



Evaluation of The Reptilian Fauna in Amasya Province, Turkey with New Locality Records

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Abstract

The present study investigated the reptilian fauna in Amasya Province, Turkey. Reptile species were identified from collections made during field studies or recorded in literature, with some new locality records obtained. Field studies were undertaken over two consecutive years (2016 and 2017). Two lacertid species, one skink species, two colubrid species and one viper species were officially recorded for the first time or their information was updated. In addition to species locality records, chorotypical and habitat selection were also assessed and the International Union for Conservation of Nature Red List of Threatened Species criteria included. Data on the distribution and locality information for each taxon is also provided. Our findings demonstrate that Amasya might be an ecotone zone between the Mediterranean, Caucasian, and European ecosystems. Although there are some concerns for the sustainable dynamics of reptilian fauna, relatively rich and different European nature information system habitat types provide basic survival conditions for reptilian fauna in the province.

1. INTRODUCTION

Turkey is the only country that almost entirely includes three of the world's 34 biodiversity hotspots: the Caucasus, Irano-Anatolian, and Mediterranean [1]. In the Palearctic realm, reptiles are represented by approximately 3,095 native species [2].

Owing to Turkey's unique tectonic history and its location within the Asian, European, and African continents, it contains various vegetation types, different types of geological structures, and different climatic conditions; therefore, it has a rich biological diversity. Anatolia is both a natural bridge and a barrier between Asia and Europe because of its unique geographical position. Turkey, which is at the intersection of fauna elements with many different origins, has the potential to contain nearly 129 reptile species [3-6], which is almost as rich as the entire European continent [7].

To date, there have been two main approaches for investigating reptile groups in Turkey undertaken by foreign or Turkish researchers. The first approach is to focus on the distribution of any specific species or group of species to evaluate mostly morphological examinations [8-13], ecological niche modeling [14-16], phylogeographical [17-19], or ecological studies [20-22]. The second approach is to undertake detailed surveys on the distribution of reptilian fauna in specific regions [23-25] or provinces [26-28].

Several herpetological studies have been undertaken in the Amasya Province [29-32]. However, these were not directly focused on the reptilian fauna of Amasya. A total of 15 reptile species have been

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recorded along the borders of Amasya Province from previous studies. Therefore, an overall reptilian assessment is lacking in this province. Thus, the objectives of the present study were to investigate the reptilian fauna in Amasya, and undertake chorotypical and European nature information system (EUNIS) habitat type assessments to determine species distributions.

2. MATERIAL AND METHODS

Field studies were performed within the borders of Amasya Province, which covers an area of 5,628 km², and is between 34°57'06" and 36°31'53" E longitudes and 41°04'54" and 40°16'16" N latitudes (Figure 1).

A total of 148 reptilian specimens were captured/observed between March 2016 and September 2017 during field studies. These specimens were identified based on the literature [3-5]. Most of the specimens were released after identification. The coordinates of all sampling points were recorded with a GPS (Garmin Etrex e-30) in UTM format. Capture methods varied depending on whether the species was aquatic or terrestrial. Aquatic species were caught by hand or a scoop net, and terrestrial species were captured by hand or with a net. Some individuals, especially the lizards, were transferred to the laboratory for identification from their pholidosis characteristics. Species conservation status was determined based on the criteria of International Union for Conservation of Nature Red List of Threatened Species (IUCN), the Bern Convention on the Conservation of European Wildlife and Natural Habitats (BERN), and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Zoogeographical assessments were conducted by considering the origin of species by classifying them into major chorotypes based on the methodology described by Vigna Taglianti et al. [33] and Sindaco et al. [6]. Additionally, major habitat preferences were evaluated in terms of the European Nature Information System (EUNIS) Habitat Classification (2004) [34].

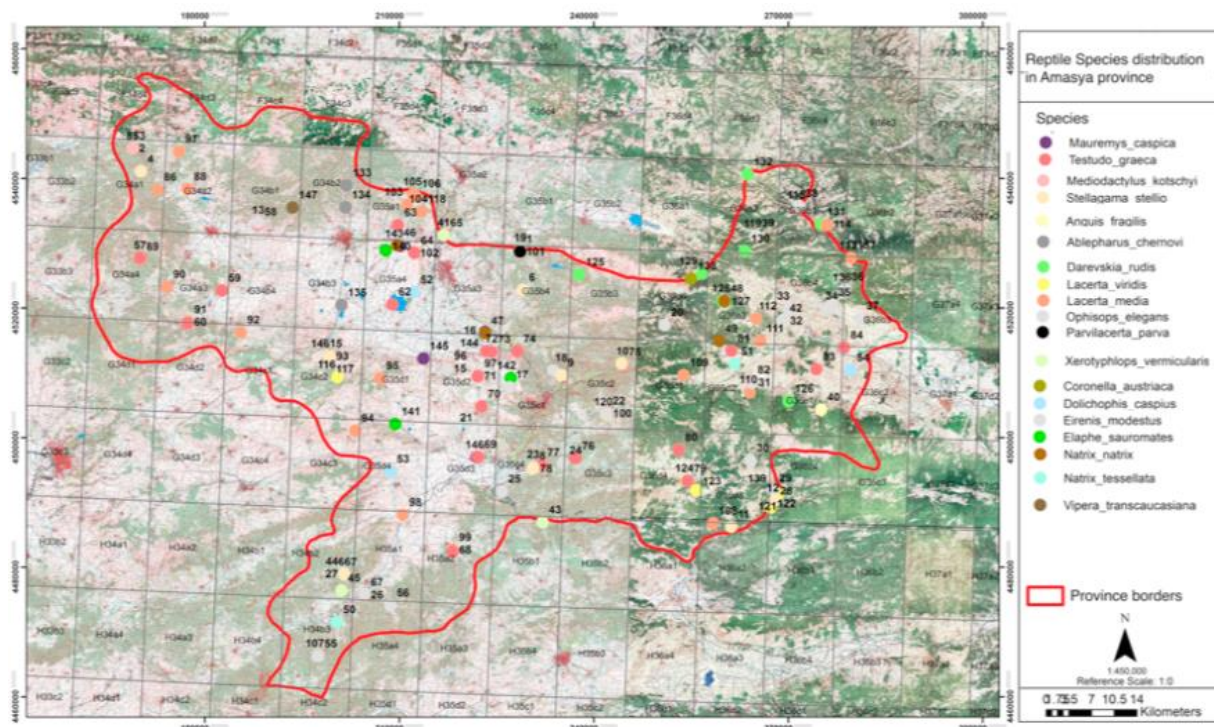


Figure 1. Reptile Species Distribution in Amasya Province (in 1:450000 scale)
Map of localities listed in the text. Corresponding numbers are shown in Appendix 1.

3. RESULTS

Based on the results from the present study, high-density population levels were observed in *Ophisops*

elegans, *Lacerta media*, and *Testudo graeca*. To date, of the 22 species recorded in the province, 90.9% of the reptile species are Least Concern (LC), one of them is Vulnerable (VU, *T. graeca*), and one is Near Threatened (NT, *Vipera transcaucasiana*) based on the IUCN Red List data [35] (Table 1). Here, we also evaluated the reptilian fauna in Amasya Province based on chorotypes and EUNIS habitat classification with results as follows:

- i) **Chorotype:** Herpetological examination of Amasya showed that the species in this area are arranged into 10 major chorotypes for reptiles, based on the classification by Vigna Taglianti et al. [33] and Sindaco et al. [6] (Table 1). The most common chorotype in the area is Turano-Mediterranean (six species), followed by E. Mediterranean and SW-Asiatic (four species each), European (two species), and E. European, Ponto-Caucasian Endemic, Armeno-Anatolian Endemic, Armeno-E Anatolian Endemic, Centralasiatic-European, and Centralasiatic-European (one species for each) (Figure 2).

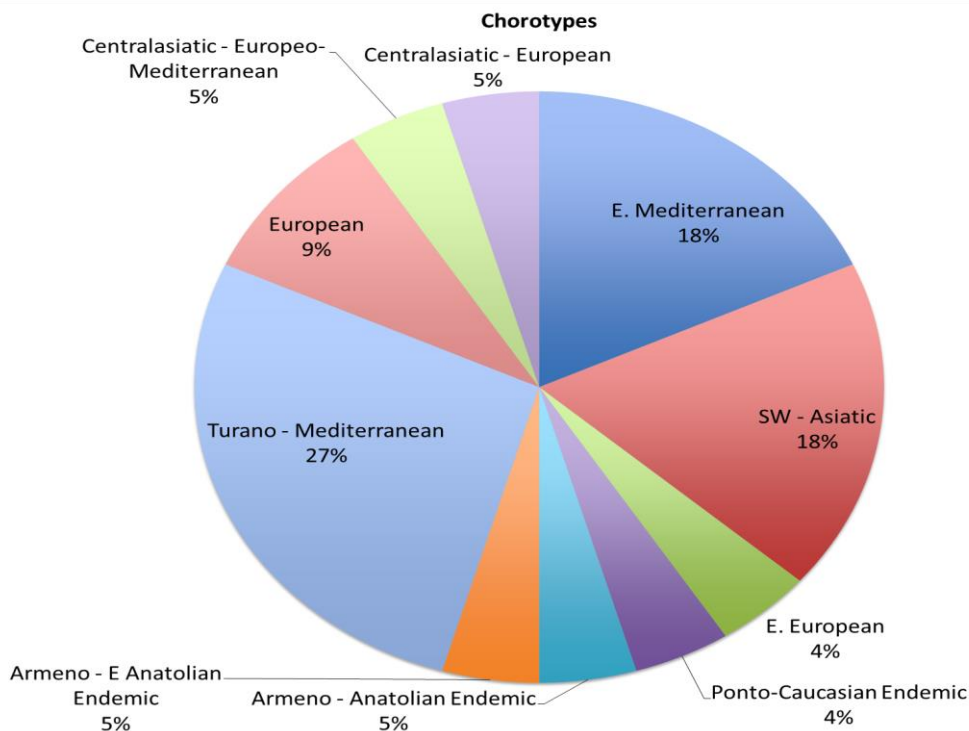


Figure 2. Chorotypes of the reptiles found in Amasya Province

- ii) **EUNIS Habitat Classification:** Although it is known that visiting sampling localities requires more time to detect the microhabitat selection by reptiles, we examined the main habitat preferences of these species. This regional assessment was undertaken based on the EUNIS Habitat Classification (2004) (Table 1). A total of 19 observed species were recorded from the 17 major EUNIS Habitats (the full names of habitat types are shown in Appendix 2).

Table 1. Reptile species of Amasya Province

Family	Species	Common name	IUCN	CITES	BERN	Observation point	Chorotypes	EUNIS	Literature
Geoemydidae	<i>Mauremys caspica</i>	Caspian turtle	LC	-	App - II	144 – 147	Turano - Mediterranean	C2	Schweiger, 1994.
Testudinidae	<i>Testudo graeca</i>	Mediterranean Spur-thighed tortoise	VU	App - II	App - II	57 – 84	Turano - Mediterranean	E1&H5&FB3	Türkozanet al. 2010
Agamidae	<i>Stellagama stellio</i>	Starred agama	LC	-	App - II	1 – 9	E. Mediterranean	A1	Baran et al, 1992
Gekkonidae	<i>Mediodactylus kotschyi</i>	Kotschyi's gecko	LC	-	App - II	10	E. Mediterranean	J1.1	Baran et al, 1992
Anguillidae	<i>Anguis fragilis</i>	Slowworm	LC	-	App - III	40	European	F.4	Başoğlu, Baran, 1977
Anguillidae	<i>Pseudopus apodus</i>	European Glass lizard	LC	-	App - II	Literature	Turano - Mediterranean	can not evaluated	Başoğlu, Baran, 1977
Lacertidae	<i>Darevskia rudis</i>	Spiny-tailed lizard	LC	-	App - III	126 – 133	Ponto-Caucasian Endemic	E2 & A1	Böhme & Budak, 1977
Lacertidae	<i>Lacerta viridis</i>	Green lizard	LC	-	App - II	117 – 125	E. European	E3	The present study
Lacertidae	<i>Lacerta media</i>	Three-lined lizard	LC	-	App - III	85 – 116	SW - Asiatic	E3&D2,1	The present study
Lacertidae	<i>Ophisops elegans</i>	Snake-eyed lizard	LC	-	App - II	12 – 39	E. Mediterranean	E1 & H5	Baran et al, 1992
Lacertidae	<i>Parvilacerta parva</i>	Dwarf lizard	LC	-	App - II	11	Armeno – Anatolian Endemic	E2,5	Baran et al, 1992
Scincidae	<i>Ablepharus chernovi</i>	Chernov's Skink	LC	-	App - III	134 – 138	Armeno – E. Anatolian Endemic	E5.4&FB	This study
Typhlopidae	<i>Xerotyphlops vermicularis</i>	Blind snake	LC	-	App - III	41 – 45	Turano - Mediterranean	E1	Başoğlu, Baran 1998, Bodenheimer 1944
Colubridae	<i>Coronella austriaca</i>	Smooth snake	LC	-	App - II	139 – 140	European	G1	The present study
Colubridae	<i>Dolichophis caspius</i>	Caspian whip snake	LC	-	App - III	52 – 54	Turano - Mediterranean	I1	Baran et al, 1992
Colubridae	<i>Dolichophis schmidtii</i>	Schmidt's whip snake	LC	-	App - III	Literature	SW - Asiatic	can not evaluated	Başoğlu, Baran 1998, Göçmen et al. 2013

Table 1. Reptile species of Amasya Province (continued)

Family	Species	Common name	IUCN	CITES	BERN	Observation point	Chorotypes	EUNIS	Literature
Colubridae	<i>Eirenis modestus</i>	Anatolian dwarf racer	LC	-	App - III	55 – 56	SW - Asiatic	E7	Başoğlu, Baran 1998, Göçmen et al. 2013
Colubridae	<i>Elaphe sauromates</i>	East-Four-Lined rat snake	LC		App - III	141 – 143	Turano - Mediterranean	I1	The present study
Colubridae	<i>Natrix natrix</i>	Grass snake	LC	-	App - III	46 – 49	Centralasiatic - Europeo-Mediterranean	C1.1 &C2	Baran et al, 1992
Colubridae	<i>Natrix tessellata</i>	Dice snake	LC	-	App - II	50 – 51	Centralasiatic - European	C1.1	Baran et al, 1992
Colubridae	<i>Zamenis hohenackeri</i>	Transcaucasian rat snake	LC	-	App - III	Literature	SW - Asiatic	can not evaluated	Bodenheimer 1944, Başoğlu, Baran 1998
Viperidae	<i>Vipera transcaucasiana</i>	Transcaucasian Long-nosed Viper	NT	-	App - II	148	E. Mediterranean	E5.4	The present study

Mauremys caspica (Gmelin, 1774)

It was firstly recorded in Amasya by Schweiger in 1994, but the localities were not certain [36]. Here we announced the exact localities of the species from Çayır (Merzifon), Eraslan (Suluova) and Yıldızköy (city center) villages. Although the species IUCN status is “LC” (Least Concerned), exploring the new populations of the species is important because landscape alteration, pollution and intensification of water management threat over this species [37].

Testudo graeca Linnaeus 1758

Specimens of this species were seen often, with miscellaneous inland habitats with very sparse vegetation providing suitable conditions for them.

Mediodactylus kotschyi (Steindachner, 1870)

Baran et al. [29] recorded *M. kotschyi* from Amasya city center. In the present study, we found this species in abandoned buildings in Kutluca village (Gümüşhacıköy).

Stellagama stellio (Linnaeus, 1758)

Consistent with previous records [29], we observed *S. stellio* in new localities containing rocky habitats, such as Ziyaret (city center), Çengelkiyi (city center), İlyas (city center), Çiğdemlik (city center), and Alan (Göynücek), Eğribük (Suluova), Bayat (Merzifon), and Güvenözü (Gümüşhacıköy) villages.

Anguis fragilis Linnaeus, 1758

The slowworm is narrowly localized in the eastern part of the province. Especially, shrub heathland habitats are suitable for them. The bush residues play a shelter role in the beginning of spring for this species. Agricultural activities that start with spring season cause an important loss of its microhabitats by removing these bush residues.

Ablepharus chernovi Darevsky, 1953

This slow worm lizard was localized to the eastern part of the province, especially in shrub heathland habitats. Bush residues provide shelter during the beginning of spring for this species. Agricultural activities that begin during the spring season cause important losses of these microhabitats by removal of these bush residues.

Darevskia rudis (Bedriaga, 1886)

This species was found in mesic grasslands and rocky habitats, especially in the northern part of the province as recorded previously [38].

Lacerta viridis (Laurenti, 1768)

L. viridis was officially recorded for the first time within the borders of Amasya Province and was observed in various locations in grasslands (especially bushes).

Lacerta media Lantz & Cyrén, 1920

When the species distribution was examined, records of *L. media* were updated from various locations in Amasya and was considered a subspecies previously described by Baran et al. [29].

Ophisops elegans Ménétries, 1832

This species was the most abundant reptile in the province and usually inhabited miscellaneous inland habitats containing very sparse vegetation.

Parvilacerta parva (Boulenger, 1887)

This species inhabited upland steppe areas with sparse vegetation and stony substrates. We only recorded it in the east section where the altitude (> 1,000 m asl) was higher than that of the province average (411 m asl).

Xerotyphlops vermicularis (Merrem, 1820)

Bodenheimer [31] recorded *X. vermicularis* in Amasya 73 years ago. We re-discovered this blind snake species in Karayakup and Gökçeli (Göynücek) and in Kızıoğlu (city center) villages in Amasya.

Coronella austriaca Laurenti, 1768

C. austriaca is usually found in moorland, rocky coastlines, open woodland (deciduous, coniferous, and mixed) and scrubland, hedgerows, woodland edges, and heathland and was recorded in two locations for the first time during the present study. One specimen was captured in Kavaloluğu village (Taşova), which contains coniferous open woodlands and the other was recorded from Umuk village (city center) where heathlands are located.

Elaphe sauromates (Pallas, 1811)

E. sauromates was another snake species collected, which was the first recording in Amasya. The specimens were recorded in Gökçebağ (Merzifon) and Bağlarüstü (city center) villages. Although the species is non-venomous and is beneficial to farmers owing to their rodent hunting ability, individuals have been killed in the past because of misbelief surrounding them in agricultural areas.

Eirenis modestus Martin, 1838

The specimens of this species were found under stones in sparsely wooded grasslands. Our records contribute to an increase in the province level information provided by previous studies regarding this species [30].

Dolichophis caspius (Gmelin, 1789)

D. caspius was recorded in agricultural areas, close to Umutlu village (Taşova) and Yedikır (Suluova). The morphology of the specimens were the same as that from other records. The previous record of this species in Amasya was from Doğantepe village [29].

Natrix natrix (Linnaeus, 1758)

The morphological characters of the examined specimens of this species were the same as that contained in the literature. The biotopes of this snake species are oligotrophic lakes and ponds.

Natrix tessellata (Laurenti, 1768)

Although this species is widespread within Turkey, records from the central and inner Black Sea region are still lacking, even if it was emphasized in the study by Baran et al. [29]. We detected the species only in two localities. Therefore, focus on this area is essential.

Vipera transcaucasiana Boulenger, 1913

V. transcaucasiana was recorded for the first time in Amasya. Mülder [39] reviewed the distribution of this species in Anatolia. Therefore, this locality record contributes to filling the gaps between Tokat and Samsun.

One lizard (*Pseudopus apodus* (Pallas, 1775)) and two snake species (*Dolichophis schmidtii* (Nikolsky, 1909)) and *Zamenis hohenackeri* (Strauch, 1873)) shown in Table 1 were recorded in the Amasya Province in previous studies [29,30]; however, we did not obtain any samples of these species during the present study.

4. CONCLUSION

Faunistic studies in Turkey are mostly associated with the revision of a species or genus [8-22]. However, detailed faunistic studies that include reptiles in a province have been increasing over the last two decades [23-28, 40]. Unfortunately, there is no faunistic study that comprises only those fauna found in Amasya Province. To date, the most detailed study involving this location has been conducted in 30 different localities in the Western and Central Black Sea region [29-32].

The chorotype assessment provides information to obtain reliable biodiversity data [33]. Additionally, Amasya is located in the valley between Yeşilirmak and the Middle Black Sea (Canik) Mountains. Yeşilirmak River is an important factor for the formation of biodiversity from inner Anatolia. Owing to these geographical patterns, Amasya can be considered a transition zone between Central, Northern, and Eastern Anatolia, and possesses various zoogeographical elements, which contribute to the biodiversity of Anatolia [41].

When the contribution from the Turano-Mediterranean (27%) and E. Mediterranean (18%) elements to the province's reptile fauna are considered, Amasya is an ecotone between Mediterranean, Caucasian, and European ecosystems. This province comprises 16.4% of all reptile species in Turkey. Additionally, the origins of these species are from 10 different geographies based on chorotyping.

Based on EUNIS habitat types, the preferred habitat for reptiles in Amasya is dry grasslands (three species). Grassland-based habitats (as a total of six different habitat types) are the most suitable habitats for reptiles in Amasya (35.3%). Moreover, nine EUNIS major habitats hosted only one reptile species. Therefore, there is a relatively rich habitat diversity for reptiles throughout Amasya Province.

In conclusion, the present study is the first long-term study of reptiles in Amasya. A total of 22 reptile species records were evaluated. *Lacerta* species (*L. media* and *L. viridis*) and *Ablepharus chernovi* records were updated based on their subspecies/species status. *C. austriaca* and *E. sauromates*, have wide geographical distribution throughout Turkey; however, official records were provided in the present study. Because the geographical distribution of the nose-horned viper (*V. transcaucasiana*) is in North Anatolia, the locality record in the given geography will contribute to the actual species distribution map. Conversely, it was determined that the presence of some species referenced by previous literature in the city was doubtful and some species showed wider distributions than previously thought. For this reason, the findings from the present study will be a useful guide for future studies on the conservation studies of these reptiles and their usage of the sustainable areas in the province.

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CONFLICTS OF INTEREST

No conflict of interest was declared by the authors.

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Appendix 1 Station numbers and coordinates

Station Numbers	UTM Zone	N	E
1	36T	741931	4508647
2	36T	710696	4475899
3	36T	734968	4521449
4	36T	706139	4509138
5	37T	261224	4486189
6	37T	267764	4490089
7	36T	738651	4494183
8	36T	751257	4511106
9	36T	675210	4535659
10	36T	673665	4539144
11	36T	734357	4527366
12	36T	740626	4509365
13	37T	250924	4517259
14	37T	281113	4518124
15	36T	693733	4528842
16	37T	265031	4531046
17	37T	269288	4517922
18	37T	276045	4519802
19	37T	278731	4522703
20	37T	264408	4508320
21	37T	264183	4496391
22	36T	710696	4475899
23	36T	714017	4472878
24	36T	706139	4509138
25	37T	267649	4491657
26	37T	267764	4490089
27	37T	271683	4535433
28	36T	724346	4508426
29	36T	738651	4494183
30	36T	743173	4495057
31	36T	749307	4503204
32	36T	734170	4506215
33	36T	734108	4490052
34	36T	740626	4509365
35	37T	270186	4519678
36	37T	276702	4520282
37	36T	726004	4498957
38	36T	739031	4512911
39	36T	722125	4529154
40	37T	275098	4504235
41	37T	269288	4517922
42	36T	710245	4473170

Station Numbers	UTM Zone	N	E
43	36T	710696	4475899
44	36T	740590	4485865
45	36T	722341	4529101
46	36T	715808	4526922
47	37T	259449	4514805
48	36T	729784	4514622
49	37T	260301	4520902
50	36T	710055	4468340
51	37T	261793	4511142
52	37T	279705	4510485
53	36T	716542	4492259
54	36T	718583	4519997
55	36T	707546	4463015
56	36T	718124	4471546
57	36T	745033	4496089
58	36T	739719	4494808
59	37T	274371	4510453
60	36T	715124	4517847
61	36T	693733	4528842
62	37T	264408	4508320
63	36T	710696	4475899
64	36T	714017	4472878
65	36T	727153	4480466
66	36T	706139	4509138
67	36T	718064	4525944
68	36T	715272	4529997
69	37T	278664	4513850
70	36T	722341	4529101
71	36T	731043	4511642
72	36T	729128	4507707
73	36T	729912	4503142
74	36T	729855	4495250
75	36T	738651	4494183
76	37T	254383	4493248
77	37T	253083	4497970
78	36T	751257	4511106
79	36T	734918	4511960
80	37T	261314	4513259
81	36T	683991	4512862
82	36T	688793	4518103
83	36T	675901	4522253
84	36T	730186	4511661
85	37T	264137	4506898

Station Numbers	UTM Zone	N	E
86	36T	673665	4539144
87	36T	680824	4539123
88	36T	682696	4533500
89	37T	279692	4527654
90	36T	707546	4463015
91	36T	727153	4480466
92	36T	734357	4527366
93	36T	692333	4512136
94	36T	706139	4509138
95	36T	710890	4498097
96	36T	718765	4532465
97	36T	717286	4535054
98	36T	718064	4525944
99	37T	261224	4486189
100	37T	258474	4486654
101	37T	276036	4532683
102	37T	271683	4535433
103	36T	724346	4508426
104	36T	729128	4507707
105	36T	749307	4503204
106	37T	253879	4509470
107	37T	265083	4518223
108	36T	683991	4512862
109	36T	680480	4517913
110	36T	675901	4522253
111	36T	677937	4533035
112	37T	265702	4514784
113	36T	714276	4506208
114	36T	717698	4534770
115	36T	713808	4493353
116	36T	716498	4533394
117	37T	265031	4531046
118	36T	706139	4509138
119	36T	707551	4506117
120	36T	718765	4532465
121	37T	255814	4491827
122	37T	254383	4493248
123	36T	749307	4503204
124	37T	268547	4491292
125	37T	267331	4489127
126	37T	260301	4520902
127	36T	677500	4541017
128	37T	275020	4532853

Station Numbers	UTM Zone	N	E
129	37T	262754	4529226
130	37T	263328	4528702
131	37T	270077	4505519
132	36T	743703	4524445
133	37T	259850	4521019
134	36T	706921	4535700
135	37T	275020	4532853
136	37T	269288	4517922
137	37T	278731	4522703
138	37T	279692	4527654
139	36T	761913	4529693
140	37T	267649	4491657
141	36T	713676	4526129
142	36T	734255	4507785
143	36T	716967	4499504
144	36T	715808	4526922
145	36T	720598	4509876
146	36T	729855	4495250
147	36T	729784	4514622
148	36T	698882	4531729

Appendix 2. Major EUNIS Habitats for reptile species in Amasya province

Species	EUNIS Code	EUNIS Habitat Name
<i>Stellagama stellio</i>	A1	Littoral rock and other hard substrata
<i>Ophisops elegans</i>	E1& H5	Dry grasslands & Miscellaneous inland habitats with very sparse or no vegetation
<i>Mediodactylus kotschy</i>	J1.1	Residential buildings of city and town centres
<i>Parvilacerta parva</i>	E2,5	Meadows of the steppe zone
<i>Anguis fragilis</i>	F.4	Temperate shrub heathland
<i>Xerotyphlops vermicularis</i>	E1	Dry grasslands
<i>Natrix natrix</i>	C1.1 & C2	Permanent oligotrophic lakes, ponds and pools & Surface running waters
<i>Natrix tessellata</i>	C1.1	Permanent oligotrophic lakes, ponds and pools
<i>Dolichophis caspius</i>	I1	Arable land and market gardens
<i>Eirenis modestus</i>	E7	Sparsely wooded grasslands
<i>Testudo graeca</i>	E1&H5&FB3	Dry grasslands & Miscellaneous inland habitats with very sparse or no vegetation & Shrub plantations for ornamental purposes or for fruit other than vineyards
<i>Lacerta media</i>	E3&D2,1	Valley mires & Seasonally wet and wet grasslands
<i>Lacerta viridis</i>	E3	Seasonally wet and wet grasslands
<i>Darevskia rudis</i>	E2 & A1	Mesic grasslands & Littoral rock and other hard substrata
<i>Ablepharus chernovi</i>	E5.4&FB	Moist or wet tall-herb and fern fringes and meadows & Shrub Plantations
<i>Coronella austriaca</i>	G1	Broadleaved deciduous woodland
<i>Elaphe sauromates</i>	I1	Arable land and market gardens
<i>Mauremys caspica</i>	C2	Surface running waters
<i>Vipera transcaucasiana</i>	E5.4	Moist or wet tall-herb and fern fringes and meadows