

## The “wetland island” of Lemnos (Greece): herpetofauna and nature conservation

(Testudines: Emydidae, Geoemydidae; Anura: Pelobatidae)

Die Feuchtgebietsinsel Limnos (Griechenland): Herpetofauna und Naturschutz  
(Testudines: Emydidae, Geoemydidae; Anura: Pelobatidae)

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### KURZFASSUNG

Erst kürzlich gaben STRACHINIS & ROUSSOS (2016) einen aktuellen Überblick über die Herpetofauna der Ägäisinsel Limnos. Die Exkursion des Autors im Jahr 2016 war allerdings speziell der herpetologischen Untersuchung der Feuchtgebiete gewidmet und basierte auf dem World Wide Fund For Nature (WWF) Feuchtgebiets-Inventar der griechischen Inseln. Auf Limnos waren 50 Inventarobjekte erfaßt. Gemäß WWF-Kartierung und eigener Untersuchung konnten an 22 dieser Lokalitäten Vorkommen von *Mauremys rivulata* (VALENCIENNES, 1833) und an neun Stellen solche von *Emys orbicularis* (LINNAEUS, 1758) festgestellt werden. Damit weist Limnos eines der größten Vorkommen dieser Wasserschildkröten in der Ägäis auf. Als Standorte sind die Umgebung der Salz- und Brackwasserseen im Nordosten der Insel bedeutsam, ebenso die zahlreichen durch Strandwallbildung blockierten Ästuarien der Fließgewässer. Ein für die Herpetofauna bedeutendes Feuchtgebiet ist eine Abgrabungsstelle mit entwickelten Feuchtgebietsstrukturen. Diesen Feuchtgebieten kommt eine hohe Naturschutzbedeutung zu, sie sind aber nur teilweise durch Natura2000-Gebeite abgedeckt.

### ABSTRACT

Most recently, STRACHINIS & ROUSSOS (2016) provided a topical overview of the herpetofauna of the Aegean Island of Lemnos. The author's excursion in 2016 was however focused on the herpetological study of the island's wetlands based on the World Wide Fund For Nature (WWF) inventory of the wetlands of the Greek islands, which lists 50 sites on Lemnos. With the help of the WWF mapping results and own observations, *Mauremys rivulata* (VALENCIENNES, 1833) was found at 22 sites and *Emys orbicularis* (LINNAEUS, 1758), at nine. Hence, the terrapin population of Lemnos is among the biggest in the Aegean. The terrapins are found mainly in the area of the salt and brackish lakes in the northeast of the island as well as the numerous barrier beach blocked estuaries. A significant wetland for the herpetofauna of Lemnos has also developed on a soil excavation site. These wetlands are of great importance in terms of nature conservation but are only covered in part by the designated Natura2000 areas.

### KEY WORDS

Reptilia: Testudines: Emydidae: *Emys orbicularis*; Geoemydidae: *Mauremys rivulata*; Amphibia: Anura: Pelobatidae: *Pelobates syriacus*; wetland habitats, nature conservation; Lemnos, Aegean, Greece

### INTRODUCTION

The Island of Lemnos (Fig. 1) is located in the northern Aegean Sea near the Dardanelles Strait on the continental shelf of Asia Minor. Until the last Ice Age, Lemnos was connected to the Anatolian continent (STRACHINIS & ROUSSOS 2016). With an area of 476 km<sup>2</sup>, it is the ninth biggest Greek island. The closest neighboring island of considerable size, the Turkish island of Gökçeada (Imbros), is only 22 kilometers away. Lemnos has a human population of about 17,000, including 5,000 in the area of the principal settlement Myrina, which is the center of the

island's relatively limited tourist trade. This largely unwooded island is flat, bare in appearance and rich in sandy beaches. The highest elevation, at 430 m, is Mount Vigla, its surroundings providing a mountainous aspect including gorges (GRUNDNER & EINHORN 2013). The Gulf of Moudros almost divides the island and contributes to the heavily indented appearance of the coastline. The bedrock comprises schist and flysch interspersed with volcanic material in the west. At the lower levels there are fertile alluvial soils. One third of the area is agricultural land, with intensive



1831, *Elaphe sauromates* (PALLAS, 1811), or *Ablepharus kitaibelii* (BIBRON & BORY SAINT-VINCENT, 1833), *Hyla arborea* (LINNAEUS, 1758) and *Bufo bufo* (LINNAEUS, 1758), the presence of which (vipers excluded) would not be surprising.

In their biogeographic account on the islands of the northeastern Aegean, KASAPIDIS et al. (1996) assigned Lemnos to the Anatolian archipelago, a view supported by the presence of *O. elegans*.

The author of this paper twice visited the Island of Lemnos. The first trip, in July 1986, comprised two excursions on which *B. viridis*, *E. orbicularis*, *M. rivulata*, *H. turcicus* and *Eryx jaculus* were observed. On the second visit that lasted from April 17 to 28, 2016, the presence of all the herpetological species previously recorded from the island was confirmed with the exception of *M. insignitus*, *E. jaculus* and *P. syriacus*. Particular importance was attached to visiting the island's wetlands.

As to the species not found by the author, *M. insignitus* was detected only in the northeast of the island and *Pelobates syriacus* seems to be restricted to the area of the salt lakes there (STRACHINIS & ROUSSOS 2016).

Among the species observed by the author, *E. jaculus* was frequently found by other visitors, especially in the sandy alluvial planes. Estimated from many roadkills, *D. caspius* seems to be the most common snake on Lemnos. Even more roadkills were seen of the legless anguid lizard, *P. apodus*, which finds little grip on the smooth asphalt and struggles to cross the roads. In addition, numerous individuals were present in the terrain. *Hemidactylus turcicus* and *M. kotschy* were rare sightings on Lemnos, *N. natrix*, *M. caspica*, *E. orbicularis* and *B. viridis* constitute herpetological communities in several wetlands. *Bufo viridis* was found in a rivulet in Myrina, but also far from water under stones in the arid areas in the north of the island.

## THE ISLAND'S WETLANDS

With the support of the Swiss MAVA Foundation for Nature Conservation (Gland, VD), The World Wide Fund for Nature Greece (WWF GREECE 2014) drew up a wetland inventory for the Greek islands from 2004–2013. It lists 75 islands with a total of 805 wetlands bigger than 0.1 ha. On the basis of this inventory, an awareness has developed for the need to preserve these wetlands and adopt conservation measures. This island inventory, which is available on the Internet at < <http://www.oikoskopio.gr> >, permits accurate identification of the sites on Google Earth® and also provides the data required for accurate orientation in the field. Thanos Giannakakis, the WWF project leader, kindly provided the author with detailed information from the inventory for a total of fifty sites on Lemnos, including the herpetological data. Most of these sites – including all the bigger ones – were visited. The island's thirteen sizeable wetlands occupy 2.62 % of the total area. Lemnos accordingly boasts the most significant wetlands in the Mediterranean region.

The large salt lakes in the northeast of the island (Figs. 3, 4). –

Inland from the bays of Keros and Alyki are three impressive lakes of substantial size. Covering an area of about 6 km<sup>2</sup>, Alyki is the biggest of these salt lakes. It has so far been used to obtain salt for private use. The road from Moudros to Plaka, in the north east corner of the island, offers good views of this large lake. It attains its maximum size from the winter rains in the catchment but also receives water through seawater infiltration. The most southerly of the lakes is Chortarolimni, which is 2 km<sup>2</sup> in size. Between the two larger lakes lies Asprolimni, whose surface has an area of 42 ha. The waters of Chortarolimni and Asprolimni are brackish as they are at a slightly greater distance from the sea. During the visit to the island, the last of the departing flamingos were still to be seen standing in the middle of Lake Alyki, which shows how low the water level was by then. The water level of the little Asprolimni lake was also down to a shallow covering, while Chortarolimni was already completely dry. The author was told that the latter dries out more frequently and for longer periods than the two other lakes. They are probably dry from May to



2 3



4 5



late autumn. During that period, they form salt marshes with typical halophytes such as *Salicornia*, *Arthrocnemum* and *Tamarix*. In the winter half-year, and in spring, the lakes attract large numbers of birds and function as a stepping stone for migrations. They are breeding grounds for birds such as the Collared Pratincole, *Glareola pratincola*; Black-winged Stilt, *Himantopus himantopus*; Pied Avocet, *Recurvirostra avosetta*; and about twenty pairs of the Eurasian Stone Curlew, *Burhinus oedipnemos*. Well above a thousand individuals of the Greater Flamingo, *Phoenicopterus roseus*, can be seen in winter; even 5,000 individuals were reported from the winter of 1996/97 (cf. the NATURA 2000 data sheets < <http://natura2000.eea.europa.eu/Natura2000/SDF.aspx?site=GR4110001> > and < <http://natura2000.eea.europa.eu/Natura2000/SDF.aspx?site=GR4110006> >). The sites and their natural wetland structures are largely well preserved with few signs of human influence in the surroundings. The climate can be considered semi-arid, with an annual average rainfall of about 500 mm.

The herpetofauna in the area is concentrated on the immediate surroundings of the lake margins, where there are ditches, small waterholes and stream retention areas along the coast. The numerous circular well shafts are also significant. The older ones in particular have a rough stone lining (Fig. 5), which amphibians can climb, while the more modern wells have a smooth cement lining. MALKMUS (1982) discussed the importance of wells as breeding sites for

amphibians and hydrophilic reptiles in Portugal. That observation applies to the whole of the Mediterranean area. The wells near the salt lakes serve as habitat and reproduction sites for *P. bedriagae*. According to the above mentioned reports on the 2009 and 2010 excursions, tadpoles of *P. syriacus* were also seen there. *Pelobates* is reported to be a common nocturnal sight on roads and tracks in the surroundings. Another amphibian species found in the area is *B. viridis*. The ditches are a suitable habitat for the terrapin species *M. rivulata* and *E. orbicularis* and the snake *N. natrix* (Fig. 6). The surrounding marshland is home to numerous *T. graeca*, *E. jaculus*, *P. apodus*, *P. najadum*, *D. caspius*, a frequent sighting here, and *O. elegans*, which is common everywhere on the island. Also *M. kotschy* can be observed in the wells.

The Diapori wetland and others (Fig. 7). – The Diapori wetland lies to the south of Kontias on the road leading to the isthmus that connects the Fakos Peninsula with the rest of the island. Kontias once lay nearby the sea and Fakos was an island; the wetland formed in the siltation area is a seasonal wetland, which largely falls dry in summer. At the time of the visit, however, there were still many pools of water. There was water in the ditches and they contained numerous specimens of *P. bedriagae* as well as *M. rivulata*, *E. orbicularis*, *N. natrix* and *B. viridis*. Again, this wetland attracts numerous bird species as winter visitors, which is why it has been declared a protected area.

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

Fig. 2: Intensive agriculture accounts for about one third of the area of Lemnos (wine-growing near Dafni in the north). (Photo: Günter Stadler)

Abb. 2: Etwa ein Drittel der Fläche von Limnos wird intensivlandwirtschaftlich genutzt (Weinbau bei Dafni im Norden). (Foto: Günter Stadler)

Fig. 3: The Alyki salt lake (size approx. 6 km<sup>2</sup>).

Abb. 3: Der Alyki-Salzsee (größe etwa 6 km<sup>2</sup>).

Fig. 4: The dried-out lake Chortarolimni in the northeast of the island of Lemnos.

Abb. 4: Der ausgetrocknete See Chortarolimni im Nordosten der Insel Limnos.

Fig. 5: The circular masonry lining of the well shafts is no obstacle to the hydrophilic herpetofauna upon entering or leaving the water body.

Abb. 5: Das ringförmige Mauerwerk, das die Brunnenschächte auskleidet, ist für die hygrophile Herpetofauna kein Hindernis beim Betreten und Verlassen des Wasserkörpers.

There are other residual wetlands on the island, e.g., near the airport, south of Moudros, in the Achivadouli Bay near Hephæstia and at Paleo Pedhino.

Sandbar-blocked estuaries (Fig. 8). – The phenomenon of sandbar-blocked estuaries, in which the discharge of stream water into the sea is prevented, is discussed in BROGGI (1994). Sandbar-blocked estuaries are formed when the coastal currents fill the estuary with sand or block it with a sandbar, leading to the retention of water in the stream. The standing water bodies thus created tend to survive for long periods of time. They have a sandy bed, in which reeds and tamarisks may grow. They are of great interest to the herpetologist as potential spawning grounds for *P. bedriagae*, *B. viridis*, and habitat to *M. caspica*, *E. orbicularis* and *N. natrrix*, and constitute the last refuges for turtles on the islands. Lemnos is lacking in wet stream midsections, which could also be attractive to *Mauremys*. As the wet section in the lower course is usually short, it will normally support only small isolated populations of 10-20 individuals; such populations are correspondingly vulnerable to external influences.

On Lemnos there are numerous examples of such blocked estuaries at various locations around the island. Some of them are still home to populations of *M. rivulata* and a few to populations of *E. orbicularis*. In most cases one also finds *P. bedriagae* and *B. viridis*, both of which are numerous on the island. The individual locations of the turtle habitats are listed in Table 1. One site is worthy of mention here for its isolated location and fine appearance, namely the one in the southern section of Gomati Bay, where *M. rivulata*, *E. orbicularis*, *N. natrrix* and *B. viridis* are all found together.

The soil excavation area in the Moschilos crater north of Varos (Fig. 9). – On the aircraft's almost circular approach to the island, the author noticed a remarkable aggregation of ponds on a hill north of the airport at Varos. At the time, the site was not included in the WWF wetland inventory but it has been added in the meantime under the designation "Zavalaki artificial ponds" (personal communication from Thanos Giannakakis, 24.10.2016). The location is the crater of the dead

Moschilos volcano. At the higher elevations of the area, military installations which, however, do not seem to be in military use any more are visible from the airfield. Locals said that over the years farmers dug a lot of soil out of the crater for deposition on the fields to ameliorate their soil. In the course of time, a wetland succession with ponds and pools developed at these excavation sites. During the visits, the biggest pond was more than 400 m long and 130 m wide, and there were other ponds of varying sizes. The bird life at the ponds included herons, ducks, coots and moorhens. From the surrounding walls of the crater, the call of *B. oedicnemus* was heard. Hundreds of *M. rivulata* were seen basking on the banks of the ponds and pools making this population most probably the most numerous on the island. This is an important example how an anthropogenic biotope quite distinct from the island's natural hydrological systems has been colonized by the Balkan Terrapin.

The status of the terrapins and the Eastern Spadefoot. – Lemnos is the "turtle island" of the Aegean and remarkable for a further insular occurrence of *P. syriacus*.

*Mauremys rivulata*. – BROGGI (2012) provided an overview of the distribution of the Balkan Terrapin in the Aegean and the threats to its survival there, listing 29 Greek and two Turkish islands. With the exception of three, all the sites are on islands with an area of over 50 km<sup>2</sup>. The populations on Lemnos are among the most numerous in the Aegean. For Lemnos, the WWF Greece wetland inventory specifies *Mauremys* populations in twenty out of fifty listed sites (see Table 1). The author was able to confirm thirteen of them. In fact, the Balkan Terrapin is found all along the coast of the island except in the far northwest; these sites all relate to stream estuaries. They comprise the lake district in the northeast of the island, the wetlands at Diapori Bay and especially the various impounded streams along the coast. No populations were found at the few inland wet sites, not even at the big reservoir north of Kondias. During the excursions to the island in 2016, two new sites were identified away from the coast: the Moschilos crater area and the waterfall near Aghios Ioannis (Lem xx and xy in Table 1).

Table 1: Known sites of *Mauremys rivulata* (VALENCIENNES, 1833), and *Emys orbicularis* (LINNAEUS, 1758), on the Greek Island of Lemnos. X – record localities according to the wetland inventory of WWF GREECE (2014), MFB – the author's observations in April 2016, \* – two streams. Coordinate datum: GGRS87.

Tab. 1: Bisher bekannte Vorkommen von *Mauremys rivulata* (VALENCIENNES, 1833) und *Emys orbicularis* (LINNAEUS, 1758) auf der griechischen Insel Limnos. X – Angaben im Feuchtgebietsinventar des WWF GREECE (2014), MFB – Beobachtungen des Autors im April 2016, \* – zwei Bäche. Koordinatenbezugssystem: GGRS87.

WWF Code	Wetland name Feuchtgebietsname	Coordinates Koordinaten	E / N O / N	<i>M. rivulata</i>	<i>E. orbicularis</i>
Lem 1	Alyki	25.376811° /	39.946697°	X	X
Lem 2	Chortarolimni	25.334358° /	39.904944°	X MFB	X MFB
Lem 4	Diapori marsh	25.149526° /	39.855776°		MFB
Lem 5	Asprolimni	25.377523° /	39.924006°	X MFB	X
Lem 6	Ragkavas Estuary	25.072313° /	39.916544°	X	
Lem 7	Moudros Bay–Airport	25.253841° /	39.913287°	X MFB	
Lem 8	Estuary of anonymous torrent near Kotsdinas	25.290126° /	39.939575°	X MFB	
Lem 9	Estuary of Tigani Beach	25.347423° /	39.966373°	X	
Lem 11	Petradi small marsh	25.082586° /	39.838041°	X	
Lem 13	Zematas Estuary	25.120040° /	39.852510°	X MFB	
Lem 18	Gomati Estuary 1	25.153108° /	39.988584°	X MFB	X MFB
Lem 21	Nevgatis	25.134736° /	39.846015°	X (MFB*)	
Lem 23	Chavouli	25.266614° /	39.842461°	MFB	
Lem 30	Estuary of Stream 1	25.296026° /	39.819995°	MFB	
Lem 32	Gomati Estuary 2	25.149070° /	39.996980°	X	
Lem 35	Tourlida Estuary	25.157604° /	39.829526°	MFB	X
Lem 37	Souladika	25.267624° /	39.957968°	X	
Lem 39	Avlonas Estuary	25.068609° /	39.899657°	X MFB	MFB
Lem 45	Petradi large Marsh	25.084613° /	39.841250°	X MFB	
Lem 54	Estuary of Falakro Beach	25.169519° /	39.989080°		X
Lem 55	Atsiki firing field	25.262965° /	39.962365°	X	
Lem 56	Panagia Pigadeli Estuary	25.246386° /	39.990352°	MFB	MFB
Lem 69	Poliochni Estuary	25.340606° /	39.851485°		(G. Stadler, Frastanz)
Lem xx	Kremasta nera (north of Aghios Ioannis)	25.312000° /	39.780000°		MFB
Lem xy	Crater Moschilos	25.152820° /	39.566150°		MFB

Another site is the unlisted syphon below the Kremasta Nera waterfall in Kaspaka (Lem xx in Table 1) at the northern end of the Aghios Ioannis Bay; Kremasta Nera means “falling water” (GRUNDNER & EINHORN 2013). This natural spectacle is best watched in the winter half-year, when there is sufficient runoff. In the syphon itself, dozens of *M. rivulata* were seen.

A curious phenomenon (already mentioned by CLARK 1989) was observed on the coast at Avlonas Bay to the north of Myrina (Lem 39 in Table 1). During the trip in July 1987, the author saw tourists standing on the bridge of the road to Aghios Ioannis feeding bread to terrapins. In the water there were dozens of terrapins, which were not in the least shy. Most of them were *M. rivulata*, some were *E. orbicularis*. This event did not recur in April 2016, although a few individuals of both species were still found there.

*Emys orbicularis*.— BROGGI & GRILLITSCH (2012) provided an overview of our knowledge on the presence of the European Pond Terrapin in the Aegean and the threats to its survival there, listing eleven islands, with three requiring confirmation. Accordingly, in the Aegean, the European Pond Terrapin is much rarer than the Balkan Terrapin. It is more demanding in terms of habitat requirements in that it prefers stable, permanent wetland structures and is sensitive to water pollution. On the islands, their populations are always significantly smaller than those of *M. rivulata*. That also applies to the record localities on Lemnos, where the European Pond Terrapin is usually represented by just a few individuals living among large Balkan Terrapin populations. Two out of six sites indicated on the WWF wetland maps were confirmed by the author and four new sites were added. The opinion by STRA-



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8 9

CHINIS & ROUSSOS (2016) who claimed that the species is endangered on Lemnos must be considered correct, even though its distribution on the island is wider than observed by those authors.

*Pelobates syriacus*.— Apart from Lemnos, Aegean island records of the Eastern Spadefoot Toad refer to Kos and

Lesbos only (SOFIANIDOU 2012). This species is mostly observed in temporary pools of stagnant water which form in flat hollows during the rainy period but also in large permanent water bodies. *Pelobates syriacus* coexists with *B. viridis* and the two terrapin species.

## DEGREE OF ENDANGERMENT AND OUTLOOK

The island of Lemnos has two NATURA 2000 zones, which partly overlap. One comprises the area around the three lakes (original designation: GR 4110001 – Chortarolimni – Limni Alyki kai Thalassos periochi) and occupies a total of 182 km<sup>2</sup>, including 71 % sea and the sunken city of Chrise (< <http://natura2000.eea.europa.eu/natura2000/SDF.aspx?site=GR4110001> >). The other major NATURA 2000 site on the island (GR 4110006 - Limnes Chortarolimni kai Alyki – Kolpos Moudrou – Elos Diapori kai Chersonisos Fakos < <http://natura2000.eea.europa.eu/natura2000/SDF.aspx?site=GR4110006> >) overlaps with the first in the area of the salt lakes but also extends along much of the Bay of Moudros to the area of Diapori and the Fakos Peninsula. In 2000-2006, the municipality of Moudros participated in what they called 'Leader conservation project'. As part of the project, an information center was set up in the old Kalliopi primary school and observation towers with information boards were installed at numerous points. These facilities have not been maintained and are

showing their age to the extent that in some cases they are now in a state of disrepair.

During heavy winter rainfalls, the Alyki salt lake floods and extends as far as the surrounding marsh. In 2015, apparently with the permission of the local authority, bulldozers were used to clear a 30 meter wide gap in the sand dunes so as to connect the lake with the sea and facilitate runoff, thus impacting the ecological balance of the hydrological system (source: Alexia Karageorgis, < <http://www.sustainablebusiness toolkit.com/natura-2000-salt-lake-site-destroyed-by-diggers> >). That can hardly be considered consistent with the declared conservation goals for the area.

Wetland alteration measures were also implemented in the case of the Diapori wetland, where new drainage ditches were dug and landfill and grading operations took place. Eutrophication impacts of intensive agriculture in the surroundings are evident. In periods of drought, water is pumped from the estuaries for agricultural use. And in some places, alterations relating to tourist trade can be seen in the vicinity of the near-

Figs. 6-9 (opposite page) / Abb. 6-9 (gegenüberliegende Seite)

Fig. 6: A juvenile *Natrix natrix* (LINNAEUS, 1758), holding *Pelophylax bedriagae* (CAMERANO, 1882), that was too big for swallowing and later was released. (Photo: Peter Goop)

Abb. 6: Eine juvenile *Natrix natrix* (LINNAEUS, 1758) hat einen *Pelophylax bedriagae* (CAMERANO, 1882) gefaßt, der zu groß war, um verschluckt zu werden, und deshalb später losgelassen wurde.

Fig. 7: The Diapori wetland near Fakos Peninsula.

Abb. 7: Das Feuchtgebiet von Diapori nahe der Fakos-Halbinsel.

Fig. 8: Impounded water of a sandbar-blocked estuary in the north of Gomati Bay.

Abb. 8: Staubereich einer Bachmündung hinter einer Küstendüne im Norden der Gomati-Bucht.

Fig. 9: The Moschilos crater north of Varos. Observe the soil extraction for agricultural purposes, which created wetland successions.

Abb. 9: Der Moschilos-Krater von Varos. Man erkennt die gezielt erfolgte Bodenabtragung, in deren Folge ein Feuchtgebiet entstand.

by sandy beaches. As such habitats are of existential importance for the hydrophilic herpetofauna, the modifications seriously impact what in most cases are only small populations. The large NATURA 2000 sites command a degree of awareness, that hard-

ly applies to the smaller waterbody systems. The herpetological species at greatest risk on Lemnos is doubtless *E. orbicularis*. Lemnos boasts natural assets of international importance. Their conservation is a worthwhile task.

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