

The reptile fauna of the Northern Dodecanese (Aegean Islands, Greece)

Die Reptilienfauna des Nord-Dodekanes
(Ägäische Inseln, Griechenland)

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KURZFASSUNG

Erstmalig werden Angaben zur Reptilienfauna von achtzehn Inseln des Nord-Dodekanes und über drei weitere Inseln gemacht. Beim Besuch der Inselgruppen Arki, Lipsi, Patmos und Agathonissi wurden Daten zur Verbreitung und Ökologie von *Cyrtopodion kotschy*, *Hemidactylus turcicus*, *Ablepharus kitaibelii*, *Laudakia stellio*, *Coluber najadum*, *Coluber caspius* und *Vipera xanthina* gesammelt.

Die Artengemeinschaften der Inseln sind im Vergleich zum naheliegendem türkischen Festland stark verarmt und als Resultat eines intensiven, noch nicht beendeten Aussterbeprozesses anzusehen.

ABSTRACT

Information on the reptile communities of eighteen islands from the Northern Dodecanese (SE Aegean Islands, Greece) is reported here for the first time. The island groups of Arki, Lipsi, Patmos and Agathonissi were visited and distributional as well as ecological information is given for *Cyrtopodion kotschy*, *Hemidactylus turcicus*, *Ablepharus kitaibelii*, *Laudakia stellio*, *Coluber najadum*, *Coluber caspius* and *Vipera xanthina*.

Faunal relaxation is the main process structuring the species communities on the islands.

KEY WORDS

Reptiles, islands, biogeography, extinction; *Cyrtopodion kotschy*, *Hemidactylus turcicus*, *Ablepharus kitaibelii*, *Laudakia stellio*, *Coluber najadum*, *Coluber caspius*, *Vipera xanthina*; Dodecanese, Aegean Islands, Greece

INTRODUCTION

The biogeography of the herpetofauna in the Aegean has been the subject of many studies dating from the last century (BOETTGER 1888, 1891; WERNER 1938; WETTSTEIN 1953; CHONDROPOULOS 1986, 1989) and the distributions of most species have been relatively well described despite the large number of islands (although some important problems still exist; see BEUTLER 1979; GRUBER 1979; CLARK 1991). In contrast to this general pattern, a few areas in the Aegean have undergone only cursory examinations or have not been visited by biologists at all. This paper examines the

reptile fauna of one of the more remote areas in the Aegean Sea, the Northern Dodecanese (Greece). This area is located in the southeastern Aegean Sea and is composed of the island of Patmos and its surrounding islets: the Fourni, Arki and Lipsi island groups and the neighbouring islands of Agathonissi and Farmakonissi, as well as the larger islands of Leros and Kalymnos (figs. 1, 2). I summarize and complement the existing information on the herpetofauna of some of these islands and report new information on 18 islands never visited before by herpetologists.

AREA AND METHODS

The islands included in this study lie on the shelf of Asia Minor in the eastern Mediterranean Sea in an area delineated by the islands of Samos and Ikaria in the

north, Kos in the south and the Central Aegean Trough in the west (fig. 1). They are located between 15 and 50 km off the coast of Turkey. The whole archipelago is

composed mostly of limestone, with the exception of Patmos which is primarily volcanic and Fourni which consists mainly of crystalline shist and marble (NAVAL INTELLIGENCE DIVISION 1943; WATSON 1964). Geographically the islands of this region can be separated into several subgroups:

1. **F o u r n i** (=Fourni, Phournoi) is a group of two major and approximately half a dozen minor islands situated just south of Icaria and Samos. They are largely denuded of any higher vegetation and support only a small population of fishermen and goatherders. The islands were visited by WETTSTEIN and WERNER (WETTSTEIN 1937), as well as by XYDA (1983) but their species list remains incomplete.

2. **A g a t h o n i s s i** (=Agatho, Gaidaros, Gaidaronissi) is a limestone island approximately 15 km off the coast of Turkey. The island's rolling hills are covered by phrygana and some degraded macchia. The only high vegetation on the island are some scattered *Ceratonia siliqua* as well as a few olive and fig trees. The ca. 150 inhabitants are mostly goatherders and fishermen. As the bonsai-shaped bushes and the conspicuous browsing line indicate, the island faces a clear overgrazing problem. Besides the impressive populations of goats, the only other mammals seen were rabbits (*Oryctolagus cuniculus*) and rats (*Rattus* sp.). Some notes on the herpetofauna of the island are included in CLARK (1992). According to the local people, there are no amphibians and no viperid snakes on the island. They also insist that *Coluber caspius* GMELIN, 1789 is the only snake species occurring on the island.

There is no available information whatsoever on the herpetofauna of the island of Farmakonissi (=Farmako) which lies south of Agathonissi and has never been visited by a herpetologist.

3. **P a t m o s** is the westernmost and one of the most densely populated islands in the group; it is also one of the better herpetologically explored. It consists of three separate mountain blocks connected by narrow isthmi. Most of the population lives in the communities of Chora, Skala and Kambos and supports itself through the extensive cruiseship and pilgrimage tourism, as well as through

fishing and animal husbandry. In the valleys of the island some grain, grapes and vegetables are grown. The rest of the island is covered by low forms of *Euphorbia acanthothamnus* and *Sarcopoterium spinosa* phrygana while some scattered macchia bushes (*Pistacia lentiscus*) grow mainly in the northern third of the island. Except for the minuscule wetlands in Alyki and Grikos, there is no surface water on the island. Patmos has been visited several times by biologists (CLARK 1968; CHONDROPOULOS 1989), and its herpetofauna is reasonably well known.

4. **A r k i** (=Arkii) is a remote group of 17 small islands surrounding the main island of Arkios. The whole group is very desolate, and all but the main island and Marathi are uninhabited. The ca. 70 inhabitants are mostly fishermen and goat-herders, but tourism is gaining importance. Especially the smaller islands are nearly bare, with only occasional *Pistacia lentiscus* bushes interrupting the sparse *Euphorbia acanthothamnus* covering. The flatter islands exhibit remnants of old terraces and other signs of past grain cultivation. Some of the islands have rats (probably *Rattus rattus*) [Arkios, Kalovolos, Psathonissi], and most of them also have goats [Arkios, Kalovolos, Psathonissi, Tsouka, Tsoukaki, Makronissi, Marathi, Strongyli, and Agrelloussa], rabbits (*Oryctolagus cuniculus*) [Arkios, Kalovolos, Makronissi, Smineronissi, Strongyli, and Agrelloussa] or even feral donkeys [Agrelloussa]. The islands have not been visited by a herpetologist before.

5. The 13 small islands commonly referred to as **L i p s i** (=Lipsii) cluster around the larger island of Lipsos and are situated just south of Arki. They lack significant surface water and are generally too small to be inhabited except Lipsos itself which has ca. 600 inhabitants. This island is mainly covered by an open *Juniperus phoenicea* bushland although substantial parts of the island are used for the cultivation of grains and some vegetables. The satellite islands are all very dry and rocky and are mostly covered by *Euphorbia acanthothamnus* and grass plant communities. Most of them, however, also support sparse, wind-sculptured *Pistacia lentiscus* bushes that act as important refugia for

whatever vertebrates live on the islands. Many of these islands support goats and rats. There are only three references in the literature concerning Lipsos (NILSON & ANDRÉN 1986; TIEDEMANN & GRILLITSCH 1986; CHONDROPOULOS 1989), while there is no existing information on the faunas of any of the surrounding isles.

6. The larger islands of L e r o s and K a l y m n o s were not visited during this study. The herpetofauna of Leros, however, is well described thanks to the efforts of CLARK (1968), DIMITROPOULOS (1987) and BUTTLE (1990) and Kalymnos has been examined by SCHNEIDER (1979, 1983). The natural habitats of the islands are described in the respective sources. Information concerning these islands has been included in this study because they form a natural group with the previous islands as well as to provide a broader picture of the distributional patterns of the reptiles in the region.

General observations on the herpetofauna of the region were made in the summers of 1986, 1988 and 1990 while intensive collecting of specimens was done in the period of 25. 6 - 4. 7. 1992 (Collecting

permit No. 83201/3312 issued by the Greek Ministry of Agriculture). During this period, the weather was sunny with light northerly winds, and maximal daily air temperatures varying between 27 °C and 33 °C. Substrate temperatures normally varied between 25 °C and 38 °C and occasionally rose up to 43 °C, although reptiles were rarely seen on the ground at such high temperatures.

I searched for reptiles by lifting stones or other suitable refugia. Specimens were either collected by hand or with the help of a noose. To minimize suffering, the captured individuals were stunned with a blow to the head and then euthanized by depositing in a freezer before preservation in 95% ethanol. All specimens collected have been deposited at the Museum of Natural History in Vienna (NHMW).

Following abbreviations were used in the text: Makronissi (A.) refers to Makronissi island next to Arkios (No. 6 on fig. 2) while Makronissi (L.) refers to Makronissi island south of Lipsos (No. 7 on fig. 2). A bracketed number (e.g. [3]) indicates the number of specimens from a specific location.

RESULTS

Cyrtopodion kotschy (STEINDACHNER, 1870)

Material: 23 individuals collected (table 1). In addition one individual was observed on Kaparonissi and one on Smineronissi.

C. kotschy is the reptile species with the widest distribution in the islands of the Aegean, as well as the species occurring at the highest population densities. Interestingly, this holds true only for the smaller islands; on larger islands this gecko seems to be exceedingly rare or absent and has yet to be reported from Patmos, Leros Lipsos and Agathonissi, although it probably occurs there at low densities (table 2). This apparent rarity of the species has been reported by other authors too (BEUTLER & GRUBER 1979; SCHNEIDER 1983) and is presumably due to increased predation and competition pressure on larger islands. The subspecific status of individuals occurring in the region has not yet been clarified (see BEUTLER & GRUBER 1977). Examined indi-

viduals, however, display typical characteristics of the eastern *danilewskii* (STRAUCH, 1887) subspecies group (e.g. cycloid scales on the regenerated tail; see also BEUTLER 1981). There is distinct inter-island variation; examined specimens from even neighboring islands differed in subtle ways. For example, all animals from Lyra had a distinct dorsal banding pattern and a yellow tail underside, while animals from Stavronissi were uniformly gray and had a light yellowish cloacal region. These observations might indicate low gene flow between the islands.

Hemidactylus turcicus turcicus (LINNAEUS, 1758)

Material: 14 individuals collected (table 1). Three more animals were seen in Skala, Patmos, and two on the houses of the settlement on Arkios. Several individuals were also found under rocks on Makronissi (L.), Agrelloussa and Wassilonissi but could not be caught.

In contrast to *C. kotschy* this species shows little morphological differentiation

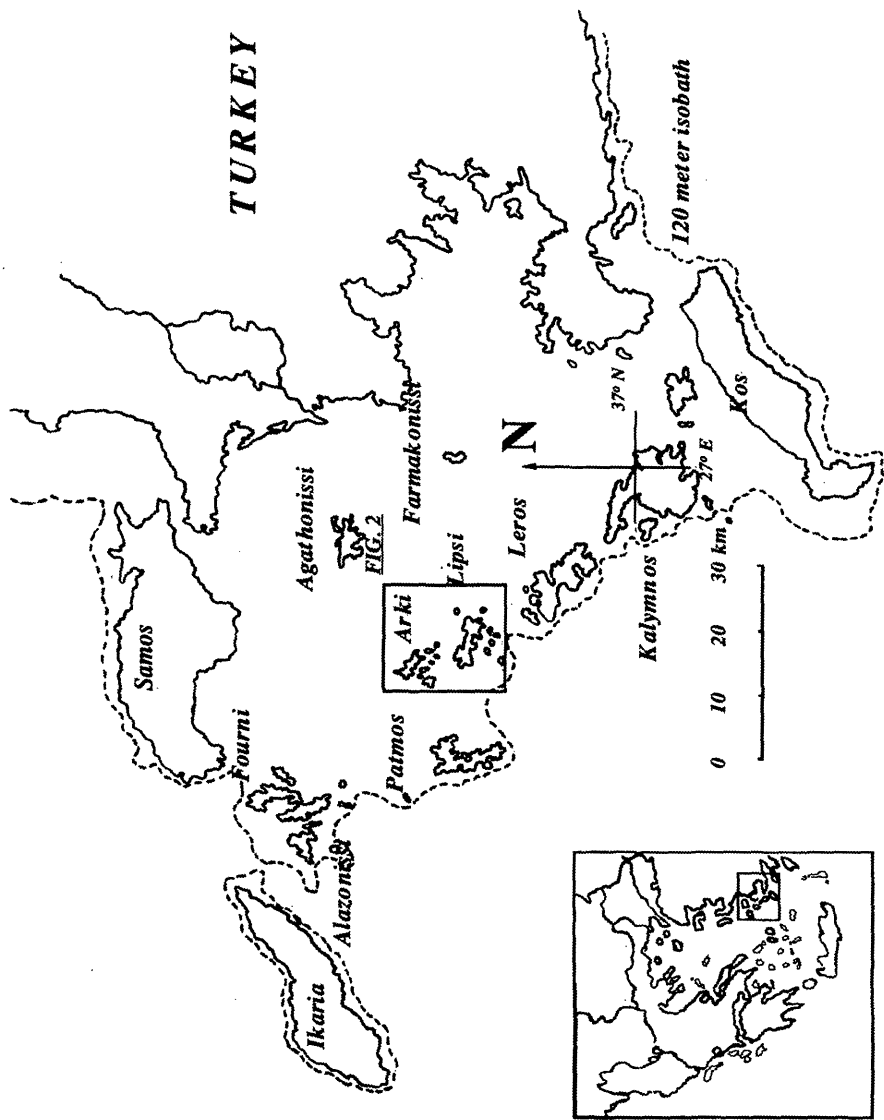


Fig. 1: Overview map of the Northern Dodecanese (Aegean Islands, Greece). The framed central area is shown enlarged in fig. 2.
Abb. 1: Übersichtskarte des Nord-Dodekanes (Ägäische Inseln, Griechenland). Das eingetragene zentrale Gebiet ist in Abb. 2 vergrößert dargestellt.

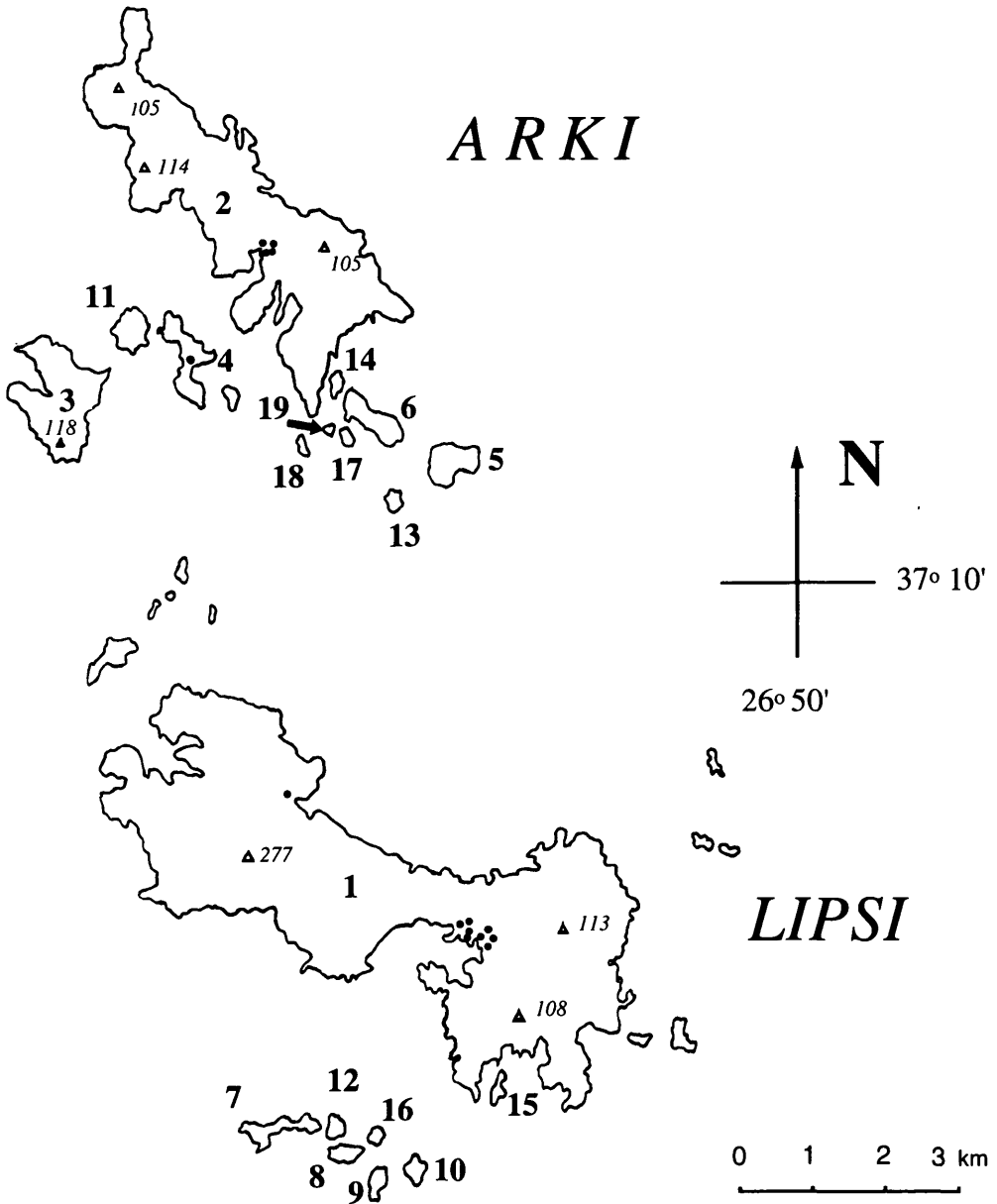


Fig. 2: Map of the Arki and Lipsi island groups. Altitudes given in meters.

Abb. 2. Detailkarte der Arki- und Lipsi-Inselgruppen. Höhenangaben in Metern.

1. Lipsos, 2. Arkios, 3. Agrelloussa, 4. Marathi, 5. Kalovolos, 6. Makronissi (A.), 7. Makronissi (L.), 8. Kaparonissi (= Kapari), 9. Pilawi Nissi (= Pilavi), 10. Stavronissi (= Stavri), 11. Strongyli, 12. Wassilonissi (= Piato?), 13. Psathonissi, 14. Abaptistos, 15. Lyra, 16. Plakonissaki (= Psomos?), 17. Tsouka, 18. Smineronissi, 19. Tsoukaki.

Table 1: The reptile specimens collected on islands of the Northern Dodecanese (Greece). M - male; F - female; SVL - snout-vent length; TL - tail length; * - regenerated tail.

Tab. 1: Das auf Inseln des Nord-Dodekanes (Griechenland) aufgesammelte Reptilienmaterial. M - Männchen; F - Weibchen; KRL - Kopf-Rumpflänge; SL - Schwanzlänge; * - regenerierter Schwanz.

Taxon/Location	Date	Sex (M/F)	SVL (mm)	TL (mm)	NHMW Inventory number
Taxon/Fundort	Datum	Geschlecht	KRL (mm)	SL (mm)	NHMW Inventarnummer
<i>Cyrtopodion kotschy</i> (STEINDACHNER, 1870)					
Makronissi (L.)	27.6.1992	2 M, 1 F	37-39	38-42*	35406: 8, 9*, 10
Plakonissaki	27.6.1992	1 M	31	31	35406: 11
Stavronissi	27.6.1992	2 M	39-41	31*	35406: 12*, 13*
Pilawi Nissi	27.6.1992	1 subadult	30	31	35406: 14
Lyra	27.6.1992	5 M	30-34	14*-33	35406: 15*, 16, 17*, 18, 19
Kalovolos	31.6.1992	1 M, 2 F	41-43	19*-31*	35406: 20*, 21*, 22
Psathonissi	31.6.1992	1 M, 1 F	31-40	3*-21*	35406: 23*, 24*
Makronissi (A.)	31.6.1992	1 M, 1 F	36-41	32*-46	35406: 25, 26*
Tsoukaki	31.6.1992	1 M	37	30*	35406: 27*
Marathi	31.6.1992	1 M, 1 F	42-46	30*-36*	35406: 28*, 29*
Abaptistos	31.6.1992	1 M	42	32*	35406: 30*
<i>Hemidactylus turcicus turcicus</i> (LINNAEUS, 1758)					
Plakonissaki	27.6.1992	3 M, 1 F	37-49	30*-49*	35407: 1*, 2, 3*, 4*
Lipsos	28.6.1992	1 F	47	33*	35407: 5*
Strongyli	31.6.1992	2 M	49-51	33*-40*	35407: 7*, 8*
Makronissi (A)	31.6.1992	1 F	43	3*	35407: 9*
Marathi	31.6.1992	1 M, 3 F	36-60	32*-58	35407: 10*, 11*, 12, 13
Abaptistos	31.6.1992	1 subadult	32	34	35407: 14
Agathonissi	01.7.1992	1 F	37	41	35407: 6
<i>Laudakia stellio stellio</i> (LINNAEUS, 1758)					
Agathonissi	01.7.1992	1 M	133	182	35403: 1
Meloi, Patmos	02.7.1992	1 F	119	164	35403: 2
Grikos, Patmos	02.7.1992	1 M	132	121*	35403: 3*
Meloi, Patmos	03.7.1992	3 M, 2 F	112-134	88-172	35403: 4*, 5, 6, 7*, 8
Kampos, Patmos	04.7.1992	1 M, 1 F	107-114	147-161	35403: 9, 10
Kampos, Patmos	04.7.1992	1 juvenile	67	98	35403: 11
<i>Ablepharus kitaibelii kitaibelii</i> (BIBRON & BORY, 1833)					
Tsouka	31.6.1992	1 juvenile	20	11*	35409: 2*
<i>Ophisops elegans macrodactylus</i> (BERTHOLD, 1842)					
Agathonissi	01.7.1992	1 M	52	103	35408: 1
Meloi, Patmos	02.7.1992	2 M	49-51	69*-122	35408: 2, 7*
Grikos, Patmos	02.7.1992	1 M, 3 F	47-52	42*-128	35408: 3, 4*, 5, 6
<i>Coluber caspius</i> GMELIN, 1789					
Agathonissi	01.7.1992	1 F	560	210	35401
<i>Vipera xanthina</i> (GRAY, 1849)					
Lipsos	01.7.1992	1 F	267	33	35400

between the islands. On inhabited islands the species is closely associated with human settlements. In more remote areas it is found in the same refugia as *C. kotschy*. The species seems to show a foraging preference for more vertical surfaces and is strictly nocturnal.

Although island size does not seem a

factor in influencing the co-occurrence of both gecko species (some of the smallest islands supported three lizard species) there is an inverse relationship in the abundances of *C. kotschy* and *H. turcicus*. Thus, on the islands on which *C. kotschy* was common *H. turcicus* was very rare and vice versa.

Laudakia stellio stellio
(LINNAEUS, 1758)

Material: 11 individuals collected (table 1). Four additional individuals were observed on Agathonissi. Numerous more observations were made on Patmos.

This species occurs on all medium-sized islands of the Northern Dodecanese. It has never been seen and is probably absent from the very small islands of the Arki and Lipsi groups. A literature search failed to produce any previous records of the species from Patmos. This is therefore probably the first published record of *L. stellio* from this particular island. On Patmos the species is ubiquitous and is associated with the dry stone walls that traverse the island. There it is seen singly or in small groups. The juvenile individual collected on Patmos (Kampos) was the only immature specimen seen on the trip.

Individuals from Agathonissi have light-colored hind legs and anterior half of the tail. Populations from the southeastern Aegean achieve relatively large body sizes (pers. observ.; see also ZAVATTARI 1929).

Ablepharus kitaibelii kitaibelii
(BIBRON & BORY, 1833)

Material: One individual collected (table 1). More animals were seen on Makronissi (A.) [1], Makronissi (L.) [2], Abaptistos [2], and Plakonissaki [1].

Because of its small body size and its secretive habits this skink often goes unnoticed. It is always found close to the ground in dense grass where it often proves very difficult to catch. The somewhat erratic distribution pattern of the species on the islands (see table 2) is probably due to this fact rather than the actual absence of the species from these islands.

Ophisops elegans macrodactylus
(BERTHOLD, 1842)

Material: 7 individuals collected (table 1). On Agathonissi one additional male was seen ca. 500 m west of Mikro Chorio but could not be caught. One individual was also seen on Arkios and one on Lipsos (1 km south of the harbor).

O. elegans was found most commonly in flat, open areas on even moderately small islands. The apparent rarity of the species on both Lipsos and Arkios was potentially related to the prolonged arid conditions. However, *O. elegans* appears to be well adapted to high environmental tempe-

ratures. It was regularly seen active in full sun even during the hottest part of the day when substrate temperatures reached 43°C. On Patmos most individuals were seen in the flat areas around Grikos (4 km south of Skala), but this lacertid is widely distributed over the whole island.

Coluber najadum dahlui
SCHINZ, 1883

This species occurs over large areas of lowland Greece and many of the land-bridge islands in the Aegean Sea. Three individuals were observed and photographed on Patmos (500 m north of Kampos), one on Lipsos (2 km north of the main harbor) and one on Arkios. The last individual was seen in the dark of an underground cistern and no details could be observed. According to the locals, this is the only snake species on Arkios. The species is day active and can be occasionally seen hunting in the heat of the day.

Coluber caspius
GMELIN, 1789

Material: 1 freshly killed individual (table 1) found on Agathonissi near the road from the harbor to Mikro Chorio.

The only specimen of this widespread species seen in the region was the freshly killed female collected on the street 500 m from the harbor of Agathonissi. Scale counts are typical for specimens from the southeastern Aegean (ventralia 204, subcaudalia 98/98). The species is also known from Kalymnos, Leros and Patmos (CLARK 1968; CHONDROPOULOS 1989, BUTTLE 1990) where it preys on lizards and mice. The local name (see Appendix) indicates that rodents are an important part of its diet.

Vipera xanthina
(GRAY, 1849)

Material: One individual (table 1) on the acropolis of Lipsos. One more animal was heard and briefly seen at night on Patmos (Kampos).

This is the only viper on this island group and has been reported in the southeastern Aegean only relatively recently (ONDRIAS 1968; NILSON & ANDREN 1986; TIEDEMANN & GRILLITSCH 1986; CHONDROPOULOS 1989). Because of its nocturnal hab-

its, it is probably more common than casual observations might indicate. It occurs at higher densities in areas close to water or with more luxuriant vegetation where it

preys on lizards and small mammals. This species has caused repeated biting accidents in the past and is loathed by the locals who kill it whenever they see it.

DISCUSSION

The herpetofauna of the Northern Dodecanese is of Asian origin. All species occur on the nearby Turkish mainland while some of them, like *O. elegans*, *V. xanthina* and *Blanus strauchi* (BEDRIAGA, 1884) are even absent from continental Greece or the western Aegean islands. In relationship to the nearby mainland, the islands harbor only impoverished species communities. Because all of the islands included in this study were connected with the Asian mainland during the last glacial maximum 18 000 years ago, they display some of the typical attributes of landbridge islands in other areas of the world (CASE 1975; RICHMAN & al. 1988). On such islands the recent time of separation from the mainland has not allowed the evolution of distinct endemic species or subspecies that are more typical of deep-water islands. In line with this generalization, the Northern Dodecanese harbors only one endemic subspecies, the melanistic whip snake *Coluber najadum calymnensis* SCHNEIDER, 1979 which is potentially just an unusual ecotype within a more widespread species.

The second characteristic of landbridge islands is the high degree of nestedness of their faunas (PATTERSON & ATMAR 1986). Thus species that occur on a smaller island will tend also to occur on every larger island too. As evidenced from table 2 this is the case in the overwhelming majority of the islands of the Northern Dodecanese.

The underlying mechanism explain-

ing such a nested distribution pattern is faunal relaxation (WILCOX 1978; CUTLER 1991). Since the time of separation from the mainland, the islands have been losing species. This historical impoverishment process interacts with stochastic factors such as inter-island dispersal and ecological factors such as species competition or predation to create the present distributional mosaic.

This faunal relaxation pattern has been hastened by both environmental effects and human influences. Since the end of the Wisconsin-Würm glaciation, the prevailing warm and dry conditions have had a negative impact on the hydric environment and the vegetation of all of the islands in the eastern Mediterranean Sea. On the islands of the Aegean, this tendency has been exacerbated by the human impact on the native habitats. Logging, fire and most importantly overgrazing have accelerated soil loss and reduced the vegetational cover to the present impoverished phrygana and remnant macchia communities.

This degradation process continues today. Overgrazing occurs on even the smallest islands, and fires are observed on a regular basis on the larger ones. Furthermore the abandonment of agriculture on the islands is leading to the gradual deterioration of stone terraces that have been controlling erosion. Finally tourism and coastal development are likely to have a negative impact on the biodiversity of the region.

Appendix: Some of the Greek names of the local reptile species

Hemidactylus turcicus - Σαμομότι (Agathonissi)
Laudakia stellio - Χοχλιάρας (Agathonissi)
Ophisops elegans - Χιλιούδι (Agathonissi), Θυμα-
 ρίτης (Lipsos, Arkios)

Typhlops vermicularis - Ήλιος (Patmos)
Coluber caspius - Ποντικολόγος (Agathonissi)
Coluber najadum - Σαίτα (Patmos)
Vipera xanthina - Όχεντρα (Patmos)

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Table 2: The reptile faunas of some Northern Dodecanese islands (Greece). Summarizing occurrence table with selected references. Figures refer to footnotes.

Tab. 2: Die Reptilienfaunen einiger Inseln des Nord-Dodekanes (Griechenland). Überblick über das Vorkommen mit ausgewählten Literaturangaben. Zahlen verweisen auf Fußnoten.

[illegible]

Island / Insel Area / Fläche (km ²)	Kaparons. 0.08	Pilavi Ns. 0.07	Siavrons. 0.01	Strongyli 0.06	Wasilons. 0.05	Psathons. 0.05	Abaptistos 0.04	Lyra 0.04	Plakons. 0.03	Tsouka 0.03	Sminerons. 0.02	Tsoukaki 0.005
<i>Cyrtopodion kotschy</i>	+ 2	+ 1	+ 1	+ 1	+ 2	+ 1	+ 1	+ 1	+ 1		+ 2	+ 1
<i>Hemidactylus turcicus</i>							+ 1	+ 1	+ 1			
<i>Ablepharus kitaibelii</i>							+ 2	+ 2	+ 2	+ 1		

- 1 - Personal observation, specimen(s) collected; persónl. Beobachtung, mit Aufsammlung.
- 2 - Personal observation, no specimen collected; persónl. Beobachtung, ohne Aufsammlung.
- 3 - WETTSTEIN (1953);
- 4 - CHONDROPOULOS (1986);
- 5 - CHONDROPOULOS (1989);
- 6 - CLARK (1968);
- 7 - CLARK (1992);
- 8 - SCHNEIDER (1979);
- 9 - SCHNEIDER (1983)
- 10 - BUTTLE (1990);
- 11 - WERNER (1938);
- 12 - DIMITROPOULOS (1987);
- 13 - DAREWSKI & BEUTLER (1981);
- 14 - ONDRIAS (1968);
- 15 - XYDA (1983);
- 16 - NILSON & ANDRÉN (1986);
- 17 - PEPER (1970);
- 18 - WETTSTEIN (1937);
- 19 - GRILLITSCH & GRILLITSCH (1953);
- 20 - CLARK (1996)

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