

# Distribution and ecological aspects of the herpetofauna of Strofadhes Islands (Ionian Archipelago, Greece)

Zur Verbreitung und Ökologie der Herpetofauna der Strophaden (Ionische Inseln, Griechenland)

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## ABSTRACT

The unknown herpetofauna of the Strofadhes Islands is presented and discussed. Its composition places Strofadhes Islands into the same biogeographical subunit as Peloponnesos and Zakynthos Island. The preferred habitats, densities, activities and thermal requirements for the most abundant species are given. The occurrence of gigantism in male individuals of *Podarcis taurica* in the smaller island (Arpya) is discussed.

## KURZFASSUNG

Die vorliegende Arbeit präsentiert Beobachtungen über die nahezu unbekannt Herpetofauna der Strophaden. Die Autoren diskutieren das Artenspektrum, welches die Strophaden als zur selben biogeographischen Untereinheit gehörig ausweist wie die Peloponnes und die Insel Zakynthos. Die Habitats, Populationsdichten, Aktivitäten und Temperaturansprüche der häufigsten Arten werden beschrieben. Das Vorkommen von Riesenzucht bei männlichen *Podarcis taurica* wird diskutiert.

## KEYWORDS

Herpetofauna, Strofadhes Islands, Greece, distribution, ecology, gigantism; *Tarentola mauritanica fascicularis*, *Hemidactylus t. turcicus*, *Algyroides m. moreoticus*, *Podarcis taurica ionica*, *Telescopus f. fallax*.

## INTRODUCTION

On the contrary to the fair knowledge of the herpetofauna of the southern Ionian Islands (WERNER 1894, 1938; KEYMAR 1986) the herpetofauna of the Strofadhes is almost completely unknown. Only the species *Telescopus fallax* (FLEISCHMANN, 1831) was mentioned from Stamfani (WERNER 1938). The main reason for this ignorance which is extended also to the other animal and plant taxa is the island's distance from the nearest safe port

and the strong winds that usually blow in the area.

We visited the Strophadhes in December 1991 in the framework of a research program for the study of the fauna of small and remote Greek islands, supported by the "A. Leventis Foundation".

This work deals with the spatial distribution of the reptile species found and their ecology (preferred habitat, density, thermal ecology, activity).

## AREA AND METHODS

### A r e a

The Strofadhes (Fig. 1) are the southernmost islands of the Ionian Archipelago, located 49 km south of Zakynthos Island and 51 km west of the Peloponnesos coasts. The bigger one of the two close

islands is named Stamfani (1.3 km<sup>2</sup>), and the smaller Arpya (0.2 km<sup>2</sup>). On Stamfani there is a monastery dating back to the 13th century. Today only one monk lives there and most of the cultivations and buildings have been ruined.

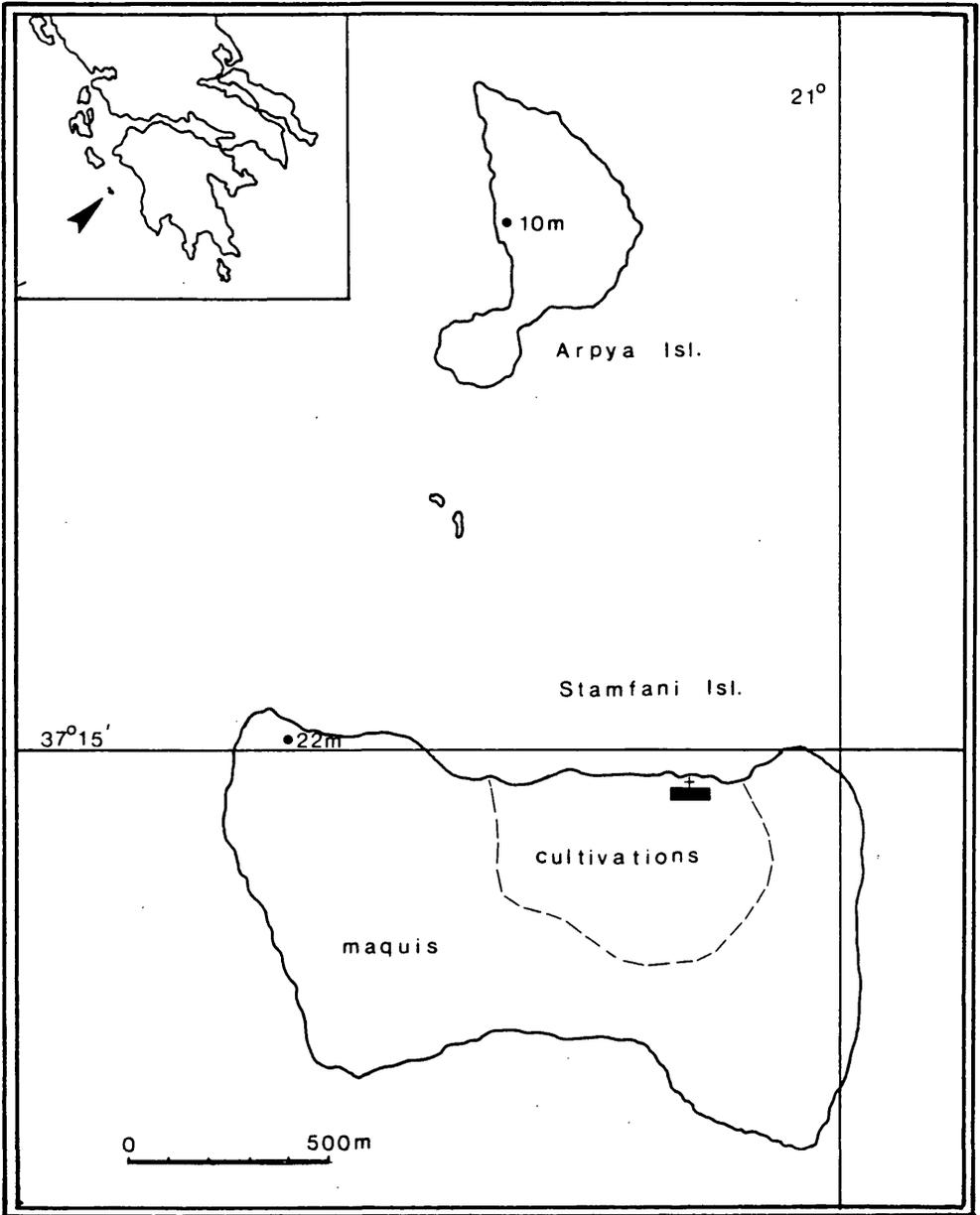


Fig. 1: The Strofades Islands Stamfani and Arpya.  
Abb. 1: Die Strophadeninseln Stamphani und Harpya.

We spent three days on the islands (1991.12.4-6.) working under ideal weather conditions for that period of the year - and especially for the reptiles: There was no strong wind blowing, 100% sunshine, and a maximum air temperature of 18°C - 20°C, or 28°C when the thermometer was exposed directly to the sunlight. The latter temperature was measured with a digital thermometer two meters above the ground.

Both islands have plane surfaces not exceeding 22 m above sea level. They look like plateaus as all coasts steeply ascend 10-15 m.

Three different habitat types have been distinguished on the islands:

1. Cultivations: Approximately 0.3 km<sup>2</sup> are now cultivated on Stamfani, whilst on Arpya only cultivations abandoned since long time ago were found. On Stamfani they are located around the monastery, mostly consist of cereals and lentils, and are protected by stone walls and *Arundo donax* from sheep, goats, and the strong winds.

2. Steep borders of the islands: The coastal area is an open rocky zone, not exceeding 20-30 m in width, with Gramineae and halophytes.

3. Maquis: The remaining area of the islands is covered by a dense vegetation

with *Juniperus phoenicea*, *Pistacia lentiscus*, *Quercus coccifera*, and *Phyllirea media* as predominant plants on Stamfani, and *Pistacia lentiscus* on Arpya. Because of the density of these shrubs many places of the islands are completely inaccessible.

## Methods

Qualitative and quantitative samplings were made in all three habitat types.

We recorded the exact location, activity, time of observation, body temperature (T<sub>b</sub>) (with a fast cloacal thermometer), and weight (W) for all collected animals, and the temperature of the air (T<sub>a</sub>), and substrate (T<sub>s</sub>). The animals collected were injected with a solution of formalin (10%) and ethanol (90%) and later fixed in ethanol (75%). The total length (L), body length (= snout-vent length, SVL) and pholidosis were examined in the laboratory.

To find out the density of the predominant species the "transect line method" was used, for the estimation of the density the method of HAYNE as described by KREBS (1987) was taken. For the animals observed the time, position, and approximate age and size were put down.

## RESULTS

### A. S t a m f a n i Island

Four reptile species were found: Two of the family Gekkonidae (*Tarentola mauritanica*, *Hemidactylus turcicus*), one of the family Lacertidae (*Algyroides moreoticus*), and the colubrid snake *Telescopus fallax*.

### 1. *Tarentola mauritanica fascicularis* (DAUDIN, 1802)

Material: Three adults, one subadult, 24 juveniles.

The specimens were abundant in the cultivated area in the border zone of the

Age	Inv. No	n	SVL (mm)	L (mm)
adults	MS41291 05-07	3	55.0-62.0	115.0-130.0
subadult	MS4129115	1	45.0	85.0
juveniles	MS41291 24-47	24	22.0-33.0 ( $\bar{x}$ =28.8)	55.0-70.0 ( $\bar{x}$ =59.8)

island. During the day the specimens were found under stones, in the crevices of stone walls and in the ruins. They were motionless with mean Tb 17.2°C while the corresponding Ta and Ts were 15.5°C and 15.7°C respectively. During the night we observed active individuals on the wall of the monastery. The mean Tb of the active animals was 15°C with corresponding Ta 14°C and Ts 14.8°C.

### 2. *Hemidactylus turcicus turcicus* (LINNAEUS, 1758)

Material: Four juvenile specimens (MS41291 19-22).

All individuals were found inactive under stones in the cultivated area around the monastery.

### 3. *Algyroides moreoticus moreoticus* BIBRON & BORY, 1883

The animals are ascribed to the subspecies *moreoticus* because of their white lateral ocelli (comp. KEYMAR 1986).

Material: Two adult males, two subadult females, one juvenile.

Sex	Inv. No.	SVL (mm)	L (mm)	W(g)
male	MS 412913	50.0	153.0	3.5
male	MS 412911	50.0	144.0	2.5
female	MS 412912	36.0	118.0	2.0
female	MS 412914	35.0	105.0	3.0
juvenile	MS 4129123	28.0	70.0	0.8

All three habitat types of the island are inhabited by this species.

The animals were active from 09.00 a. m. when Ta was 20°C till 04.00 p.m. The majority of the individuals was basking on stones close to the shrubs. Maximum activity was observed at 12.00 a.m. The Tb of the active animals was found to range from 20.2°C to 28°C (mean 24.8°C), whilst the corresponding Ta was 19°C - 21.2°C (mean 20.4°C), and Ts 19.2°C - 25°C (mean 21.3°C). Most of the active specimens were juvenile and subadult.

In a transect of 850 m long we ob-

served 22 *Algyroides*, four adults and 18 subadults and juveniles. The average density calculated was 5 specimens per 1000 m<sup>2</sup>.

### 4. *Telescopus fallax fallax* (FLEISCHMANN, 1837)

Material: One specimen (MS612913; 470 mm long, SQU 19, V 176, Sc 50/50, upper labials 8/8).

The animal was found inactive under a stone in the maquis.

## B. A r p y a Island

Two reptile species were found only: One gekkonid (*Tarentola mauritanica*), and the lacertid *Podarcis taurica*.

### 1. *Tarentola mauritanica fascicularis* (DAUDIN, 1802)

Material: Two adults and two juveniles.

Age	Inv. No.	SVL (mm)	L (mm)	W(g)
adult	SA 5129130	64.0	140.0	11.0
adult	SA 5129127	58.0	99.0	6.2
juvenile	SA 5129128	30.0	60.0	0.3
juvenile	SA 5129131	25.0	55.0	0.3

All specimens were found inactive, under stones, in the border zone of the island and around the abandoned cultivations. The Tb of a single specimen was found to be 17°C, corresponding Ta 14°C and Ts 15°C.

### 2. *Podarcis taurica ionica* LEHRS, 1902

Material: one adult male, two adult females, two subadults.

The lizards were found basking from 10.00 a.m. to 03.00 p.m. very close to the shrubs which offer them an effective shelter. No specimens were seen in the open field. The gigantic males (Fig. 2) were basking in the small openings between the shrub branches, never outside of the periphery of the shrubs.

Sex	Inv. No.	SVL (mm)	L (mm)	W(g)
male	SA 6129135	91.0	244.0	14.0
female	SA 5129126	52.0	130.0	2.3
female	SA 5129133	46.0	102.0	2.0
subad.	SA 5129132	41.0	131.0	1.5
subad.	SA 5129129	40.0	121.0	1.5

The mean  $T_b$  of the active animals was  $25.6^\circ\text{C}$  ( $24^\circ\text{C}$  -  $28^\circ\text{C}$ ), the cor-

responding mean of  $T_a$  was  $20.6^\circ\text{C}$  ( $16^\circ\text{C}$  -  $22^\circ\text{C}$ ) and of  $T_s$   $19.9^\circ\text{C}$  ( $18^\circ\text{C}$  -  $21.8^\circ\text{C}$ ).

In a transect of 500 m long we observed 36 individuals. Four of them were gigantic males with total lengths of approximately 250 mm each. The estimated density of the population was 45 specimens per 1000  $\text{m}^2$ .

## DISCUSSION

The great depths that surround the Strofadhés and exceed 900 m in the direction of Peloponnesos and Zakynthos, the Tyrrhenian limestone that constitutes the geological formation of the islands' surface (PSARIANOS & al. 1979), and the shallow sea, not deeper than 8 m, that separates the islands, lead us to conclude that:

The Strofadhés are quite recent islands, not older than 350.000 years as the surfaces of the islands consist of Tyrrhenian sediments. The islands were joined together at least during Würm glaciation, 15.000 years before present, but were never connected to the Peloponnesos or Zakynthos.

Both fauna and flora are expected to originate rather recently from adjacent land species that managed to pass the existing sea barrier.

Consequently, endemism - especially above species level - is expected to be less pronounced than in other Greek islands.

The herpetofauna observed on the Strofadhés verifies the above expectations:

All species found are also inhabitants of the adjacent coasts of the Peloponnesos and Zakynthos; especially *Algyroides m. moreoticus* is a characteristic endemic species in this area.

The distribution of the Lacertidae on the two islands of Strofadhés (*A. m. moreoticus* exclusively in Stamfani, *P. taurica ionica* in Arpya only) is of special interest. It can be attributed either to biogeographical (dispersal) or ecological (available niche, competition, enemies) reasons. ARNOLD (1987) and BUTTLE (1988) refer to many cases of real sympa-

try of these two species in Peloponnesos without any indication of mutual ecological replacement. The ecological conditions on both islands (weather, soil, vegetation type) are more or less similar, except for the open cultivated areas on Stamfani. For all that, *P. taurica* which usually prefers the open grassland (CHONDROPOULOS 1984) lives on Arpya where no grass exists, whilst is absent from Stamfani where the cultivations would constitute a suitable habitat. As both islands are very close to each other and must have been united until quite recently, the reasons for the specific separation cannot be biogeographical. Furthermore it seems improbable that a species can disperse 50 km across the sea - passively in this case - and, on the other hand, should be incapable to cross 800 m between the islands. Such a problematic distribution has been observed in the Balearic Islands concerning *P. lilfordi* (GÜNTHER, 1874) and *P. sicula* RAFINESQUE, 1810 (PEREZ MEL-LADO 1989). We believe that these distributional questions could be answered by special ecological research suited for very small islands and islets, not by standard ecological approaches.

The observed activities of *A. moreoticus* and *P. taurica* are within the frame of the known winter activities of Lacertidae in South Europe (AVERY 1982; VALAKOS 1990). The animals are active during the warm hours in the middle of the day, having lower body temperatures than in other periods of the year, when they are basking late in the morning and early in the afternoon.

The density of *P. taurica* on Arpya is almost twice as high as the known densities of this species in other Ionian Islands and Western Greece as are given by CHONDROPOULOS (1984). No comparative data exist for *A. moreoticus*.

*T. mauritanica* is a typical nocturnal species. It is inactive during the day, even though its body temperature is higher than (17.2°C) than at night (15°C), when the animal is active. The same has been reported by ARNOLD & BURTON (1978)

for other populations.

The adult males of *P. taurica ionica* in Arpya can be characterized gigantic, compared to males of other populations of the subspecies. In table 1 we give L, SVL, and W of the biggest males observed in different populations of *P. taurica ionica*. In specimens of the western Peloponnesos there is also an increase in body length, but not correspondingly in body weight as in Arpya.

Table 1: Dimensions of the biggest known males of *Podarcis taurica ionica* (LEHRS, 1902) from different regions.

Tabelle 1: Maße der größten bekannten Männchen von *Podarcis taurica ionica* (LEHRS, 1902) aus verschiedenen Gebieten.

Region	L (mm)	SVL (mm)	W (g)	Reference
Zakynthos Isl.	232.5	73.6	7.6	CHONDROPOULOS (1984)
Kefalonia Isl.	232.5	75.5	9.2	CHONDROPOULOS (1984)
Ithaki Isl.	217.5	70.2	7.5	CHONDROPOULOS (1984)
Kefalonia Isl.	232.5	75.5	9.2	CHONDROPOULOS (1984)
Kerkyra Isl.	213.5	71.9	6.7	CHONDROPOULOS (1984)
W. Peloponnesos	241.5	84.9	10.8	CHONDROPOULOS (1984)
Epirus	220.9	73.5	7.6	CHONDROPOULOS (1984)
Arpya Isl.	244.0	91.0	14.0	this work

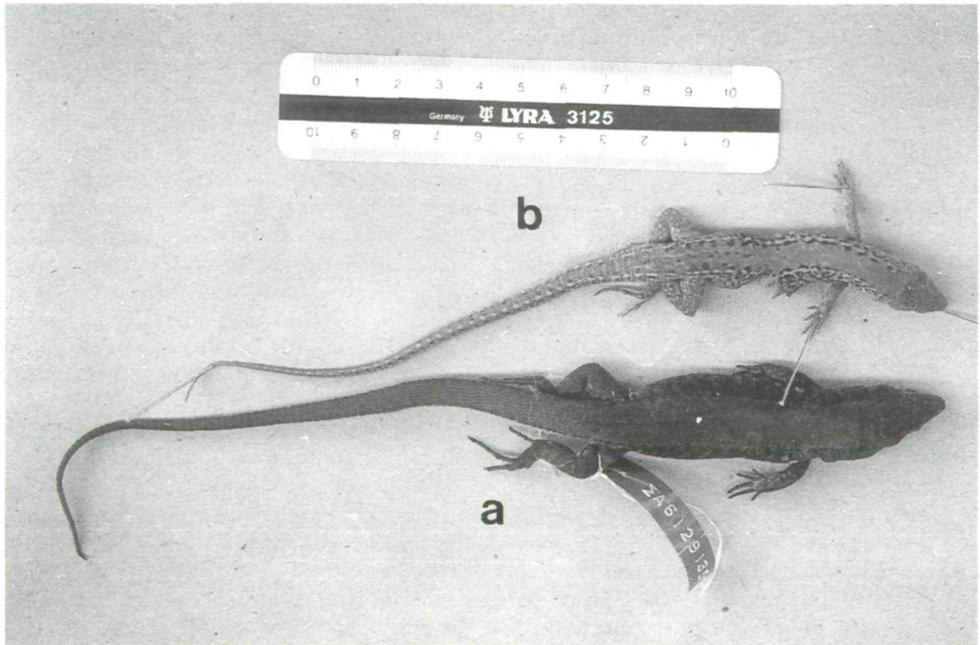


Fig. 2: a - The gigantic male of *Podarcis taurica ionica* (LEHRS, 1902) collected in Arpya; b - Male of *P. taurica ionica* from NW-Peloponnesos.

Abb. 2: a - Das riesenwüchsige Männchen von *Podarcis taurica ionica* (LEHRS, 1902) von der Insel Arpya; b - Männliche *P. taurica ionica* von der NW-Peloponnes.

The problem of differentiation of the body size with insularity has been studied by many scientists (e. g. SACCHI 1961; ANGERBJORN 1986). RADOVANOVIC (1956) refers to island populations of gigantic *P. sicula* in Dalmatia.

We consider that gigantism in the studied case could be attributed to the ab-

sence of predation and interspecific competition as documented by ANGERBJORN (1986) for wood mice (*Apodemus*), or to the increasing intraspecific competition because of increasing density related to the small size of the islands, as reported by MELTON (1982).

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