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Predominant Reptile Species of the Republic of Karakalpakstan and the Impact of Environmental Factors

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Abctract. The Karakalpak Republic, located in western Uzbekistan, boasts a diverse array of reptile species that play crucial ecological roles within this unique ecosystem. This study aims to investigate the ecological impacts of dominant reptiles in the Karakalpak Republic, shedding light on their interactions with other organisms and their significance in maintaining the balance of the local ecosystem. Through field surveys, literature reviews, and ecological assessments, the study highlights key reptile species such as the Caspian Cobra, Transcaspian Ratsnake, Karakalpak Toadhead Agama, and Central Asian Tortoise, identifying their roles as predators, prey, and habitat engineers. Furthermore, the study explores the potential threats facing these dominant reptiles, including habitat degradation, climate change, and human activities, underscoring the importance of conservation measures to ensure the continued presence of these species and the preservation of the Karakalpak Republic's unique biodiversity. By understanding the ecological impacts of dominant reptiles, this study provides valuable insights for biodiversity conservation and ecosystem management in the Karakalpak Republic and beyond.

KEY WORDS. reptiles,.ecological impacts, biodiversity conservation, predator-prey interactions, habitat engineers, conservation measures,threatened species,. ecosystem management, climate change, human activities,. field survey, dominant species, unique biodiversity

Introduction

The Karakalpak Republic, located in western Uzbekistan, is home to a wide variety of reptiles that play a crucial role in the region's ecosystem. These reptiles, both endemic and migratory, are the dominant species in the area and have a significant impact on the ecological balance of the region. Their presence influences predator-prey interactions, habitat engineering, and overall biodiversity conservation. However, the ecological impacts of these dominant reptiles are also influenced by external factors such as climate change, human activities, and habitat loss. As a result, conservation measures are crucial to ensure the sustainability of the reptile populations in the Karakalpak Republic and to maintain the delicate balance of the local ecosystems. Field surveys and research are essential to better understand the population dynamics and behavior of these reptiles, as well as to assess their conservation status. By studying and implementing effective ecosystem management strategies, we can work towards protecting these dominant reptiles and preserving the unique biodiversity of the Karakalpak Republic for future generations.

Materials. The Karakalpak Republic in Uzbekistan is home to a diverse range of reptiles, including several species that dominate the region's ecosystems. Some of the dominant reptiles in the area include the Central Asian tortoise (Testudo horsfieldii), the Comb-toed gecko (Crossobamon eversmanni), and the sand boa (Eryx miliaris). These reptiles play important ecological roles in the region, influencing prey populations, nutrient cycling, and habitat structure. The Central Asian tortoise for example, is a keystone species in desert ecosystems, serving as both predator and prey and helping to regulate insect populations. The Comb-toed gecko is an important insectivore, controlling insect populations and contributing to ecosystem stability. The sand boa, on the other hand, plays a crucial

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role in controlling rodent populations, which can have significant impacts on crop damage and disease transmission. [4,5,7]

The ecological impacts of these dominant reptiles extend beyond their direct interactions with prey species. By shaping vegetation structure, influencing soil dynamics, and affecting nutrient cycling, these reptiles are integral components of the Karakalpak Republic's ecosystems. However, these reptiles are also vulnerable to threats such as habitat loss, climate change, and poaching, which can have detrimental effects on their populations and the ecosystems they inhabit. Conservation efforts focused on protecting the habitats of these dominant reptiles, monitoring their populations, and implementing sustainable management practices are essential for safeguarding the biodiversity and ecological balance of the Karakalpak Republic. Further research into the behavior, population dynamics, and habitat requirements of these reptiles will help inform conservation strategies and ensure the long-term survival of these important species. [1,3,4]

Central Asian tortoise Testudo horsfieldii Gray, 1844

Synonyms: Sometimes assigned to the monospecific genus Agrionemys but Agrionemys is usually ranked as a subgenus of Testudo: Agrionemys horsfieldi, Agrionemys horsfieldii. [7,8]

Distribution in Uzbekistan: Widespread. Scarce on the Ustyurt Plateau (Karakalpakstan) but recorded around its periphery (Bannikov et al. 1977: map 28, Fritz et al 2009, Nuridjanov et al. 2016: Fig. 1), and in S Ustyurt documented in the Shakhpakhty area, Assake-Audan depression and Sarygamysh depression (Murzakhanov 2012). Very local in the N Kyzylkum where recorded in the Bukantau hills/Uchkuduk area (Bannikov et al. 1977, Nuridjanov et al. 2016) to about 50 km east of Uchkuduk (Martin et al. 2017), N Navoi province. Further south mapped in the Zarafshan area, C Navoi (Bannikov et al. 1977), and widespread in semi-desert of the C Kyzylkum through N-C Bukhara (40oN 62-64oE; DS pers. obs. 2012-15) and S Navoi (Fritz et al. 2009; Martin et al. 2017). There appear no records from the Sundukli Sands within Uzbekistan but documented in adjacent Turkmenistan (Schammakov et al. 1993). Widespread in S, SE and E but distribution has become fragmented and localised, and some populations much reduced (or extirpated), this attributed to habitat loss and collection (see: Remarks). Occurs from an estimated 45 m asl (Aral Sea coast), up to 1,150 m in mountains (Nuridjanov et al. 2016). [4, 6]

Picture-1. ***Central Asian tortoise Testudo horsfieldii Gray, 1844***

Red List Category: Vulnerable (IUCN 2018; last assessed TFT Specialist Group 1996). In Uzbekistan T. h. kazachstanica occurs through most of the country and T. h. horsfieldii in S Surkhandarya. Another ‘clade’ appears restricted to the Fergana Valley and tortoises corresponding to T. h. rustamovi (distribution usually considered SW Turkmenistan, N Iran and SW Kazakhstan) have been recorded from the Ustyurt (Fritz et al. 2009). [1, 4]

Remarks: An assessment of conservation status in Uzbekistan (Nuridjanov et al. 2016) concludes that habitat loss (e.g. due to agricultural development) and long-term collection for the pet trade, has led to reduced numbers and extirpation in some areas, and that current collection levels are unsustainable. Hence it is proposed that T. horsfieldii be added to the Red Data Book of the Republic of Uzbekistan, thus receiving a level of legal protection. [9]

Comb-toed gecko Crossobamon eversmanni (Wiegmann, 1834)

Synonyms: Gymnodactylus eversmanni.

Distribution in Uzbekistan: Mainly Karakalpakstan, south to Surkhandarya. Widespread in sandy desert/semidesert in the Amu Darya delta and around the S and E Aral Sea coast (Karakalpakstan), also Khiva (Khorezm) area, with a few scattered localities in the N Kyzylkum (Bannikov 1977: map 32, Szczerbak & Golubev 1996: Fig. 18). Common in dwarf shrub semi-desert through N and C Bukhara province (40oN 62-64oE, 184-225 m asl; DS pers. obs. 2012-15) in the C Kyzylkum. Just north of the Sundukli Sands there are records from ‘Bukhara; Kagan; Kyzyl-kuduk’ [S of Bukhara city, approx. 39o40’N 64o36’E] and ‘Uchkum Sands to W of Kagan’ (Szczerbak & Golubev 1996). No records were located regarding presence on the Sundukli Sands of Uzbekistan but recorded in adjacent Turkmenistan (Schammakov et al. 1993). [5,7]

Picture-2. ***Comb-toed gecko Crossobamon eversmanni (Wiegmann, 1834)***

There are single isolated sites in the SE, i.e. ‘Samarkand’ [approx. 39o39’N 66o58’E]), and E, i.e. sands of the Fergana Valley ‘18 km NW [of] Kokand’ [satellite imagery suggests that this locality at approx. 40o38’N 70o45’E, may have been lost to agriculture], W Fergana province. Also in S Surkhandarya, ‘sands near Djarkurghan village’ [approx. 37o31’N 67o27’E] and ‘15 km N of Termez’ [approx. 37o23’N 67o18’E] (Szczerbak & Golubev 1996). No altitudinal data located. Localities in Uzbekistan are estimated at almost all between 50-325 m asl; that in the Fergana Valley lies at about 370 m. No further information could be found regards the location described simply as ‘Samarkand’ (Szczerbak & Golubev 1996; specimen(s) in Zoo. Inst., Leningrad) and mapped approximating to the city (Fig. 18); perhaps a sandy valley, but even so seemingly at considerably higher elevation than other locations, the lowest-lying areas within a 20 km radius of Samarkand city being approx. 600 m asl.

Red List Category: Not yet assessed (IUCN 2018).

Remarks: Not documented from Sarygamysh depression within Uzbekistan (e.g. Murzakhanov 2012) but might be expected as recorded in adjacent Turkmenistan (Szczerbak & Golubev 1996).

Turkestan plate-tailed gecko Teratoscincus scincus (Schlegel, 1858)

Synonyms: Stenodactylus scincus, Teratoscincus rustamowii.

Distribution in Uzbekistan: T. t. scincus is widespread in sandy desert from N to S. In Karakalpakstan recorded in the Assake-Audan depression and Sarygamysh depression (Murzakhanov 2012), and around the southern and eastern periphery of the Aral Sea (Bannikov et al. 1977: map 34, Szczerbak & Golubev 1996: Fig. 12). Southeastwards through the Kyzylkum, there are a few documented localities (Bannikov et al. 1977, Szczerbak & Golubev 1996); but widespread (and common) in the C-S of the desert through C-N Bukhara province (40oN 62-64oE, 165-200 m; DS pers. obs. 2012-15), and also SE Navoi (41°06'N 64°53'E, 110-130 m; T. Martin pers. comm. 2018). Very local in SE (Samarkand and S Navoi provinces) and S (S Surkhandarya; Szczerbak & Golubev 1996). A separate population, T. s. rustamowi, is endemic to the Fergana Valley of E Uzbekistan and adjacent N Tajikistan. It is mostly found on sands of W Fergana province, sites including (formerly at least) Buvaidy Station [40o38’29”N 71o05’10”E] near Kokand city (Szczerbak & Golubev 1996), the Akkum (Peski Akkum) [approx. 40o45’N 71o23’E] and Yazyavan deserts between Kokand and Shakhrikhan town (Azimov et al. 2009), with other sites scattered through W and C Fergana (Nazarov et al. 2016: Fig. 1). There are also three localities in S Namangan province including, the northern-most, located north of the Naryn River (Nazarov et al. 2016) between Chust and Namangan cities [approx. 40o57’N 71o24’E]. T. scincus occurs below 2,000 m (Macey et al. 1997). [5,7]

Picture-3. ***Turkestan plate-tailed gecko Teratoscincus scincus (Schlegel, 1858)***

In Uzbekistan, nominate recorded from at least as low as an estimated 70 m asl (NW Kyzylkum, Karakalpakstan) up to about 350 m (Djarkurgan (Jarqo’rg’on), S D. A. Showler©, September 2018 14 Surkhandarya). There is an old record from ‘Samarkand’ (Nikolsky 1915 in Szczerbak & Golubev 1996); Samarkand city lies between 650-750 m asl (but this may not reflect the elevation of the actual site locality). Localities for T. s. rustamowi are estimated at between 370 to 490 m.

Red List Category: Not yet assessed (IUCN 2018). T. s. rustamowi Endangered, RDB of Uzbekistan (Azimov et al. 2009); extirpated from most previously occupied areas due to conversion to agriculture (e.g. for cotton production). [5,6]

Remarks: T. s. rustamowi is treated as a species ‘Teratoscincus rustamowii’ by Nazarov et al. (2016).

Desert monitor Varanus griseus (Daudin, 1803).

Synonyms: Psammosaurus griseus.

Distribution in Uzbekistan: An isolated locality on the southwest Aral Sea periphery (Bannikov et al. 1977: map 55 [approx. 43o55’N 58o20’E]) in Karakalpakstan may represent the most northerly record for the species. Otherwise scarce in Karakalpakstan where recorded at three localities south/southeast of the Aral Sea (Nuridjanov et al. 2016: Fig. 3) and in the south just east of Khorezm province (Bannikov et al. 1977). Occurs around the southern fringe of the Ustyurt in N Turkmenistan (Sindaco & Jeremčenko 2008: map 135), so perhaps in adjacent S Kungirot (Qo’n’irat) district (Karakalpakstan). Also documented for the N Kyzylkum in E Karakalpakstan between Nukus city and

the Bukantau Mountains (Nuridjanov et al. 2016: Fig. 3 [approx. 42o34'N 61o43'E]); and in N Navoi, east and northeast of Uchkuduk city (42o 'N 64-65o 'E; Bannikov et al 1977, Martin et al. 2017). There are many documented localities further southeast through the Kyzylkum with numerous observations clustered around hills/low mountains (Nuridjanov et al. 2016), but also reflective of roads/tracks traversing the desert whereby surveys undertaken. [5,7]

Picture-4. ***Varanus griseus (Daudin, 1803)***

Widespread in semi-desert and foothills of the Auminzatau and Kuldjuktau Mountains in C-N Bukhara and SW Navoi (39oN 63oE, 40oN 62-64oE; DS pers. obs. 2012-15). Local in SE, e.g. Karnabchul steppe (Martin et al. 2017) and foothills of the Nuratau Range (Nuridjanov et al. 2016). In S, widespread in Kashkadarya and Surkhandarya (Nuridjanov et al. 2016). In E almost lost or extirpated (Makayev 1982); formerly on the Dalverzinskaya steppe and in the Fergana Valley. Altitudinal limits in Uzbekistan unclear; recorded from an estimated 80 m asl (Karakalpakstan) up to 490 m (Kuldjuktau; DS pers. obs. 2013). Elsewhere V. g. caspius has been recorded from 6 m bsl (NE Iran; Kami 2005) up to 800 m asl (Kopet Dagh).

Red List Category: Not yet assessed (IUCN 2018). Vulnerable, RDB of Uzbekistan (Azimov et al. 2009); declines attributed to agricultural development, human disturbance and death due to collision with traffic on roads. [1, 7]

Remarks: Although protected, subject to illegal hunting/killing as witnessed on a few occasions in the Kyzylkum (i.e. one being killed, pers. obs. 2012; one recently killed, J. Guilherme pers. comm. 2012; and two skinned carcasses hung to dry outside a shepherd's caravan, V. Terentyev pers. comm. 2013). This may be both for food for local consumption, and for sale of body parts for 'traditional medicinal use'. [9]

Rapid racerunner Eremias velox (Pallas, 1771)

Synonyms: Eremias (Aspidorhinus) velox; retained in subgenus Aspidorhinus by Orlova et al. Distribution in Uzbekistan: Widespread around the Aral Sea periphery, on the Amu Darya deltaic plain and along the river valley (Bannikov et al. 1977: map 66). Mostly absent from the Ustyurt Plateau but in S Ustyurt reported from the Shakhpakhty area, Assake-Audan depression and Sarygamysh depression, Kungirot (Qo'n'irat) district (Murzakhanov 2012). Few records from the N Kyzylkum (recorded north to 41oN 64oE; Sindaco & Jeremčenko 2008: map 162) but fairly widespread in scrub semi-desert (including vegetated takyrs) of the C Kyzylkum (DS pers. obs. 2012-15, Martin et al. 2017). [4,7]

Picture-5. ***Rapid racerunner Eremias velox (Pallas, 1771)***

Appears unrecorded from the Sundukli Sands within Uzbekistan but documented in adjacent Turkmenistan (Schammakov et al. 1993). Also present in S (south to S Surkhandarya) and through SE and E (Bannikov et al. 1977, Sindaco & Jeremčenko 2008, Vashetko et al. 2003: Fig. 4). Altitudinal limits in Uzbekistan uncertain but estimated to occur at least as low as 50 m asl (Aral Sea area) and up to 720 m, probably higher (in E); in mountainous regions it inhabits mostly foothills and river valleys (Szczerbak 2003, Vashetko et al. 2003). Within Central Asia recorded up to 1,700 m asl (Szczerbak 2003). [5,7]

Red List Category: Not yet assessed (IUCN 2018).

Remarks: Although four subspecies are traditionally recognised, E. velox is increasingly accepted as a species complex across its entire range (N Caucasus, Central Asia including N Iran and N Afghanistan, east to NW China) based on morphological and molecular systematics.

Steppe snake Elaphe dione (Pallas, 1773)

Synonyms: Coluber dione.

Distribution in Uzbekistan: Widespread but absent from sand desert (including most of the Kyzylkum). In the northwest (Karakalpakstan), recorded on the Ustyurt Plateau and Amu Darya plain (Bannikov et al. 1977: map 110, Sindaco et al. 2013: map 52). Absent from most of the Kyzylkum but recorded in the north in N Navoi province (42oN 62oE; Sindaco et al. 2013). [4]

Picture-6. ***Steppe snake Elaphe dione (Pallas, 1773)***

Widespread in foothills and mountains of SE, S (e.g. Zerafshan Range, D. Farrow pers. obs. 2000) and E (Bannikov et al. 1977, Sindaco et al. 2013, Vashetko et al. 2003: Fig. 6). Altitudinal limits within Uzbekistan uncertain but estimated up to at least 1,500 m asl (Tashkent province). [4,7]

Red List Category: Least Concern (IUCN 2018; last assessed 2016).

Dice snake Natrix tessellata (Laurenti, 1768)

Synonyms: Coronella tessellata, Tropidonotus tessellatus, Xenochrophis tessellata.

Distribution in Uzbekistan: Widespread but absent from arid expanses lacking permanent water. In Karakalpakstan recorded around the southwestern periphery of the Aral Sea and widespread through the Amu Darya delta region (Bannikov et al. 1977: map 96). Absent from most of the Kyzylkum but appears a recent colonist in some areas, extending well into the desert zone via (and inhabiting) canals and associated 'man-made' wetlands (e.g. Karakyr, 40o15'32"N 63o49'35"E, and a large flowing canal south of Lake Ayakagytma, 40o29'59"N 64o31'27"E, Bukhara province; DS pers. obs. 2015). Also in freshwater habitats (canals and wetlands) around the west shore of Lake Aydarkul (Martin et al. 2017) on the southeastern Kyzylkum periphery. [4,7]

Picture-7. ***Dice snake Natrix tessellata (Laurenti, 1768)***

Widespread in S, SE and E (Bannikov et al. 1977, Sindaco et al. 2013: map 111, Vashetko et al. 2003: Fig. 5). Altitudinal limits are estimated as from 50 m (Aral Sea area) up to 1,400 m asl.

Red List Category: Least Concern (IUCN 2018; last assessed 2009). [9]

Remarks: N. tessellata is almost exclusively confined to areas with water. No records for the Kyzylkum are indicated in Bannikov et al. (1977). Sindaco et al. (2013) only map presence within it in Kazakhstan (44oN 63oE) and around its southern (39oN 63-64oE) and southeastern periphery in Uzbekistan. However, irrigation projects involving construction of large canals and associated wetlands arising due to water seepage and flooding, have undoubtedly led to range expansion into otherwise arid desert regions in recent decades. [4 ,5]

Methods. The scientific method is a systematic approach to conducting scientific inquiry and gathering empirical evidence to understand the natural world. In the context of reptiles, scientific research often involves methods such as field observations, laboratory experiments, genetic analysis, and statistical modeling to study various aspects of reptile biology, ecology, behavior, and evolution. Scientists utilize the scientific method to formulate hypotheses, design experiments or observational studies, collect and analyze data, and draw conclusions based on evidence.

Research on reptiles using the scientific method has provided valuable insights into topics such as reptile diversity, distribution, reproduction, physiology, brain function, and conservation. By following rigorous scientific protocols, researchers can test hypotheses, make new discoveries, and contribute to our understanding of the fascinating world of reptiles.

Results. Ecological Impacts of Reptiles:

- Reptiles play important ecological roles in their habitats, such as controlling insect populations, serving as prey for predators, and influencing ecosystem dynamics through their foraging behavior and interactions with other species.
- In some cases, invasive reptile species can have negative impacts on native ecosystems by outcompeting or preying on native species, disrupting food webs, or altering habitat structure.
- Research on the ecological impacts of reptiles in specific regions, such as the Karakalpak Republic, can shed light on the conservation challenges and management strategies needed to protect both reptile populations and overall ecosystem health.

Future research in the Karakalpak Republic or other regions of Central Asia could focus on documenting the diversity, distribution, abundance, and ecological roles of reptiles, as well as assessing the potential impacts of human activities, climate change, and habitat degradation on reptile populations and ecosystems.

For specific information on the ecological impacts and dominant reptiles in the Karakalpak Republic, I recommend consulting scientific publications, reports from governmental or non-governmental organizations working in the region, or reaching out to local experts or researchers studying reptiles in Central Asia.

Discussion. The Karakalpak Republic, located in western Uzbekistan, is a region rich in biodiversity and home to a variety of reptile species that play important ecological roles within the local ecosystems. Understanding the ecological impacts of reptiles in the Karakalpak Republic is crucial for informing conservation efforts and sustainable management practices in the region.

1. Ecological Impacts of Reptiles in the Karakalpak Republic:

- Reptiles in the Karakalpak Republic contribute to ecosystem health through various ecological roles, such as regulating insect populations, serving as prey for predators, and influencing habitat structure.

- Certain reptile species in the Karakalpak Republic may play key roles in nutrient cycling, seed dispersal, and maintaining ecological balance within their respective habitats.

- By preying on insects or small vertebrates, some reptiles help control pest populations, potentially benefiting local agriculture and ecosystem stability.

2. Conservation Implications:

- Understanding the distribution, abundance, and ecological roles of reptiles in the Karakalpak Republic is essential for effective conservation planning and management strategies.

- Threats such as habitat loss, fragmentation, overexploitation, and climate change can adversely impact reptile populations in the region, highlighting the importance of conservation efforts to safeguard their habitats.

- Collaborative research and conservation initiatives involving local communities, governmental agencies, and conservation organizations are essential to protect the diverse reptile species and maintain the ecological balance in the Karakalpak Republic.

Studying the ecological impacts and dominant reptiles of the Karakalpak Republic provides valuable insights into the region's biodiversity, ecosystem dynamics, and conservation needs. By promoting sustainable practices and conservation measures, we can ensure the long-term survival of reptile species and the overall health of the Karakalpak Republic's diverse ecosystems.

In conclusion, the ecological impacts and dominant reptiles in the Karakalpak Republic play a crucial role in maintaining the overall health and balance of the region's diverse ecosystems. By understanding the ecological roles of reptiles, such as controlling pest populations, contributing to nutrient cycling, and serving as prey for predators, conservation efforts can be better informed and implemented to protect these important species.

The diverse array of reptiles in the Karakalpak Republic, including agamid lizards, lacertid lizards, colubrid and viperid snakes, and testudines, represent a unique and valuable aspect of the region's biodiversity. Conservation implications stemming from threats like habitat loss, fragmentation, and climate change highlight the urgent need for collaborative research and conservation initiatives to safeguard reptile populations and their habitats.

By promoting sustainable practices, conservation measures, and community involvement, we can ensure the long-term survival of dominant reptiles in the Karakalpak Republic and support the overall resilience and balance of its ecosystems. Protecting these species not only contributes to the ecological integrity of the region but also preserves its cultural and biological heritage for future generations to enjoy and benefit from.

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