 2012; BROGGI & GRILLITSCH 2012). Species with small populations and specialized needs are particularly under threat of extinction (FOUFOPOULOS & IVES 1999). Suitable habitats on small islands tend to be limited in size and can only support small populations. The Gavdos population is very small and thus vulnerable. In the context of climate change, the future of many *Mauremys* populations in the Aegean must be considered very uncertain.

Testudo graeca (LINNAEUS, 1758)

The Spur-thighed Tortoise is not native to Crete or Gavdos. Fossil evidence on Crete was established for *Testudo marginata* SCHOEPPF, 1782 (GEORGALIS & KEAR 2013). There are increasingly frequent reports of tortoises on Greek islands, includ-

Figs. 2-5 (opposite page) / Abb. 2-5 (gegenüberliegende Seite)

Fig. 2: Beach at Agios Ioannis (Gavdos) showing coastal dunes with juniper.

Abb. 2: Der Strand bei Agios Ioannis (Gavdos) zeigt ausgedehnte Küstendünen mit Wacholderbestockung.

Fig. 3: Mediterranean temporary ponds at Agios Panteleimon (Gavdos), unique European habitat of the African vascular plant *Callitriche pulchra*.

Abb. 3: Mediterrane temporäre Tümpel bei Agios Panteleimon (Gavdos), einziges europäisches Vorkommen der afrikanischen Gefäßpflanze *Callitriche pulchra*.

Fig. 4: Brook near Agios Georgios (Gavdos) holding a population of *Mauremys rivulata* (VALENCIENNES, 1833).

Abb. 4: Bach nahe Agios Georgios (Gavdos) mit einer Population von *Mauremys rivulata* (VALENCIENNES, 1833).

Fig. 5: Young *Mauremys rivulata* (VALENCIENNES, 1833) in a brook near Agios Nikolaos (Gavdos).

Abb. 5: Juvenile *Mauremys rivulata* (VALENCIENNES, 1833) in einem Bach nahe Agios Nikolaos (Gavdos).



2 3

4 5





Fig. 6: Young *Telescopus fallax pallidus* (ŠTĚPÁNEK, 1944), found under a stone near Vatsiana (Gavdos).

Abb. 6: Junger *Telescopus fallax pallidus* (ŠTĚPÁNEK, 1944), gefunden unter einem Stein nahe Vatsiana (Gavdos).

ing *T. graeca* on Crete (BUTTLE 1985). In summer, townspeople take their pets with them, also to originally tortoise-free islands where some of them may escape. George PAPADAKIS from the Princess Apartments in Kastri told that he had seen a tortoise on the road from Karave to Kastri a few days before and had carried it across the road. On 16 April, 2013 the landlady in the harbor bar at Karave showed a *T. graeca* to the author that she had found in the woods above the village three weeks earlier. It is therefore clear that this species of tortoise has now arrived on Gavdos.

Telescopus fallax pallidus
(ŠTĚPÁNEK, 1944) (Fig. 6)

Telescopus fallax pallidus is the subspecies of European Cat Snake that the Island of Gavdos shares with Crete (cf. PIEPER 1970), maybe also Elasa, Christiana, Santorini and Kassos (GRILLITSCH & GRIL-

LITSCH 1999). The separation of the Cretan *T. fallax* from continental (Peloponnese) populations was a consequence of the sinking of the connecting land bridge at the end of the Miocene, 5.4 myr ago (KYRIAZI et al. 2013). A male specimen of *T. fallax* was found (leg. STUBBE) during WETTSTEIN's collecting trips on June 6, 1942 (WETTSTEIN 1953). At the present visit to Gavdos, this snake, called "agio fido" in Greek, was found under stones several times: two specimens on the track from Vatsiana to Cap Tripiti (April 13), a drowned specimen in a well in the Neveli cultural landscape and a specimen on the path from Kastri to Ambelos (April 15), and one in the woods near the power plant above Metoxi (April 19).

How can one explain the presence of the Cat Snake on extremely isolated small islands? One hypothesis is human introduction with a religious background. Snake rituals have been common since the days of

ancient Greece (LYMBERAKIS & POULAKAKIS 2010). With markings resembling a cross on the back of its head, the European Cat Snake is considered a holy snake and subject to a snake cult celebrated on August 15, in Arginia and Markopoulon on the island of Cephalonia (GITTENBERGER & HOOGMOEND 1985, WARNECKE 1988). The Cat Snake also occurs on the extremely isolated Strofades Island of Stamfordi (1.3 km²) (VALAKOS & MYLONAS 1992). The origin of the population there is seen as an instance of active human transport in connection with an ancient monastery that was founded on the island in the 13th century (WARNECKE 1988). Another record of the cat snake described from an isolated island refers to

Telescopus fallax intermedius GRUBER, 1974, from Antikythira. The occurrence of *T. fallax* on Thera (Santorin) is probably also the result of dispersal by man (KYRIAZI et al. 2013). The presence of morphologically similar forms in small islands of the southern Aegean calls for further research. Genetic investigations would doubtlessly shed light on their relationship.

An unconfirmed reference is added at the end. WETTSTEIN (1953: 791) mentioned that upon his visit to the island he was credibly told that *Hierophis gemonensis* (LAURENTI, 1768) occurs on Gavdos, a snake species common to the western Balkans as far as Crete to the south. He did however not find this species on Gavdos.

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