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A review of the knowledge on the distribution of the genus *Triturus* (RAFINESQUE, 1815) in Greece
(Caudata: Salamandridae)

Zum Kenntnisstand der Verbreitung der Gattung *Triturus* (RAFINESQUE, 1815) in Griechenland
(Caudata: Salamandridae)

KONSTANTINOS SOTIROPOULOS & ANASTASIOS LEGAKIS & ROSA-MARIA POLYMENI

KURZFASSUNG

Bibliographische Angaben wurden gesammelt, um die Verbreitung der Gattung *Triturus* (RAFINESQUE, 1815) in Griechenland darzustellen. Danach kommt die Gattung vorwiegend im Norden und Westen des Landes vor, was mit den klimatischen Gegebenheiten in diesen Gebeiten im Einklang steht.

In der Literatur wird für Griechenland das Vorkommen von *T. vulgaris, T. 'cristatus'* und *T. alpestris* - jeweils in mehreren Unterarten - angegeben. Für den Bereich des Untersuchungsgebietes werden die unzureichenden Kenntnisse über Verbreitung, Systematik und Ökologie der behandelten Formen deutlich.

ABSTRACT

Bibliographical data have been collected to present the distribution of the genus *Triturus* (RAFINESQUE, 1815) in Greece. The genus is chiefly found in the northern and western parts of the country, which agrees well with the climatic conditions there.

T. vulgaris, T. 'cristatus' and *T. alpestris* - with a number of subspecies each - have been described in the literature to occur in Greece. Insufficient knowledge on distribution, systematics, and ecology of these forms became evident for the country under study.

KEYWORDS

Triturus alpestris, Triturus 'cristatus', Triturus vulgaris; distribution in Greece

INTRODUCTION

Comparatively little is known on the occurrence, systematics, biology and ecology of newts of the genus *Triturus* (RAFINESQUE, 1815) in Greece.

The purpose of this paper is to illustrate the distribution patterns of the members of the genus in Greece, based on bibliography.

The Greek philosopher ARISTOTLE was the very first to mention the occurrence of *Triturus* (referred as 'Κορδυλοσ' - 'Kordylos') in Greece, in his essay 'On the History of Animals'. The scientific papers on *Triturus* in Greece which have been published so far are not only limited in volume but sometimes also of questionable quality. Most of them merely refer to distributional data (e. g. WERNER 1938; BURESCH & ZONKOV 1941). Very few articles deal with the systematics of the genus in Greece (WOLTERSTORFF 1934, 1935a, 1935b, 1936), and only one (SMIRINA & SOFIANIDOU 1985) with ecology (age structure in *T. alpestris*). *T. alpestris* seems to be the best studied species of the genus in Greece. There are many recent records (ADAMAKOPOULOS & HATZIRVASSANIS 1988; BRINGSOE 1994), including an article on the morphological variation within a number of populations (BREUIL & PARENT 1988).

For the present paper, literature was obtained from the archives of the Hellenic Zoological Society as well as from the archives of the 'Project for the Survey of the Fauna of Greece' (Section of Zoology, University of Athens). Some of the most recent references come from observations

made by a team of naturalists / mountaineers (ADAMAKOPOULOS & MATSOUKA & HATZIRVASSANIS).

According to bibliography, *T. vulgaris* (*T. vulgaris vulgaris, T. vulgaris graecus, T. vulgaris meridionalis*), *T. 'cristatus'* (*T. cristatus karelinii, T. cristatus carnifex, T. cristatus elisabethae, T. karelinii*) and *T. alpestris* (*T. alpestris alpestris, T. alpestris veluchiensis*) occur in Greece.

DISTRIBUTION OF THE GENUS *TRITURUS* IN GREECE ACCORDING TO BIBLIOGRAPHY

Triturus vulgaris (LINNAEUS, 1758) (Fig. 1)

Nominal taxa indicated in the corresponding literature are given in parentheses: (*Tv*) - *Triturus vulgaris* (LINNAEUS, 1758), (*Tvg*) - *Triturus vulgaris graecus* (WOLTERSTORFF, 1905), (*Tvv*) - *Triturus vulgaris vulgaris* (LINNAEUS, 1758), (*Tvm*) - *Triturus vulgaris meridionalis* (BOULENGER, 1882).

- Greece generally - ONDRIAS 1966, 1968 (*Tvg*); THORN 1968 (*Tvg*); KALEZIC 1983, 1984 (*Tvg*)
1 Evros - HELMER & SCHOLTE 1985 (*Tvv*)
2 Thraki - ONDRIAS 1968 (*Tvv*); THORN 1968 (*Tvv*)
3 Rodope Mt. - ASIMAKOPOULOS 1994 (*Tv*)
4 Lake Vistonis - JERRENTRUP 1990 (*Tv*)
5 Nestos Delta - JERRENTRUP 1986 (*Tv*); HEMMER & KORDGES 1987 (*Tv*)
6 Lake Kerkini - JERRENTRUP 1990 (*Tv*)
7 Florina - CHABANAUD 1919 (as *Triton meridionalis*)
8 Lake Prespa (850 - 1000 m asl.) - CATSADORAKIS 1986 (*Tv*); BOUSBOURAS & IOANNIDIS 1994 (*Tvg*)
9 Grevena - ADAMAKOPOULOS & HATZIRVASSANIS 1988 (*Tv*)
10 Katara - ANONYMOUS 1993 (*Tvg*)
11 Kerkyra - WERNER 1902 (as *Molge vulgaris* var. *meridionalis*); WOLTERSTORFF 1905 (as *Triton vulgaris graeca*); EBNER 1913 (as *Molge vulgaris graeca* f. *corcyrensis*); WERNER 1938 (*Tvg* f. *corcyrensis*); BURESCH & ZONKOV 1941 (*Tvg*); MERTENS 1961 (*Tvg*); ONDRIAS 1966, 1968 (*Tvg*); KEYMAR 1986a, 1986c (*Tvg*)
12 Preveza - WERNER 1938 (*Tvg*); BURESCH & ZONKOV 1941 (*Tvg*)
13 Louros - Arachthos Delta - HEMMER & KORDGES 1987 (*Tv*)
14 Tymfristos Mt. - HELDREICH 1878 (as *Triton taeniatus*); BEDRIAGA 1883 (as *Triton paradoxus*); WERNER 1938 (*Tvg*); BURESCH & ZONKOV 1941 (*Tvg*)
15 Lefkada - WERNER 1938 (*Tvg*); BURESCH & ZONKOV 1941 (*Tvg*); MERTENS 1961 (*Tvg*); ONDRIAS 1966, 1968 (*Tvg*); KEYMAR 1986a, 1986c (*Tvg*); BROGGI 1994 (*Tvg*)
16 Archondochori - KEYMAR 1986c (*Tvg*)
17 Acheloos Delta - KEYMAR 1986c (*Tvg*); HEMMER & KORDGES 1987 (*Tv*)
18 Parnassos Mt. - HELDREICH 1878 (as *Triton taeniatus*); BEDRIAGA 1883 (as *Triton paradoxus*); WERNER 1938 (*Tvg*); BURESCH & ZONKOV 1941 (*Tvg*)
19 Evvoia - BURESCH & ZONKOV 1941 (*Tvg*)
20 Kefalonia - WERNER 1938 (*Tvg*); BURESCH & ZONKOV 1941 (*Tvg*); MERTENS 1961 (*Tvg*); ONDRIAS 1966, 1968 (*Tvg*); KEYMAR 1986a, 1986c (*Tvg*)
21 Patra - BURESCH & ZONKOV 1941 (*Tvg*)
22 Kalogria Wood - BRINGSOE 1985 (*Tvg*)
23 Kalavryta (1000 m asl.) - STEPANEK 1944 (*Tvg*); BRINGSOE 1985 (*Tvg*); KEYMAR 1986b (*Tvg*)
24 Ileia (W. Peloponnese) - KEYMAR 1986c (*Tvg*)
25 Didyma - BRINGSOE 1985 (*Tvg*); KEYMAR 1986b (*Tvg*); CLARK 1989 (*Tvg*)
26 Modhon (Messinia) - BIBRON & BORY 1832 (as *Triton abdominalis*); HELDREICH 1878 (as *Triton punctatus*); WERNER 1938 (*Tvg*); BURESCH & ZONKOV 1941 (*Tvg*); BRINGSOE 1985 (*Tvg*); KEYMAR 1986 (*Tvg*)
27 Tinos - ERBER 1867 (as *Triton taeniatus*); BIRD 1935 (*Tvv*); WERNER 1938 (*Tvg*)
28 Athos Mt. - KLAPTOCZ 1910 (as *Molge vulgaris*)
29 Aitoloakarnania (W. Greece) - BEDRIAGA 1883 (as *Triton paradoxus*); WERNER 1938 (*Tvg*); BURESCH & ZONKOV 1941 (*Tvg*)
30 Kertezi - BRINGSOE 1994 (*Tvg*)

Triturus 'cristatus' (LAURENTI, 1768) (Fig. 2)

Nominal taxa indicated in the corresponding literature are given in parentheses: (*Tc*) - *Triturus cristatus* (LAURENTI, 1768), (*Tck*) - *Triturus cristatus karelinii* (STRAUCH, 1870), (*Tk*) - *Triturus karelinii* (STRAUCH, 1870), (*Tce*) - *Triturus cristatus carnifex* (LAURENTI, 1768), (*Tce*) - *Triturus cristatus elisabethae* KEYMAR, 1986a.

- Central and Northern Greece - ONDRIAS 1968 (*Tck*); THORN 1968 (*Tck*); ARNOLD & BURTON 1980 (*Tc*)
- Greek Islands - CHEYLAN 1988 (*Tc*)
1 Evros - HELMER & SCHOLTE 1985 (*Tck*)
2 Komotini - WERNER 1938 (*Tck*); BURESCH & ZONKOV 1941 (*Tck*); ONDRIAS 1966 (*Tck*)
3 Lake Vistonis - JERRENTRUP 1990 (*Tc*)
4 Nestos Delta - JERRENTRUP 1986 (*Tc*); HEMMER & KORDGES 1987 (*Tc*)
5 Athos Mt. - KLAPTOCZ 1910 (as *Molge cristata*); WERNER 1938 (*Tck*); BURESCH & ZONKOV 1941 (*Tck*); ONDRIAS 1966 (*Tck*)
6 Lake Kerkini - JERRENTRUP 1990 (*Tc*)
7 Kentriko (400 m asl.) - ANONYMOUS 1993 (*Tck*)
8 Dafnochori (150 m asl.) - ANONYMOUS 1993 (*Tck*)
9 Thessaloniki - BURESCH & ZONKOV 1941 (*Tck*)

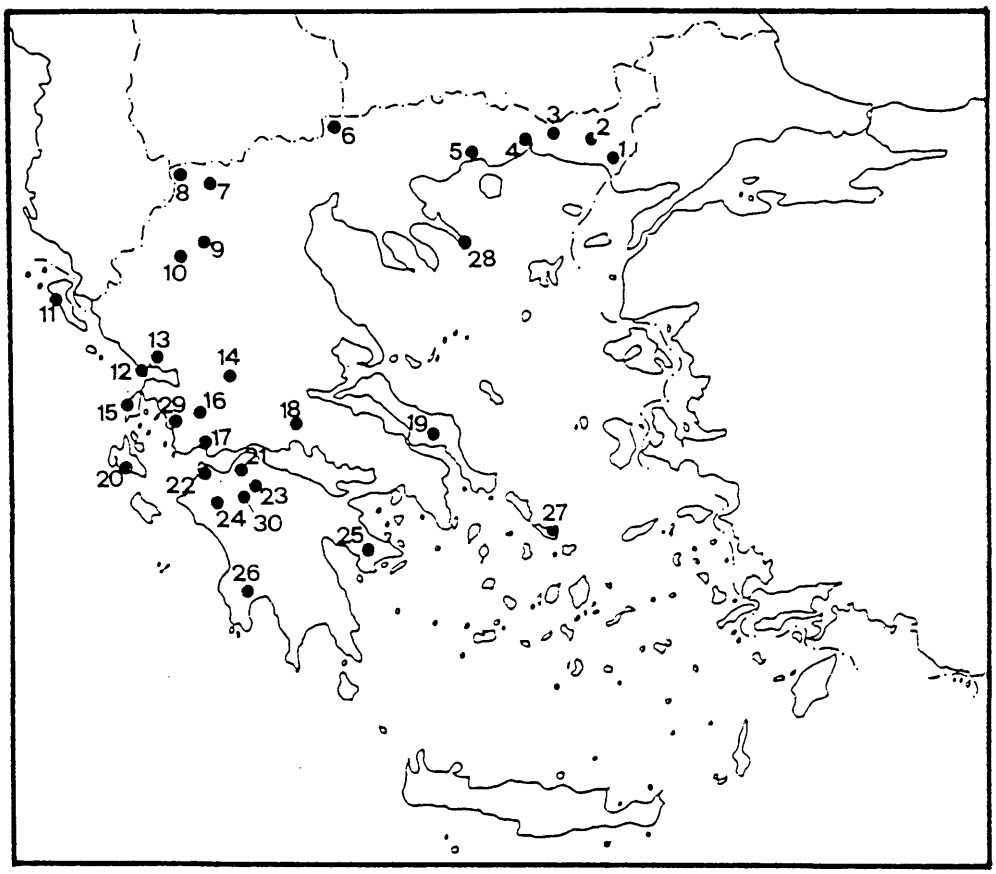

Fig. 1: Distribution of *Triturus vulgaris* in Greece (bibliographical data).
Abb. 1: Die Verbreitung von *Triturus vulgaris* in Griechenland nach bibliographischen Angaben.

10 Lake Prespa (850 - 1000 m asl.) - BURESCH & ZONKOV 1941 (*Tck*); CATSADORAKIS 1986 (*Tc*); BOUSBOURAS & IOANNIDIS 1994 (*T'k'*)
11 Ano Kaliniki (600 m asl.) - WALLIS 1987 (*Tcc*); ANONYMOUS 1993 (*Tcc*)
12 Florina (700 m asl.) - CHABANAUD 1919 (as *Triton cristatus*); ANONYMOUS 1993 (*Tck*)
13 Kerkyra - KEYMAR 1984 (*Tc*), KEYMAR 1986a (*Tce*); LANZA & VANNI 1987 (*T'k'*)
14 Smolikas Mt. - CHABANAUD 1919 (as *Triton cristatus*)
15 Milies (Pindos 1100 m asl.) - ASIMAKOPOULOS 1992 (*Tc*)
16 Pindos - CRUCITTI & TRINGALI 1986 (*T'k'*)
17 Zygos Mt. (1400 - 1700 m asl.) - ADAMAKOPOULOS & HATZIRVASSANIS 1988 (*Tc*)
18 Vasilitsa Mt. (1100 - 2000 m asl.) - ADAMAKOPOULOS & HATZIRVASSANIS 1988 (*Tck*)
19 Parnassos Mt. - WERNER 1938 (*Tck*); BURESCH & ZONKOV 1941 (*Tck*); ONDRIAS 1966 (*Tck*)

Triturus alpestris (LAURENTI, 1768) (Fig. 3)

Nominal taxa indicated in the corresponding literature are given in parentheses: (*Ta*) - *Triturus alpestris* (LAURENTI, 1768), (*Taa*) - *Triturus alpestris alpestris* (LAURENTI, 1768), (*Tav*) - *Triturus alpestris veluchiensis* WOLTERSTORFF, 1935.

- Northern Greece - ONDRIAS 1966, 1968 (*Taa*); THORN 1968 (*Taa*)
- N. Greece and Thraki - OOSTERBROEK 1994 (*Taa*)
- Central Greece - OOSTERBROEK 1994 (*Tav*)
- NW Peloponnese - BRINGSOE 1985 (*Ta*)

1 Vrontous Mt. - ANONYMOUS 1993 (*Ta*)
2 Grammos Mt. (1800 - 1950 m asl.) - ADAMAKOPOULOS & HATZIRVASSANIS 1988 (*Ta*);

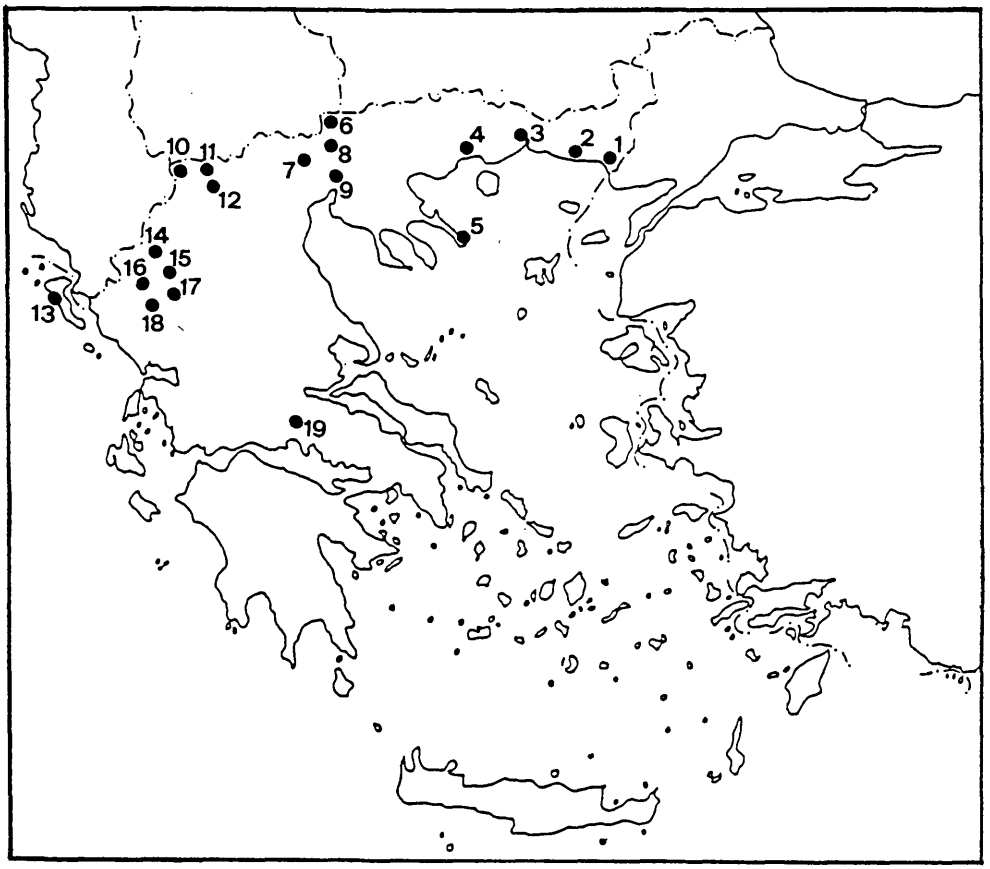

Fig. 2: Distribution of *Triturus 'cristatus'* in Greece (bibliographical data).
Abb. 2: Die Verbreitung von *Triturus 'cristatus'* in Griechenland nach bibliographischen Angaben.

BRINGSOE 1994 (*Ta*)

3 Smolikas Mt. (1300 - 2400 m asl.) - CRUCITTI & TRINGALI 1986 (*Ta*); ADAMAKOPOULOS & HATZIRVASSANIS 1988 (*Ta*); BRINGSOE 1994 (*Ta*)

4 Drakolimni (Smolikas Mt., 2200 m asl.) - BREUIL & PARENT 1988 (*Tav*)

5 Mikrilimni (Smolikas Mt., 2200 m asl.) - BREUIL & PARENT 1988 (*Tav*)

6 Drakolimni (Tymfi Mt., 2050 m asl.) - SMIRINA & SOFIANIDOU 1985 (*Ta*); BREUIL & PARENT 1988 (*Tav*); CLARK 1989 (*Ta*); BRINGSOE 1994 (*Ta*)

7 Xerolimni (Tymfi Mt., 1750 m asl.) - BREUIL & PARENT 1988 (*Tav*); BRINGSOE 1994 (*Ta*)

8 Vasilitsa Mt. (1100 - 2000 m asl.) - ADAMAKOPOULOS & HATZIRVASSANIS 1988 (*Ta*); BRINGSOE 1994 (*Ta*)

9 Flenga (Pindos, 1900 m asl.) - MALAKOU & al. 1985 (*Ta*)

10 Lyngos Mt. (1400 - 1900 m asl.) - ADAMAKOPOULOS & HATZIRVASSANIS 1988 (*Ta*); BRINGSOE 1994 (*Ta*)

11 Milies (Pindos, 1100 m asl.) - ASIMAKOPOULOS 1992 (*Ta*)

12 Zygos Mt. (1400 - 1700 m asl.) - ADAMAKOPOULOS & HATZIRVASSANIS 1988 (*Ta*); BREUIL & PARENT 1988 (*Tav* up to 1750 m asl.); BRINGSOE 1994 (*Ta*)

13 Kerketio Mt. (1280 m asl.) - BREUIL & PARENT 1988 (*Tav*); BRINGSOE 1994 (*Ta*)

14 Tymfristos Mt. (1800 - 2100 m asl.) - WOLTERSTORFF 1934 (as *T. alpestris* n. f.), 1935a (as *T. alpestris graeca*), 1935b (as *T. alpestris graeca*), 1936, 1939 (*Tav*); CYREN 1935 (as *T. alpestris graeca*); WERNER 1938 (*Ta*); BURESCH & ZONKOV 1941 (*Tav*); ONDRIAS 1966, 1968 (*Tav*); THORN 1968 (*Tav*); ARNOLD & BURTON 1980 (*Ta*); BREUIL & PARENT 1988 (*Tav*); ANONYMOUS 1993 (*Tav*); BRINGSOE 1994 (*Ta*)

15 Karpenisi (700 m asl.) - ANONYMOUS 1993 (*Tav*)

16 Oiti Mt. (1700 m asl.) - ADAMAKOPOULOS & al. 1986 (*Ta*); BREUIL & PARENT 1988 (*Tav*); BRINGSOE 1994 (*Ta*)

17 Vardousia Mts. (1100 - 1300 m asl.) - ADAMAKOPOULOS & HATZIRVASSANIS 1988 (*Ta*);

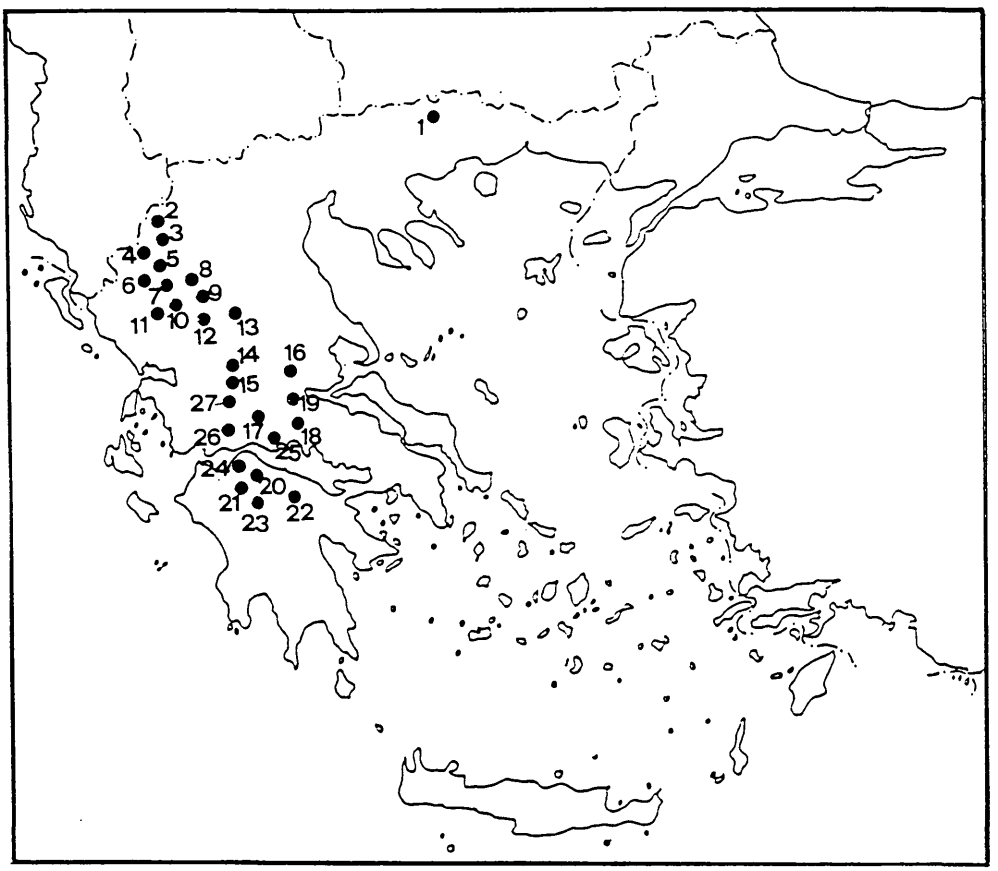

Fig. 3: Distribution of *Triturus alpestris* in Greece (bibliographical data).
Abb. 3: Die Verbreitung von *Triturus alpestris* in Griechenland nach bibliographischen Angaben.

BRINGSOE 1994 (*Ta*)
18 Parnassos Mt. - WERNER 1938 (*Ta*); BURESCH & ZONKOV 1941 (*Ta*); ONDRIAS 1966, 1968 (*Tav*); THORN 1968 (*Tav*); ARNOLD & BURTON 1980 (*Ta*); BREUIL & PARENT 1988 (*Tav*)
19 Kallidromo Mt. (980 m asl.) - HATZIRVASSANIS 1994 (*Ta*)
20 Klokos Mt. (1300 m asl.) - ADAMAKOPOULOS & al. 1988 (*Ta*); BRINGSOE 1994 (*Ta*)
21 Panachaiko Mt. (1050 and 1150 m asl.) - ADAMAKOPOULOS & al. 1988 (*Ta*); BRINGSOE 1994 (*Ta*)
22 Killini Mt. (1600 m asl.) - BREUIL & PARENT 1988 (*Tav*); BRINGSOE 1994 (*Ta*)
23 Kertezi (745 m asl.) - BRINGSOE 1994 (*Tav*)
24 Romanos (Panachaiko Mt., 860 m asl.) - BRINGSOE 1994 (*Ta*)
25 Lidorikion - BRINGSOE 1994 (*Ta*)
26 Tichio (700 m asl.) - BRINGSOE 1994 (*Ta*)
27 Domnitsa (Panaetolikon Mt., 950 - 1300 m asl.) - BRINGSOE 1994 (*Ta*)

DISCUSSION

From the above data, the distribution of the newts appears to be restricted to remote mountainous areas, mainly in north-western Greece. This is well explained by the climatic conditions prevailing in this area (high moisture levels, rainfall during the whole year) (fig. 4).

T. alpestris spends almost all of the year in water bodies, preferring cold water with little or no vegetation (COOKE &

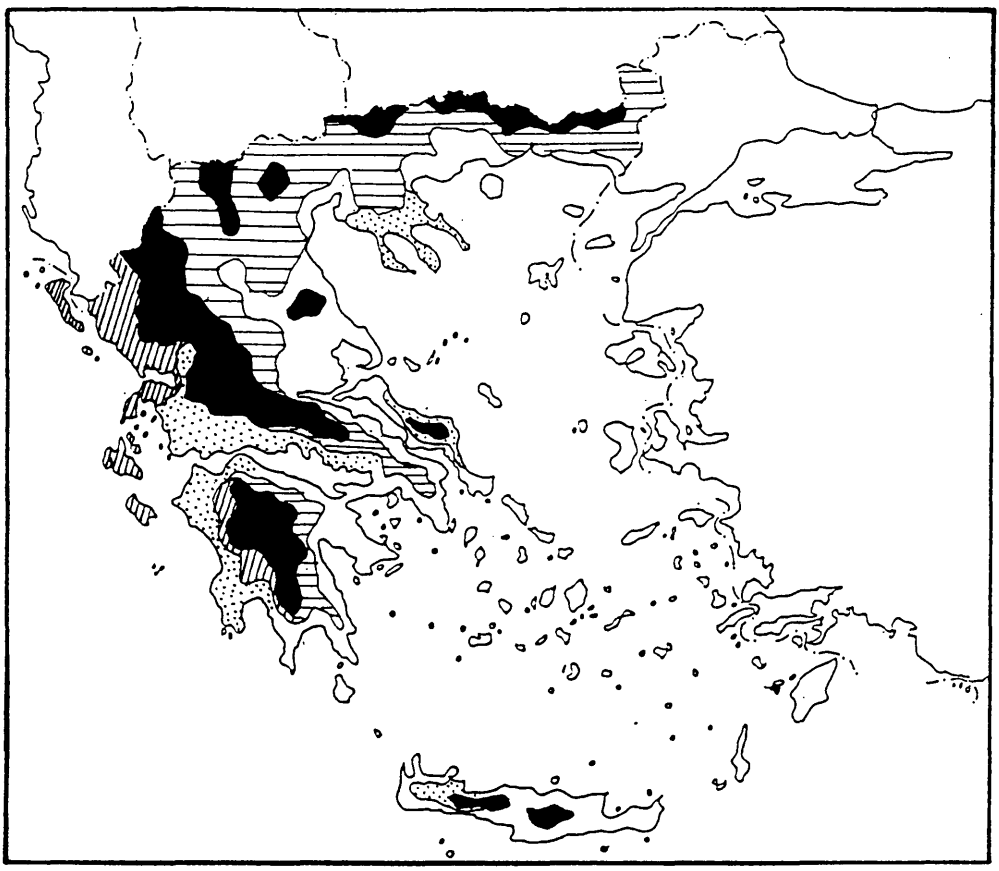

Fig. 4: Map of bioclimatic zones of Greece (from MAVROMMATIS 1978, modified).
■ - humid and cold/cool, //////// - humid and temperate/hot,
≡ ≡ ≡ - sub-humid and cold/cool, ⁝⁝⁝⁝⁝⁝⁝⁝ - sub-humid and temperate/hot.

Abb. 4. Karte der bioklimatischen Zonen Griechenlands (verändert nach MAVROMMATIS 1978).
■ - feucht und kalt/kühl, //////// - feucht und warm/heiß,
≡ ≡ ≡ - mäßig feucht und kalt/kühl, ⁝⁝⁝⁝⁝⁝⁝⁝ - mäßig feucht und warm/heiß.

FRAZER 1976; ARNOLD & BURTON 1980). The newt is active at quite low temperatures and able to survive at least short periods when exposed to temperatures below freezing point (KALEZIC & HEDGECOCK 1980). The Alpine Newt is distributed mainly in the montane region, from NW Greece to N Peloponnese (fig. 3) above altitudes of 1000 m, where the prevailing weather conditions (MAVROMMATIS 1978) as well as habitat types favour the presence of this species.

T. '*cristatus*' is reported from North and Central Greece (fig. 2) from sea level to 2000 m asl but most of the recent records refer to the North. The Crested Newt is basically a lowland species associated with deciduous woodland (KALEZIC & HEDGECOCK 1980). Local distribution is strongly dependent on the presence of ponds and small well vegetated lakes in open humid areas with adjacent deciduous woodlands. North and Central Greece provide such breeding sites for the Crested Newt.

T. vulgaris is the most terrestrial species of all. It is usually found in high humidity lowland areas, cultivated land, hilly

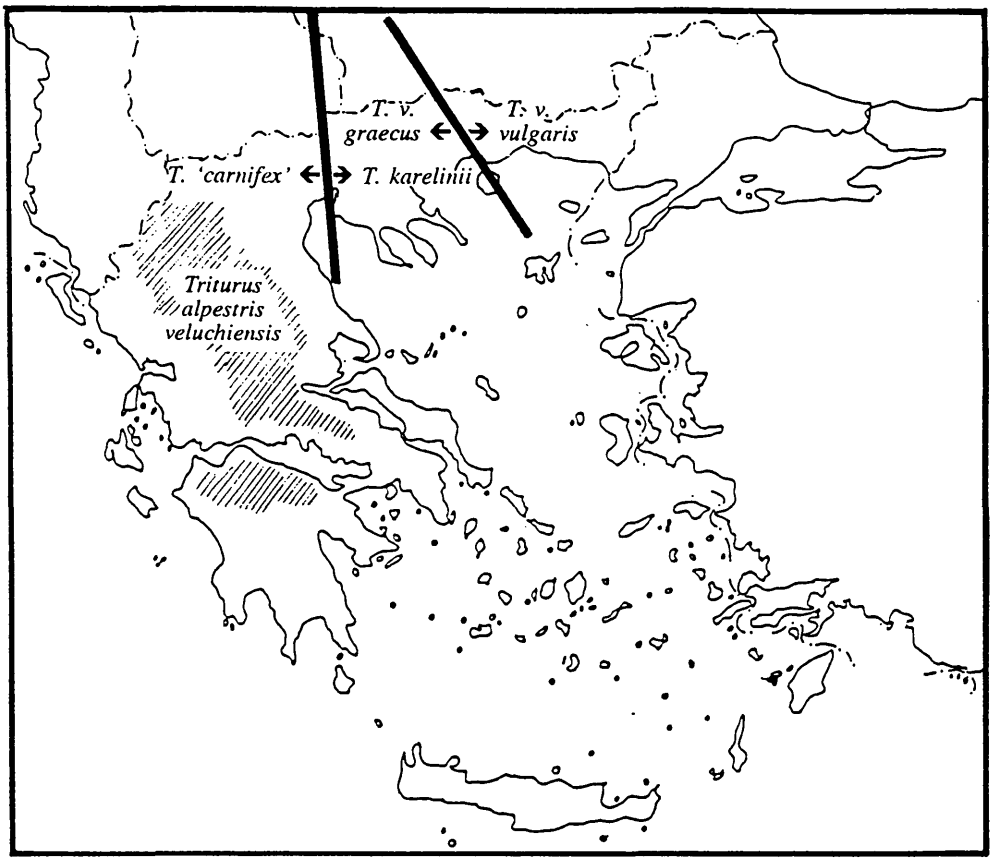

Fig. 5: Probable distribution of *Triturus* species in Greece.
Abb. 5: Wahrscheinliche Verbreitung der Arten der Gattung *Triturus* in Griechenland.

grasslands, reaching the altitude of 1200 m along the southern limits of distribution, and needs water bodies only for reproduction (COOKE & FRAZER 1976; BELL 1977; KALEZIC & HEDGECOCK 1980). The distribution of the Smooth Newt in the Ionian Islands as well as the western mainland of Greece and Peloponnese (fig. 1) fits well the above characteristics because of the lowland hilly surface structures and the humid temperate weather conditions in these areas.

From the Island of Tinos (27 in fig. 1) (BIRD 1935) and Messinia (26 in fig. 1) (BIBRON & BORY 1832) where newts were recorded in the past, their populations may have vanished today, due to great environmental changes in the last decades (extensive landscape modifications, use of chemicals, aridity, etc.). That is why these references as well as all references before 1960 should be considered as uncertain.

The main problem arising from the Greek distribution records is caused by the sympatric reference of conspecific subspecies, the taxonomic status of which is insufficiently known.

As to *T. vulgaris* in Greece, the occurrence of the following taxa is mentioned: *T. vulgaris vulgaris, T. vulgaris graecus* and *T. vulgaris meridionalis*. The re-

ported presence of *T. vulgaris meridionalis* (WERNER 1902; CHABANAUD 1919) from Kerkyra (11 in fig. 1) and Florina (7 in fig. 1) appears to be questionable and is probably erroneous. According to current knowledge, this taxon has a North Italian - West Yugoslavian distribution (THORN 1968; KALEZIC 1983, 1984). The morphological similarities of *meridionalis* and *graecus* and the fact that the latter was described not before 1935 (WOLTERSTORFF), indicates that the old *meridionalis* records refer to *T. vulgaris graecus*. Furthermore, MERTENS (1961) suggests that even Kerkyra's population belongs to *T. vulgaris graecus*. Generally, it has been suggested that *T. vulgaris graecus* is distributed in NW, Central, and SW mainland Greece as well as in the Ionian Islands while *T. vulgaris vulgaris* occurs in the NE of the country (ONDRIAS 1966, 1968; KALEZIC 1983, 1984; HELMER & SCHOLTE 1985) (fig. 5).

The following taxa which belong to the *T. 'cristatus'* group are mentioned to occur in Greece: *T. cristatus, T. karelinii* and *T. carnifex*. They all are now generally believed to represent separate species (ARNTZEN & SPAREBOOM 1989). Accurate assignment of Greek Crested Newts would require a detailed systematic analysis. Some authors suspect all Greek *'cristatus'* to be synonyms of *T. karelinii* (LANZA & VANNI 1987). Others suggest that the NW Greek *'cristatus'* belong to *carnifex* among which the Ano Kaliniki population (11 in fig. 2) represents a divergent type of *T. carnifex* (WALLIS 1987; WALLIS & ARNTZEN 1989), whereas NE Greek *'cristatus'* are *T. karelinii* (ARNTZEN pers. comm.). Concluding, we think that - according to present knowledge - the most plausible distribution of *T. 'cristatus'* in Greece is that shown in figure 5.

According to BREUIL & PARENT (1988), the North and Central Greek *T. alpestris* belong to the subspecies *veluchiensis*, except perhaps some populations of Grammos (2 in fig. 3) and Smolikas (3 in fig. 3) which look different. Occurrence of *T. alpestris alpestris* in NE Greece (ONDRIAS 1966, 1968) should be considered uncertain until recent data confirm the presence of this taxon in the area. Compared to the scarcity of *T. alpestris* locality records from before 1985, the number of localities increased significantly as soon as more extensive and complete surveys were carried out (ADAMAKOPOULOS & HATZIRVASSANIS 1988; BREUIL & PARENT 1988; BRINGSOE 1994).

From all informations available we suggest that *T. vulgaris graecus, T. vulgaris vulgaris, T. carnifex, T. karelinii* and *T. alpestris veluchiensis* are the most probable and plausible taxa of *Triturus* to occur in Greece. Their most likely distribution is illustrated in fig. 5. The above tentative analysis of the newt's distribution reveals still insufficient knowledge and leaves the field open for future research on questions of distribution, systematics and ecology of *Triturus* in Greece.

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AUTHORS: Konstantinos SOTIROPOULOS, Dr. Anastasios LEGAKIS, Zoological Museum, Deptartment of Biology, University of Athens; Dr. Rosa-Maria POLYMENI, Section of Ecology and Taxonomy, University of Athens, Panepistimioupolis, 157 84 Athens, Greece.