

## LAND SNAIL FAUNA OF AEGEAN REGION (TURKEY): ENDEMISM PATTERNS AND VULNERABILITY

ÛMİT KEBAPÇI, MEHMET ZEKİ YILDIRIM

**Abstract.** *In this study, it is aimed to evaluate the endemism patterns and vulnerability in land snail fauna of Aegean region, among the most populated regions in Turkey. According to field studies and available literature 145 species, of which 29 are endemics, were determined in the area. 15 of the endemic taxa are strictly endemic to the region. This figure changes when the regional endemics, taxa shared by Eastern Aegean islands (Greece), are included. Unlike other centres of endemism in Anatolia, in Aegean region many taxa have extensions along grabens thanks to glacial sea level changes and peculiar geology. Anthropogenic pressure and destruction of habitats particularly caused by tourism activities and housing, are the most important threats.*

**Keywords:** *Aegean region, land snails, endemism, vulnerability, anthropogenic pressure.*

**Rezumat. Fauna de melci tereștri din Regiunea Egeană (Turcia): caracteristici endemice și vulnerabilitate.** *Prezentul studiu urmărește să evalueze caracteristicile endemice și vulnerabilitatea faunei de melci tereștri din Regiunea Egeană, una dintre cele mai populate regiuni din Turcia. Conform studiilor din teren și a literaturii de specialitate, în zonă au fost determinate 145 de specii, 29 dintre acestea fiind endemice. 15 dintre taxonii endemici sunt caracteristici numai acestei regiuni. Această valoare se schimbă dacă sunt luate în calcul și endemismele regionale, taxonii comuni cu cei din Insulele Mării Egee de est (Grecia). Spre deosebire de alte centre endemice din Anatolia, în Regiunea Egeană, mulți taxoni se extind de-a lungul grabenelor ca urmare a schimbărilor nivelului mării din perioada glaciară și a particularităților geologice. Presiunea antropică și distrugerea habitatelor cauzată, în special, de activitățile turistice și domestice reprezintă cele mai importante amenințări.*

**Cuvinte cheie:** *Regiunea Egeană, melci de uscat, endemism, vulnerabilitate, presiune antropică.*

### INTRODUCTION

The Aegean region is one of the geographical regions of Turkey (Fig. 1). Located in the western half of the country and surrounded by Aegean Sea it covers 85,000 km<sup>2</sup> (about 10% of total area). The region is a remarkably deforming part of the Alpine-Himalayan orogenic belt, which has the highest seismic activity in Europe (KOMUT, 1998). This is reflected as parallel depressions (grabens or rift valleys), extending inwards from the sea and a long coastline of 2,805 km, nearly 35% the Turkish coastline.

In the area, as compared to montane areas of Turkey, topography is relatively even and the elevated habitats are separated by broad depressions. Thus, the aquatic gastropod fauna has relatively been studied (BILGIN, 1967 and 1980; YILDIRIM, 1999), as compared to the land snail fauna which has been subject of few surveys only.



Figure1. Map of Aegean region.  
Figura 1. Harta regiunii Egeene

**MATERIAL AND METHODS**

The study is based on excursions performed between 2003 and 2008 and literature data. During the excursions, the southern half of the region was surveyed. For the analysis of the results and literature data, a GIS application (DIVA GIS version 5.4) and Shannon index for diversity analysis has been used.

Table 1. Distribution of land gastropod taxa in 7 geographical regions of Turkey: endemics (of regional /national scale) in thick borders, also shared species between regions.

Tabel 1. Distribuția gasteropodelor de uscat în cele 7 regiuni ale Turciei: endemisme (la scară regională/națională) în careurile îngroșate, de asemenea speciile comune regiunilor.

	MAR	AEG	MED	C ANA	W BLA	C & E BLA	E ANA	SE ANA
<b>MARMARA</b>	<b>153 19/33 E</b>							
<b>AEGEAN</b>	79	<b>145 15/29 E</b>						
<b>MEDITERRANEAN</b>	60	74	<b>274 141/155 E</b>					
<b>CENTRAL ANATOLIA</b>	29	32	37	<b>74 11/37 E</b>				
<b>WESTERN BLACK SEA</b>	62	48	43	35	<b>120 30/47 E</b>			
<b>CENTRAL AND EASTERN BLACK SEA</b>	38	26	27	26	45	<b>229 91/115 E</b>		
<b>EASTERN ANATOLIA</b>	12	11	18	19	16	36	<b>91 21/39 E</b>	
<b>SOUTHEASTERN ANATOLIA</b>	9	12	20	8	10	10	16	<b>43 9/13 E</b>

**RESULTS AND DISCUSSIONS**

145 species and 29 endemics (15 being narrow endemics of the region) have been determined to occur in the region (Table 1) (DEMIRSOY, 1999, SCHÜTT, 2005).

When the biodiversity of land snails (according to Shannon index) is mapped (Fig. 2), four regions (having values above 2) appear with higher diversity. It can also be seen that northwestern and interior parts are relatively unknown and relatively poor in diversity according to current knowledge. Of these, two eastern areas can be accepted as extensions of endemism centres Uludağ and Lakes Region. However, remaining two as exemplified by the distribution of Zonitidae in Turkey, show a distinct faunal composition among other regions of Turkey and a higher affiliation with eastern Aegean islands. The area extending from Muğla northwards along Aegean coast towards Izmir (Fig. 2, left circle) have the highest overall diversity values in southwestern Anatolia and it is somewhat split into two. These two areas are also characterized by marked presence of the genus *Zonites* MONFORT, 1810, endemic to Greece and Turkey, replaced by *Turcozonites* RIEDEL, 1987 in further east. As of *Zonites* spp., few other mesophilic species having similar feature (like *Lindbergia karainensis* RÄHLE & RIEDEL, 1987) can be found extending along western Taurus ranges bordering Aegean region.

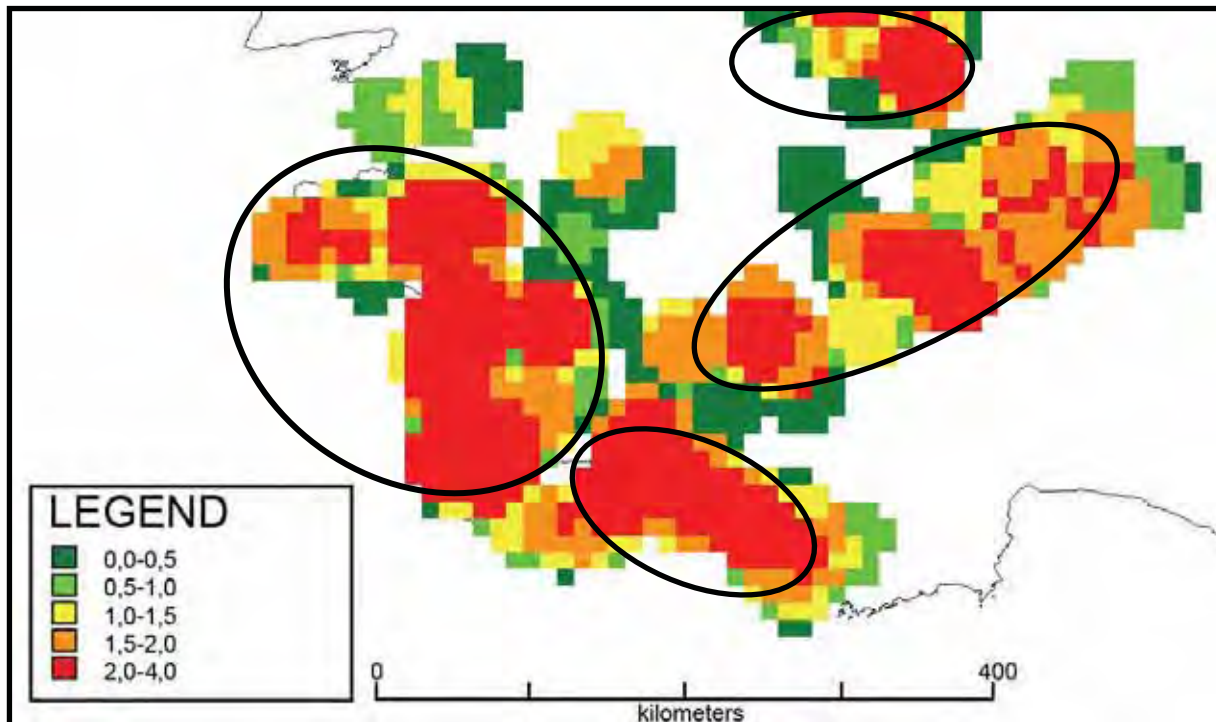


Figure 2. Biodiversity of land snails (according to Shannon index) in Aegean region.  
 Figura 2. Biodiversitatea melcilor de uscat (conform indicelui Shannon) în regiunea Egeană.

As for endemic taxa in strict sense (Fig. 3, upper map) of the two mentioned areas, only two distant spots with high biodiversity - e.g. distinctness in endemic taxa - are discernible (circled in Fig. 3) with a gap in between (Bodrum-Milas area, shown with square in Fig. 3) possessing few endemics in narrow sense despite having high overall biodiversity (Fig. 2).

When the regional endemics (e.g. species shared with off-shore Greek islands) are included (Fig 3, lower map), it can be seen that the figure changes greatly. This denotes the importance of Aegean endemics among the fauna of coastal parts of southwestern Anatolia. In Fig. 3, inclusion of Aegeanin ' endemics has no effect on 'northern' part, unlike eastern part in which Aegean elements are present.

Despite presence of certain endemism centres on mainland, since faunal exchanges between mainland and islands (even with Rhodes separated from mainland 1.8 mya) were re-established several times since Messinian crisis, homogenization to some degree can be mentioned for the faunas. This is in particular enabled by the corridor like depressions transferring humidity and uninterrupted mountains (horsts) extending into the sea as islets. Several instances of inland records of the 'Aegean' endemics, like *Milax altenai* FORCART, 1972 (YILDIRIM & KEBAPÇI, 2004), also prove this phenomenon. Another characteristic of the unique fauna is the distinctness and limited exchange with fauna of the Taurus Mountains. Presence of genera *Rhabdoena* KOBELT & MOELLENDORFF, *Zonites* MONTFORT and marked absence of *Buliminus* BECK, *Paramastus* HESSE, *Sprattia* BOETTGER and *Turcozonites* RIEDEL indicate isolation of two speciation centres.

During the marine transgressions lower elevations are invaded by the sea. This can be a reason for lower biodiversity of endemics in interior parts and corridor-like depression areas. These isolation phases should certainly have been effective in emergence of different faunas.

As in Greek islands, heavy use of the coastal land and recently more interior parts threatens sustainability of habitats. Several centres like Bodrum and Izmir become more populated as centres of tourism and economy. These tourism centres possess high endemic land snail biodiversity when regional endemism considered, but low endemism in narrow sense due to homogenization via connections took place. For such cases, naturally also in other groups, usage of national level endemism as a tool can be confusing in the determination of rarity and conservational status.

## CONCLUSIONS

Unfortunately, as in the case of Antalya and Bursa-İstanbul areas, the highest snail diversity of Aegean region is found around coastal cities like Izmir, the most populated city of the region. It is worth to keep in mind, however, that all above mentioned figures are still results of poor surveys and incomplete taxonomical works. For understanding the conservational consequences, taxonomical and distributional relations, future studies are needed.

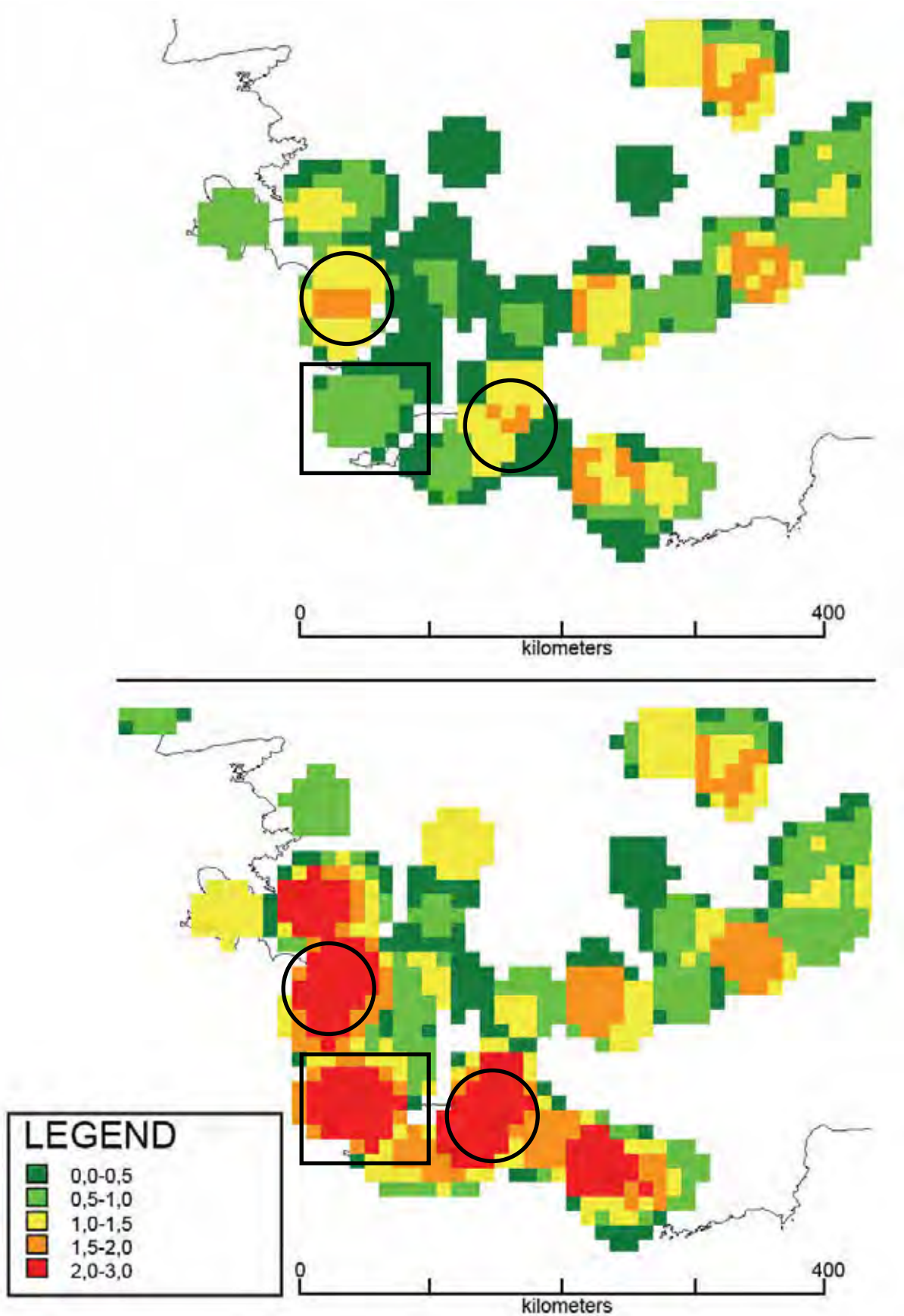


Figure 3. Biodiversity of endemic land snails (according to Shannon index) in Aegean region: only Anatolian endemics (upper map), endemics shared with East Aegean islands included (lower map).

Figura 3. Biodiversitatea melcilor de uscat endemici (conform indicelui Shannon) în regiunea Egeană: sunt incluse numai endemismele din Anatolia (harta de sus) și endemismele comune cu cele ale insulelor din Marea Egee de Est (harta de jos).

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**Mehmet Zeki Yildirim, Ümit Kebapçı**

Mehmet Akif Ersoy Üniversitesi,  
Fen Edebiyat Fakültesi, Biyoloji Bölümü, 15030 Burdur, Turkey  
E-mail: kebabci@gmail.com  
E-mail: mzekiyildirim@gmail.com

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