Official journal website:
amphibian-reptile-conservation.org

Amphibian & Reptile Conservation
11(1) [General Section]: 93–107 (e140).

The herpetofauna of central Uzbekistan

[1,2,*]Thomas Edward Martin, [1,2]Mathieu Guillemin, [1,2]Valentin Nivet-Mazerolles, [1,2]Cecile Landsmann, [1,2]Jerome Dubos, [1,2]Rémy Eudeline, and [3]James T. Stroud

[1]*Emirates Centre for the Conservation of the Houbara, Urtachol massif, Karmana Shirkat farm, Navoi Region, REPUBLIC OF UZBEKISTAN*
[2]*Reneco for Wildlife Preservation, PO Box 61 741, Abu Dhabi, UAE.* [3]*Department of Biological Sciences, Florida International University, Miami, Florida, USA*

***Abstract.*—The diverse habitats of central Uzbekistan support a rich herpetofaunal community, but distributions and relative abundances of the species comprising this community remain poorly known. Here, we present an annotated species inventory of this under-explored area, with detailed notes on distributions and population statuses. Fieldwork was concentrated in southern Navoi and western Samarkand provinces, although some records were also made in the far north of Navoi province, near the city of Uchkuduk. Data were collected between March and May/June in 2011, 2012, and 2013, with herpetofaunal records being made opportunistically throughout this period. Survey effort was concentrated in semi-desert steppe habitats, especially the Karnabchul steppe area located to the south of the city of Navoi and an expanse of unnamed steppe located to the north of Navoi. Further records were made in a range of other habitat types, notably wetlands, sand dune fields, and low rocky mountains. Total fieldwork equated to approximately 8,680 person-hours of opportunistic survey effort. In total, we detected two amphibian and 26 reptile species in our study area, including one species classified as Globally Vulnerable by the IUCN. We present distributional data supporting the first record of regional range extensions of five species from within our study area. Our results represent the most detailed data concerning reptile and amphibian diversity and distributions produced from Uzbekistan in recent years. We conclude by recommending that further, systemized survey work needs to be conducted within the area to supplement our findings with more robust estimates of species abundances supported by more detailed information on species-habitat relationships.**

Keywords. Central Asia, faunistics, inventory, steppe, distribution, survey

Citation: Martin T, Guillemin M, Nivet-Mazerolles V, Landsmann C, Dubos J, Eudeline R, and Stroud J. 2017. The herpetofauna of central Uzbekistan. *Amphibian & Reptile Conservation* 11(1) [General Section]: 93–107 (e140).

Received: 08 April 2016; **Accepted:** 01 Aug 2016; **Published:** 14 June 2017

Introduction

Central Asia (defined in this study as the five Central Asian Republics and Afghanistan) encompasses a wide range of habitats, which in turn support a rich and, in some areas, highly endemic biodiversity. The region's ecological importance is reflected by it encompassing five "global 200" terrestrial ecosystems (Olson and Dinerstein 1998) and two biodiversity hotspots (Myers 2003). Despite this importance, the region's fauna remains poorly explored (Ayé et al. 2012). Increased research interest in Central Asia in recent years has resulted in a significant increase in information regarding some taxonomic groups, notably birds (Ayé et al. 2012; Wassink 2015), although little contemporary field-based work has examined the diversity and distributions of other taxa, including reptiles and amphibians (herpetofauna).

Recent information regarding regional-scale distributions and habitat associations of Central Asian amphibian and reptile communities is scarce, with the limited available data focusing on particular countries and habitats. Large-scale herpetofaunal distribution studies have been completed for Turkmenistan (Schkammakov et al. 1993; Tuniyev et al. 1999) and parts of Kazakhstan (Lambert 2002). Trans-national biogeographical patterns for lizard communities in the region's mountains have also been examined (Bobrov 2005). Detailed descriptions, however, remain largely lacking for entire habitat types and countries within Central Asia. Very little community-level information exists on the semi-desert steppe habitats that predominate in non-montane areas of southern Central Asia, and recent outputs from Uzbekistan—the most populous country in the region—are restricted to a small number of species-specific ecology

Correspondence. **tom_martin_2010@yahoo.co.uk*

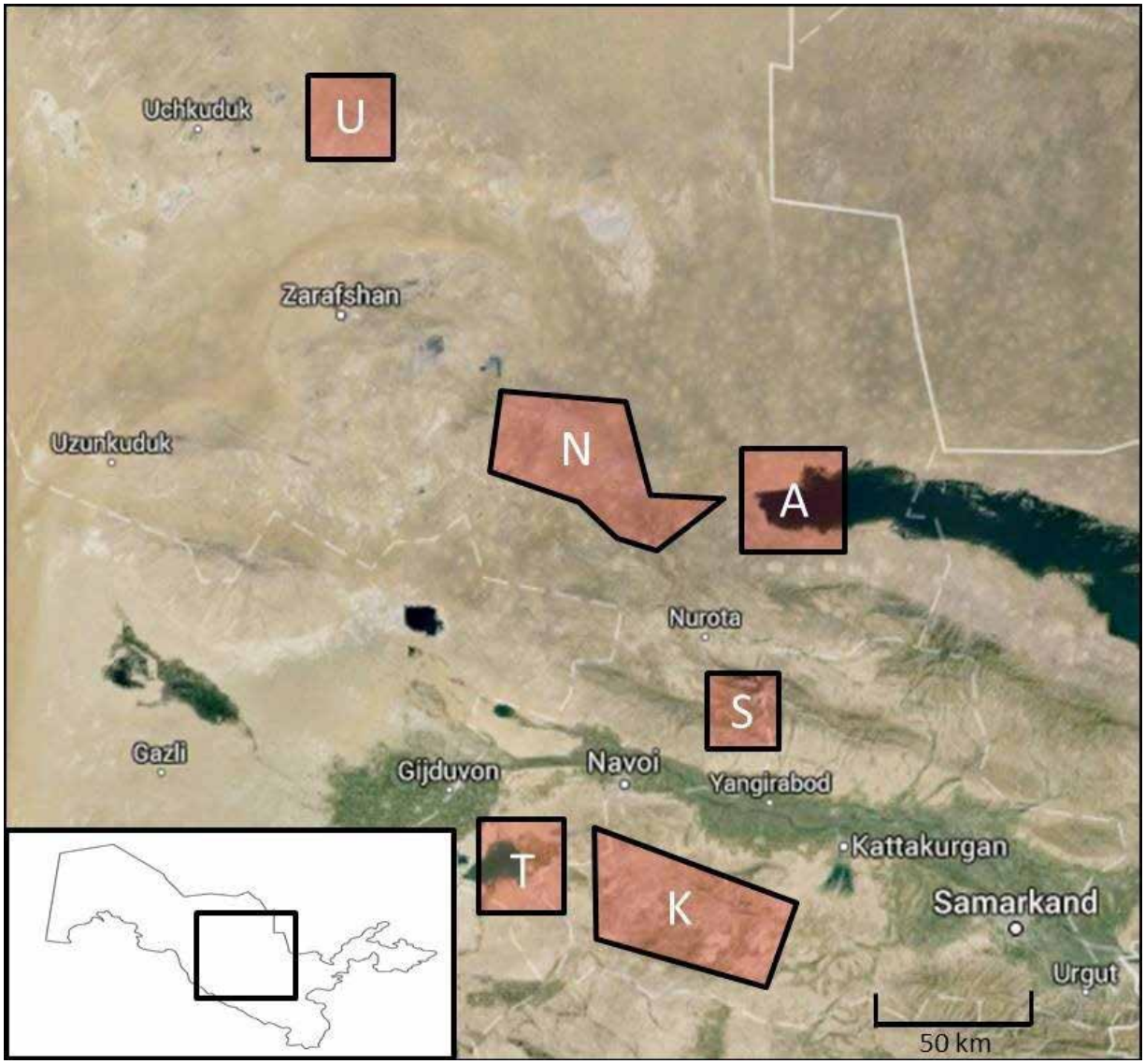

Fig. 1. Map of our study areas within central Uzbekistan. Inset shows the study area within the entirety of Uzbekistan. Notations represent the following locations: K = Karnabchul steppe, N = northern steppe, S = Sarmysh nature park, T = Lake Tudakul, A = Lake Aydarkul, U = Uchkuduk study area.

papers (Lagarde et al. 2002, 2003; Ikramov and Azimov 2004; Clemann et al. 2008). Prior to these, the only existing herpetology resources from Uzbekistan are a number of regional-scale Russian-language texts dating back to the Soviet era, which remain largely inaccessible to the international scientific community (e.g., Bannikov 1971; Rustamov 1981; Rustamov and Shcherbak 1986).

As well as a lack of community-level research, knowledge relating to the statuses of individual species in Uzbekistan is also restricted to a limited range of resources. These include IUCN (2016) species distribution maps (which are lacking for the majority of Central Asian species), coarse-grained spatial range maps provided by The Reptile Database (2016), and a Soviet-era Russian-language text (Bannikov 1971), and regional-scale atlas maps provided in guidebooks to the Western Palearctic as a whole (Sindaco and Jeremcenko 2008; Sindaco et al. 2013). This general lack of zoological knowledge appears to have had an impact on regional conservation strategies, with steppe and semi-deserts in Central Asia having been noted as being poorly-represented in existing protected area networks (Chemonics International 2001).

In this study we attempt to address this knowledge-gap by providing an annotated checklist of the herpetofauna community of central Uzbekistan, based on opportunistic records made while conducting surveys of the Asian Houbara Bustard (*Chlamydotis macqueenii*). These records represent the first recent data regarding herpetofaunal community composition in this part of Uzbekistan and from the Central Asian semi-desert steppe habitats where survey work was focused. We also provide records from a number of other habitats occurring in the region, notably sand dunes, low mountains, and wetlands.

Materials and Methods

Study site: Fieldwork was concentrated principally in semi-desert grassland habitats (Plate 1) which predominate in central Uzbekistan (Ayé et al. 2012; World Wildlife Fund 2013). This habitat is invariably referred to locally as "steppe." While true steppe is a less arid ecosystem found in higher latitudes, for ease of reference we henceforth use this term for the semi-desert habitats in our study area. The principal purpose of the authors' work in these habitats was to monitor populations of Asian Houbara Bustard (*Chlamydotis macqueenii*). Bustard surveys were concentrated in two large expanses of steppe; the Karnabchul steppe region (BirdLife International 2016a) located in southern Navoi province and far western Samarkand province, and a large expanse of steppe located to the north of Navoi city (Fig. 1). While completing this survey work we opportunistically recorded herpetofauna wherever possible (see below). When not committed to completing bustard surveys in the steppe, we surveyed a number of other habitats, most notably the extensive sand dune fields which occur sporadically within our two main steppe study areas, the low mountains of the Sarmysh nature park (BirdLife International 2016c) and the wetland habitats found along the western shore of Lake Aydarkul (BirdLife International 2016b) and eastern shore of Lake Tudakul (BirdLife International 2016d) (Fig. 1). A single five-day visit was also made from 29 April to 03 May 2013 to a large area of steppe and dunes in northern Navoi province, near the city of Uchkuduk, on the fringes of the Kyzylkum desert (Fig. 1).

Altitude throughout this spatially extensive study area ranges from 230 m along the shore of Lake Tudakul to 1,993 m at the highest peak of the mountainous Sarmysh area. Most of the area consists of slightly undulating steppe, however, where elevation typically varies between 300–380 m. The area possesses a continental climate characterized by hot, dry summers, and cold winters with frequent thaws (Glazirin et al. 1999). Mean temperatures vary from 33 ºC in July to 1.9 ºC in January. Average annual rainfall is approximately 126 mm, with an average of 32 mm falling in February (the wettest month) and <1 mm falling in July (the driest month) (Emirates Centre for the Conservation of Houbara 2013, unpublished data). The area possesses a highly complex geology—the result of its location on a tectonic collision zone (Hendrix and Davis 2001).

Vegetation in steppe habitats is dominated by hardy shrubs of the *Artemesia* genus, interspersed with other shrub assemblages, while sand dune habitats are dominated by a variety of psammophytic plant species (Makhmudovich 2006). Mountainous areas within the Sarmysh Nature Park area possess an Irano-Turanian vegetation assemblage characterized by small, hardy shrubs and trees, notably those of the genera *Prunus* and *Pistacia* (Ayé et al. 2012).

Fieldwork: Herpetofaunal records were made by the authors over the course of three fieldwork seasons spanning the spring (and in one case the early summer) months of 2011, 2012, and 2013. Fieldwork dates ran from 13 March to 27 May in 2011, 04 March to 31 May in 2012, and 15 March to 25 June in 2013. These spring and early summer months represent the optimal time for completing herpetofauna surveys in Central Asia given that most species hibernate during the cold winter months, and that some species return to hibernation prior to the hottest summer months and do not resume activity until the following spring (Lagarde et al. 2003). All records were collected opportunistically, rather than via formalized survey work. These opportunistic records were made in a number of ways. During formal Bustard survey hours within steppe habitats, records were kept of all herpetofaunal species observed while driving between established survey sites during the day, or encountered on foot at these survey sites. Records within steppe habitats were also made driving along roads at night, and from casual exploration during the middle of the day when conditions were not suitable for formal survey work. Exploration was also conducted in sand dune habitats, the low mountains of Sarmysh Nature Park, and the shores of Lake Aydarkul and Tudakul outside of formal survey work. This exploration involved extensive driving and walking on foot in these habitats, both in the day and at night, and noting any records made, as well as targeted searching in microhabitats likely to support specialized herpetofaunal species, such as dune crests, rocky gullies, and well-vegetated river banks. While this opportunistic record making did not follow a systematic survey methodology, herpetofauna species were still actively searched for by the authors, except when formal bustard survey work was being conducted. We estimated the approximate person-hours of survey effort represented by our opportunistic records by calculating the number of days each surveyor spent in the field multiplied by eight (the average number of hours per day each surveyor spent in the field, excluding hours spent conducted formalized bustard counts).

Data analysis: After the completion of survey work we carefully identified all species detected by our survey effort, using all existing field guides and distribution atlases encompassing Central Asia (Bannikov 1971; Sindaco and Jeremcenko 2008; Sindaco et al. 2013). All species identifications were then independently verified by JS. We also sought additional species verifications from Dr. Tatjana Dujsebayeva at the Kazakhstan Institute of Zoology for all records of *Eryx* Sand boas—a group that can be particularly difficult to separate in the field. We then compiled an inventory of all identified species following the taxonomy provided by Frost (2014) for amphibians and the Reptile Database (2016) for reptiles. We recorded the conservation status of each species in our inventory following the most recent IUCN Red List database (IUCN 2016). We also noted whether each spe-

cies was endemic to Central Asia as defined by species descriptions given by the IUCN (2016).

Categorical abundance estimates for each species were then assigned based on frequency of records. The following categories were used: abundant (typically recorded multiple times every day in suitable habitat); common (typically recorded around once per day); fairly common (typically recorded once per week); uncommon (recorded less than five times per season on average) and rare (known from less than five records overall). A data deficient (DD) category was used for species exclusively found in the Sarmysh mountains which were too briefly explored to provide meaningful abundance estimates.

Finally, we attempted to determine whether our records for each species in our inventory represented an extension to their known spatial range. We assessed two different magnitudes of range extensions: national range extensions for species which had not been previously reported from Uzbekistan, and regional range extensions for species previously reported as occurring in Uzbekistan, but not within our study area, by existing distribution maps. Potential range extensions were assessed by comparing each species in our inventory with records reported in herpetological papers from the region (Lagarde et al. 2002, 2003; Ikramov and Azimov 2004; Clemann et al. 2008), biological summaries of sites of special scientific interest (Birdlife International 2016a,b,c,d), existing distribution maps provided by the IUCN (2016), the Reptile Database (2016), and the two volumes of the only recent species distribution atlas covering Central Asia (Sindaco and Jeremcenko 2008; Sindaco et al. 2013). We also consulted distribution maps provided in Bannikov (1971), although this fairly inaccessible Russian-language text does not provide range maps for all species in the region.

Results

Opportunistic survey effort in our study area constituted approximately 8,680 person-hours. A total of 28 species were detected by this survey effort—two amphibian species and 26 reptile species. All these species are native to the study area, with no current records of introduced or invasive species in the region. Only a single species (*Testudo horsfieldii*) is considered Globally Threatened or Near-Threatened by the IUCN (2016). However, only five species (17.9%) are assigned a definitive threat category—all other species in our inventory remain unassessed or are considered data deficient. No species in our inventory is restricted exclusively to Central Asia, although several, such as the Turkestan Agama (*Paralaudakia lehmanni*), are almost entirely confined to the region and therefore considered "near-endemic." All species we detected were previously known to occur in Uzbekistan (IUCN 2016; Reptile Database 2016), thus we report no national range extensions. However, records for five species (*Eremias scripta*, *Eryx miliaris*, *Hemorrhois ravergieri*, *Natrix tessellata*, and *Echis carinatus*) represent regional range extensions within central Uzbekistan. A full summary of species detected in our study area is provided in Table 1, with the descriptions below providing more detailed information for each species in our inventory.

AMPHIBIANS

Green Toad: *Bufotes viridis* (Laurenti 1768) (Bufonidae) (Plate 5)

A widespread species found from western Europe to Kazakhstan. The taxonomy of species appears to be unclear, with some sources splitting Central Asian populations as *B. variabilis*, and others separating the populations of the southern and eastern Central Asian steppes still further as *B. pewzowi* (Ficetola and Stöck 2016), although we retain the Frost (2013) nomenclature. A nocturnal species, it is locally abundant in our study area, and is typically found around permanent and ephemeral water sources throughout the area's steppe habitats. However, individuals were also occasionally encountered in the open steppe at least one km from any known water sources. The species has been previously reported as occurring in the study area (Bannikov 1971; BirdLife International 2016c).

Marsh Frog: *Pelophylax ridibundus* (Pallas 1771) (Ranidae) (Plate 6)

A widely distributed species found throughout much of Europe and western Asia. It is abundant in unpolluted, non-saline water sources, particularly in agricultural fields and drainage ditches located on the peripheries of steppe habitats and the two large lake ecosystems, and small mountain streams in the Sarmysh region. Unlike *B. viridis*, this species was never observed far away from water. *Pelophylax ridibundus* is previously known to occur within the study area (Bannikov 1971; BirdLife International 2016c).

REPTILES

Russian Tortoise: *Testudo horsfieldii* (Gray 1844) (Testudinidae) (Plate 7)

The only Chelonian species found in our study area, *T. horsfieldii* is restricted to Central Asia and Iran, and is listed as Vulnerable by the IUCN (2016). The species is abundant in the steppe habitats of our study area, with multiple individuals typically being seen every day in this habitat from between early March when they emerge from hibernation to mid-June, when their hibernation resumes (Lagarde et al. 2003). It was by a large margin the most frequently encountered herpetofaunal species during the course of our fieldwork. The species has been previously mapped as occurring in central Uzbekistan (Bannikov 1971; Sindaco and Jeremcenko 2008; BirdLife International 2016a–d) although the atlas map in Sindaco and Jeremcenko (2008) does not note its pres-

Table 1. Summary of amphibian and reptile species recorded in our central Uzbekistan study area between 2011 and 2013. New range extensions are marked in bold. Species marked † are assessed as Threatened or Near Threatened by the IUCN (2016). Abundance estimates are denoted as follows: A = abundant; C = common; Fc = fairly common; U = uncommon; R = rare; DD = data deficient. Broad locales in the "locations" column are denoted as follows: A = Lake Aydarkul; K = Karnabchul steppe; N = northern steppe area; S = Sarmysh nature park; T = Lake Tudakul; U = Uchkuduk area. All taxonomy follows Frost (2014) for amphibians and the Reptile Database (2016) for reptiles.

Class	Order	Family	Common name	Scientific name	Abundance	Locations
Amphibia	Anura	Bufoidae	Green Toad	*Bufotes viridis*	A	K, N
		Ranidae	Marsh Frog	*Pelophylax ridibundus*	A	K, S
Reptilia	Testudines	Testudinidae	†Russian Tortoise	*Testudo horsfieldii*	A	K, N, U
	Squamata (Sauria)	Agamidae	Turkestan Agama	*Paralaudakia lehmanni*	Fc	K, S
			Brilliant Ground Agama	*Trapelus agilis*	A	K, N
			Sunwatcher Toadhead Agama	*Phrynocephalus helioscopus*	Fc	K, N
			Secret Toadhead Agama	*Phrynocephalus mystaceus*	U	N, U
			Lichtenstein's Toadhead Agama	*Phrynocephalus interscapularis*	Fc	N
		Geckkonidae	Common Wonder Gecko	*Teratoscincus scincus*	Fc	N
			Russian Bent-toed Gecko	*Tenuidactylus fedtschenkoi*	Fc	K
			Caspian Bent-toed Gecko	*Tenuidactylus caspius*	Fc	K, N
		Lacertidae	Striped Racerunner	*Eremias lineolata*	U	N, U
			Rapid Fringe-toed Lizard	*Eremias velox*	A	K, N
			Reticulate Racerunner	*Eremias grammica*	U	N, U
			Sand Racerunner	*Eremias scripta*	R	N, U
		Scincidae	Berber Skink	*Eumeces schneideri*	DD	S
		Anguidae	European Glass Lizard	*Pseudopus apodus*	DD	S
		Varanidae	Desert Monitor	*Varanus griseus*	C	K, N, U
	Squamata (Serpentes)	Boidae	Tartar Sand Boa	*Eryx tataricus*	U	K, N
			Dwarf Sand Boa	*Eryx miliaris*	U	K, N
		Colubridae	Spotted Desert Racer	*Platyceps karelini*	U	K, N
			Wadi Racer	*Platyceps rhodorachis*	R	K
			Diadem Snake	*Spalerosophis diadema*	U	K
			Spotted Whipsnake	*Hemorrhois ravergieri*	R	N
		Lamprophiidae	Steppe Ribbon Racer	*Psammophis lineolatus*	Fc	K, N
		Natricidae	Dice Snake	*Natrix tessellata*	U	A, T
		Elapidae	Central Asian Cobra	*Naja oxiana*	U	K, S
		Viperidae	Saw-scaled Viper	*Echis carinatus*	C	K, N

ence in the Uchkuduk area, where our records indicate the species to occur.

Turkestan Agama: *Paralaudakia lehmanni* (Nikolsky 1896) (Agamidae) (Plate 8)

Found only in southern Central Asia and Pakistan. *Paralaudakia lehmanni* is a fairly common species in suitable habitats within our study area, being regularly sighted on boulders and crevasses in rock faces within low mountain habitats on the periphery of the Karnabchul steppe and in the Sarmysh Nature Park. The species has been previously mapped as occurring in the study area (Sindaco and Jeremcenko 2008).

Brilliant Ground Agama: *Trapelus agilis* (Olivier 1807) (Agamidae) (Plate 9)

A widespread species found in the Caucasus, much of Central Asia, Iran, and the Indian subcontinent. *Trapelus agilis* is abundant in our study area, being typically observed multiple times per day in open steppe habitats and in the low mountains on the edge of the Karnabchul area, once the species has emerged from hibernation in mid-late March. It is frequently observed basking on top of Artemisia shrubs. *Trapelus agilis* has been previously mapped as occurring in our study area (Sindaco and Jeremcenko 2008; BirdLife International 2016a–d).

Sunwatcher Toadhead Agama: *Phrynocephalus helioscopus* (Pallas 1771) (Agamidae) (Plate 10)

This species is found in southern European Russia and much of Central Asia. It is fairly common in the open steppe habitats of our study area, and has occasionally

Plate 1. Semi-arid "steppe" habitats (*Photograph – CL*).

Plate 2. Vegetated sand-dune habitats (*Photograph – CL*).

Plate 3. Low rocky mountains (*Photograph – JD*).

Plate 4. Wetland habitats as Lake Aydarkul (*Photograph – RE*).

Plate 5. *Bufotes viridis* (*Photograph – TM*).

Plate 6. *Pelophylax ridibundus* (*Photograph – TM*).

Plate 7. *Testudo horsfieldi* (*Photograph – TM*).

Plate 8. *Paralaudakia lehmanni* (*Photograph – TM*).

been observed in sand dunes. It is previously recorded as occurring throughout central Uzbekistan (Bannikov 1971; Sindaco and Jeremcenko 2008; IUCN 2016; BirdLife International 2016a,c).

Secret Toadhead Agama: *Phrynocephalus mystaceus* (Pallas 1776) (Agamidae) (Plate 11)

This distinctive, large-bodied agama possesses a wide but patchy distribution across southern European Russia, much of Central Asia, and eastern Iran. A strict sand dune species, it is uncommon in our study area, typically being observed only once or twice per research season in very specific areas, such as the dune fields within the northern steppe area and in the vicinity of Uchkuduk where we observed both single individuals and apparent pairs. The species has been previously mapped as occurring throughout our study area (Sindaco and Jeremcenko 2008).

Lichtenstein's Toadhead Agama: *Phrynocephalus interscapularis* (Lichtenstein 1856) (Agamidae) (Plate 12)

A small agamid found in all the Central Asian Republics and the northern border areas of Iran. *Phrynocephalus interscapularis* is fairly common in our study area. As with *P. mystaceus* it is restricted to sand dunes, although the two species display strong niche separation within this habitat. Clemann et al. (2008) describe how *P. mystaceus* occupies dune crest microhabitats, while *P. interscapularis* occupies mid-dune microhabitats and swales between dunes—a pattern our observations corroborate. The species has been previously mapped as occurring throughout our study area (Sindaco and Jeremcenko 2008).

Common Wonder Gecko: *Teratoscincus scincus* (Schlegel 1858) (Gekkonidae) (Plate 13)

A widespread species found throughout Central Asia, Iran, Pakistan, and parts of the Arabian Peninsula. *Teratoscincus scincus* is a strictly nocturnal species which appears to be fairly common within our study area (although this abundance estimate could be a product of our sampling effort—see Discussion). We only detected *T. scincus* in the northern steppe habitats of our study area, where it was encountered regularly on roads while driving at night, and occasionally on foot when walking in the open steppe after dusk. The species is indicated to occur throughout our study area by Bannikov (1971), although our records represent a slight range extension to the atlas maps produced by Sindaco and Jeremcenko (2008).

Russian Bent-toed Gecko: *Tenuidactylus fedtschenkoi* (Strauch 1887) (Gekkonidae) (Plate 14)

Restricted to Central Asia and northern border areas of Pakistan and Iran. *Tenuidactylus fedtschenkoi* is fairly common in rocky mountain habitats on the peripheries of our two main steppe study areas, as well as on isolated rocky outcrops within the steppe. The species was almost always observed within a short distance of holes and crevasses in the rock face, where they retreated when disturbed. *Tenuidactylus fedtschenkoi* has been previously mapped as occurring in our study area (Bannikov 1971; Sindaco and Jeremcenko 2008; BirdLife International 2016a,c).

Caspian Bent-toed Gecko: *Tenuidactylus caspius* (Eichwald 1831) (Gekkonidae) (Plate 15)

A widespread species found throughout southern Central Asia and around the basin of the Caspian Sea. *Tenuidactylus caspius* is common in our study area, being found in a variety of habitats including cliff faces, isolated rocky outcrops in the steppe, abandoned ruins, and within inhabited buildings. It is mapped as occurring throughout our study area by the IUCN (2016), although our records represent modest extensions to the distribution maps provided by Bannikov (1971) and Sindaco and Jeremcenko (2008).

Striped Racerunner: *Eremias lineolata* (Nikolsky 1897) (Lacertidae) (Plate 16)

This species is found throughout southern Central Asia and in north-eastern Iran. It is uncommon in our study area, being found only in extensive areas of vegetated sand dunes, often alongside populations of *E. scripta* and *E. grammica*. It has been previously mapped as occurring throughout our study area (Sindaco and Jeremcenko 2008; BirdLife International 2016d).

Rapid Fringe-toed Lizard: *Eremias velox* (Pallas 1771) (Lacertidae) (Plate 17)

A widespread species found throughout Central Asia, southern European Russia, and Iran. *Eremias velox* is abundant in our study area and was by far the most frequently observed *Eremias* species, occurring at high densities throughout the region's open steppe habitats. The species has been previously mapped as occurring throughout our study area (Sindaco and Jeremcenko 2008).

Reticulate Racerunner: *Eremias grammica* (Lichtenstein 1823) (Lacertidae) (Plate 18)

Distributed across Central Asia, western China, and north-eastern Iran, *E. grammica* is an uncommon species in our study area. It was only observed in vegetated sand dune habitats similar to those inhabited by *E. lineolata* and *E. scripta*. It has been previously reported as occurring throughout the study area (Bannikov 1971; Sindaco and Jeremcenko 2008).

Sand Racerunner: *Eremias scripta* (Strauch 1867) (Lacertidae) (Plate 19) *Regional range extension

A widely, although patchily, distributed species found throughout Central Asia, western China, Iran, and Paki-

Plate 9. *Trapelus agilis* (*Photograph – TM*).

Plate 10. *Phrynocephalus helioscopus* (*Photograph – VNM*).

Plate 11. *Phrynocephalus mystaceus* (*Photograph – RE*).

Plate 12. *Phrynocephalus interscapularis* (*Photograph – VNM*).

Plate 13. *Teratoscincus scincus* (*Photograph – TM*).

Plate 14. *Tenuidactylus fedtschenkoi* (*Photograph – TM*).

Plate 15. *Tenuidactylus caspius* (*Photograph – TM*).

Plate 16. *Eremias lineolata* (*Photograph – MG*).

stan. It is rare within our study area, having been recorded a total of four times. It appears to inhabit similar habitats to *E. lineolata* and *E. grammica*, being found locally within well-vegetated sand dune fields. While *E. scripta* has been noted as occurring at Lake Tudakul (BirdLife International 2016d), our records of this species in the northern steppe and Uchkuduk areas represent regional range extensions to its known distribution, with none of our consulted sources noting its occurrence in these areas of central Uzbekistan.

Berber Skink: *Eumeces schneideri* (Daudin 1802) (Scincidae) (Plate 20)

A widespread species found from North Africa to the Indian sub-continent. Within our study area, the species is known from a single individual found on rocky scree in a canyon within the mountains of the Sarmysh Nature Park on 26 May 2012. As we only spent a few days prospecting for herpetofauna in the Sarmysh area, it is hard to ascertain whether this species is genuinely rare here, or whether it is more common than our limited survey effort in appropriate habitats suggests. At the very least, it appears to be very localized and habitat-specific within central Uzbekistan. We never encountered the species in the steppe or in mountainous ecosystems immediately adjacent to the steppe (unlike other rocky habitat specialists such as *Paralaudakia lehmanni* and *Tenuidactylus fedtschenkoi*). The species has been previously mapped as occurring in our study area (Sindaco and Jeremcenko 2008; BirdLife International 2016c).

European Glass Lizard: *Pseudopus apodus* (Pallas 1775) (Anguidae) (Plate 21)

A widespread species found from eastern Europe to eastern Kazakhstan. Within our study area it is known only from three records of live individuals in tall grass meadows in close proximity to streams within the Sarmysh Nature Park, and four dead individuals seen in villages on the outskirts of Sarmysh (two having been hit by vehicles, one being carried in a plastic bag by a local, and one found washed up on the bank of a small river). As with *Eumeces schneideri*, the species appears to be very localized within our study area, but our low survey effort within the Sarmysh mountains makes it difficult to accurately estimate its relative abundance within its limited range. It has been previously mapped as occurring in our study area (Bannikov 1971; Sindaco and Jeremcenko 2008; BirdLife International 2016c).

Desert Monitor: *Varanus griseus* (Daudin 1803) (Varanidae) (Plate 22)

This large-bodied monitor lizard is widely distributed in arid habitats from north Africa to the Indian Subcontinent. It is a common species in our study area, typically being observed at least once per day in open steppe habitat and sand dunes from mid-April onwards, when the species emerges from hibernation. It has been previously recorded as occurring throughout our study area by Bannikov (1971) although Sindaco and Jeremcenko (2008) do not map its occurrence in the Uchkuduk area, where we observed the species several times.

Tartar Sand Boa: *Eryx tataricus* (Lichtenstein 1823) (Boidae) (Plate 23)

A widespread Asian species found from Iran through southern Central Asia to western China and Mongolia. It is an uncommon inhabitant of open steppes and sand dunes in our study area. Its appearance seems to be highly variable in central Uzbekistan. The species has been previously mapped as occurring throughout central Uzbekistan (Sindaco et al. 2011).

Dwarf Sand Boa: *Eryx miliaris* (Pallas 1773) (Boidae) (Plate 24) *Regional range extension

A less widely-distributed species than *E. tataricus*. *Eryx miliaris* is largely confined to Central Asia, with its range extending slightly into Iran and southern European Russia. An uncommon species in our study area, it was detected about as frequently, and in similar habitats to, *E. tataricus*. Our records of this species constitute a regional range extension. BirdLife International (2016d) noted its presence at Lake Tudakul, but none of our consulted sources indicate the species to occur in Karnabchul or the northern steppe areas where we have detected it.

Spotted Desert Racer: *Platyceps karelini* (Brandt 1838) (Colubridae) (Plate 25)

This species is found in all the Central Asian Republics, Iran, and Pakistan. It is uncommon in our study area, being occasionally recorded in the open steppe and sand dune habitats of Karnabchul and the northern steppe areas. It has been previously mapped as occurring in our study area (Bannikov 1971; Sindaco et al. 2011; BirdLife International 2016d).

Wadi Racer: *Platyceps rhodorachis* (Jan 1865) (Colubridae) (Plate 26)

A widely but disjunctively distributed species, found in east Africa, Arabia, Iran, Central Asia, and the northern Indian sub-continent. It appears to be rare in our study area, being known from a single predated and partially consumed individual (see Plate 26) found on the northern border of the Karnabchul steppe, close to a range of rocky foothills, on 17 May 2012. The species has been previously mapped as occurring in our study area (Bannikov 1971; Sindaco et al. 2011).

Diadem Snake: *Spalerosophis diadema* (Schlegel 1837) (Colubridae) (Plate 27)

A widely distributed species occurring from west and north Africa throughout the Middle East to Central Asia. This fairly large snake species is uncommon in our study area, typically being observed two or three times per season in open steppe and in close proximity to inhabited areas. The species is noted as occurring throughout the study area by Bannikov (1971), although Sindaco et al. (2011) do not map its occurrence in central Uzbekistan.

Spotted Whipsnake: *Hemorrhois ravergieri* (Mènètries 1832) (Colubridae) (Plate 28) *Regional range extension

Distributed in Turkey, the Caucasus, Iran, Central Asia, and western China. It is a rare species in our study area, known from a single record of an individual observed in open steppe habitat on 11 May 2011 in

Plate 17. *Eremias velox* (*Photograph – TM*).

Plate 18. *Eremias grammica* (*Photograph – RE*).

Plate 19. *Eremias scripta* (*Photograph – MG*).

Plate 20. *Eumeces schneideri* (*Photograph – TM*).

Plate 21. *Pseudopus apodus* (*Photograph – RE*).

Plate 22. *Varanus griseus* (*Photograph – RE*).

Plate 23. *Eryx tataricus* (*Photograph – TM*).

Plate 24. *Eryx miliaris* (*Photograph – MG*).

our northern steppe study area. This record represents a regional range extension for *H. ravergieri*. The species is not mapped as occurring in central Uzbekistan by Bannikov (1971) and Sindaco et al. (2011), and while its presence has been noted in the Lake Tudakul area (BirdLife 2016d), it does not appear to have been previously reported as occurring further north in Uzbekistan.

Steppe Ribbon Racer: *Psammophis lineolatus* (Brandt 1838) (Lamprophiidae) (Plate 29)

Found in all the Central Asian Republics, western China, and Iran. *Psammophis lineolatus* is fairly common in the steppe and sand dune habitats of our study area, being observed on average about once per week. The species was, overall, the most frequently observed snake species during the course of our fieldwork. The species has been previously mapped as occurring throughout our study area (Bannikov 1971; Sindaco et al. 2011).

Dice Snake: *Natrix tessellata* (Laurenti 1768) (Natricidae) (Plate 30) *Regional range extension

A widespread species ranging from central Europe to Egypt, the Middle East, and western China. It was uncommon within our study area, typically being observed a few times per season in freshwater habitats along the shores of Lake Aydarkul and Lake Tudakul, as well as in irrigation canals in cultivated land in the vicinity of Tudakul. Our records for this species represent a regional range extension to its known distribution. Bannikov (1971) and Sindaco et al. (2011) do not map its presence anywhere in our study area. BirdLife International (2016d) notes its presence at Lake Tudakul, but our records from the western shore of Lake Aydarkul appear to be entirely new.

Central Asian Cobra: *Naja oxiana* (Eichwald 1831) (Elapidae) (Plate 31)

Restricted to southern Central Asia and borders areas of Iran and the Indian sub-continent. *Naja oxiana* is an uncommon species in our study area. It was typically observed about once per season in steppe habitats close to low foothills in the Karnabchul area (including one dead individual found on a road measuring 156 cm), and in the low mountains of Sarmysh. The species has been previously noted as occurring throughout the study area (Bannikov 1971; Sindaco et al. 2011; BirdLife International 2016a,c).

Saw-scaled Viper: *Echis carinatus* (Schneider 1801) (Viperidae) (Plate 32) *Regional range extension

A widespread species found in the Middle East, Iran, Central Asia, and the Indian sub-continent. This highly venomous viper is common in suitable habitats within our study area, being observed almost daily within a few specific areas of human habitation on the edge of the Karnabchul area, and occasionally in the open habitats of Karnabchul and the northern steppe areas. Our records represent a regional range extension for *E. carinatus*. Bannikov (1971) only maps the species as occurring along Uzbekistan's western border with Turkmenistan, while Sindaco et al. (2011) note its occurrence only in the south-west and extreme north of the country.

Discussion

The results presented in this paper represent by far the most extensive recent account of Uzbekistan's herpetofauna, resulting from nearly 8,700 person-hours of observational sampling. Our results are not only based on significant survey effort, but are also derived from extensive surveys encompassing a broad and representative range of Central Uzbekistan's habitats, in contrast to other recent papers from the country (i.e., BirdLife International 2016a–d; Lagarde et al. 2002, 2003; Ikramov and Azimov 2004; Clemann et al. 2008). Thus, this study provides a much-needed update to the understanding of the diversity and distributions of the region's understudied herpetofauna, especially with regards to the five reported regional range extensions. The results of this study allow for some appreciation of the relative diversity of the central Uzbekistan herpetofauna compared to that found in surrounding countries. While differences in sampling effort and scope need to be considered, the 28 species detected in our study area do not appear to represent as diverse a species assemblage as steppe/foothill mosaic landscapes found further south in Turkmenistan. In Turkmenistan, 49 species have been recorded from a broadly comparable site (Tuniyev et al. 1999) but do seem to support higher overall richness compared to a steppe/foothills site in southern Kazakhstan, further to the north (Lambert 2002), where just 17 species were recorded. This tentatively suggests that a latitudinal diversity gradient exists across the Turian Plain—the biogeographical zone encompassing most non-mountainous areas of Central Asia (Djamali et al. 2010). Determining the precise delimitations of such a gradient may represent an interesting avenue for future regional research. The results of this study also highlight the extent to which the conservation status of the Central Asian herpetofauna remains heavily neglected. For example, our review of IUCN (2016) classifications revealed that only 18% of species in the area possess definitive threat evaluations. An improved understanding of Central Asia's herpetofauna—and biodiversity in general—is therefore crucial in order to both better understand the consequences of, and to mitigate, the heavy environmental pressures facing the region. Regionally, key threats to the Central Asian herpetofauna include climate change and habitat degradation due to overgrazing and other unsustainable land uses (Christensen et al. 2004; Lioubimtseva et al. 2005), as well as unsustainable collection for the international pet trade (Kuzmin 1994; Cheung and Dudgeon 2006; Robinson et al. 2015). With regards to our central Uzbekistan study sites specifically, habitats are also threatened by extensive mining operations seeking to

Plate 25. *Platyceps karelini* (*Photograph – MG*).

Plate 26. *Platyceps rhodorachis* (*Photograph – CL*).

Plate 27. *Spalerosophis diadema* (*Photograph – MG*).

Plate 28. *Hemorrhois ravergieri* (*Photograph – RE*).

Plate 29. *Psammophis lineolatus* (*Photograph – MG*).

Plate 30. *Natrix tessellata* (*Photograph – TM*).

Plate 31. *Naja oxiana* (*Photograph – TM*).

Plate 32. *Echis carinatus* (*Photograph – TM*).

exploit the abundant mineral resources (including gold, uranium, and natural gas) found throughout much of the area (F. Andrianova, pers. comm.). The relative impacts of these threats are expected to differ between habitats. Species well adapted to human-modified landscapes (notably *T. caspius* and *E. carinatus*) or rocky hills (such as *T. fedtschenkoi*, *P. lehmanni*, and *E. schneideri*) are in likelihood less vulnerable to habitat loss and degradation than species occurring exclusively in the steppe, where grazing and mining activities are concentrated.

While the results of this study represent a valuable contribution to regional herpetological knowledge, these records exhibit a strong bias towards the steppe ecosystems forming the focus of our simultaneous Bustard survey work. While considerable observational effort was directed towards central Uzbekistan's other major habitats (with the exception of the mountains of Sarmysh—see Materials and Methods), they were not explored to the same extent as the steppe. This could mean that some of the relative abundance values assigned for non-steppe species in Table 1 are influenced by reduced survey effort in dune, wetland, and mountain habitats, and thus underestimate true relative abundances. As the bulk of our observations were made during daylight hours, this could also be true for strictly nocturnal species, such as *Teratoscincus scincus* or *Echis carinatus*. Concentrating survey effort in the spring may also have led to underestimating the relative abundance of any species possessing peak activity periods in the summer months.

Reduced survey efforts in non-steppe habitats may have led to some species in these areas being unrecorded due to a simple lack of detection. For example, the Blunt-nosed Viper (*Macrovipera lebetina*) was not conclusively observed during our fieldwork, but has been previously recorded as occurring in central Uzbekistan (Bannikov 1971; BirdLife International 2016c). A long (50 cm>), fat-bodied snake carcass observed along a roadside in low hills near the village of Kyzulkuduk in the northern steppe area in May 2011 may have been this species. However, this specimen was not closely examined and no photograph was taken to verify its identity. Other species indicated to potentially occur in the region, but were not detected by our survey effort, include *Eremias arguta*, *Crossobamon eversmanni*, and *Gloydius halys* (Bannikov 1971; Sindaco et al. 2011).

Conclusions

This study provides a valuable overview of the diverse herpetofaunal community of central Uzbekistan. However, further work in the area is required to extend the region's species inventory, and subsequently provide more accurate species abundance estimates, while improving knowledge of species-habitat relationships. Further field surveys are encouraged to focus on the region's non-steppe habitats (especially montane ecosystems), which were under-represented by survey effort in this study, and to employ more systematic survey methods than were possible here. This study highlights the significant lack of information regarding the conservation status of most species occurring in the steppes and other habitats of central Uzbekistan, and we strongly recommend that IUCN threat status auditors utilize all available resources to address the apparent knowledge gap occurring in this part of Central Asia.

Acknowledgements.—This project was completed under the supervision of the Emirates Centre for the Conservation of the Houbara (ECCH), which is managed by Reneco for Wildlife Preservation (www. reneco.org). We greatly thank H.H. Sheikh Mohammed Bin Rashid Al Maktum, funder of the ECCH, for his support. We are also grateful for the support of Frédéric Lacroix, Mohamed Beljafla, Adeline Cadet, and Yves Hingrat, respectively general manager of, director of ECCH, project manager of ECCH, and head of Reneco's ecology and conservation department. We also thank staff involved in methods design and data collection—particularly ecology coordinators: Eric Le Nuz and Cédric Ferlat, and field workers: Andy Simpkin, Olga Lukshyts, Vladimir Bezmelnitsyn, Alfonso Godino, Yury Bakur, Jesse Gabbard, Edward Mongin, Maksim Tarantovich, and Valerie Dombrovski. Finally, we extend thanks to Dr Tatjana Dujsebayeva of the Kazakhstan Institute of Zoology for assistance with verifying our species records of *Eryx* Sand Boas, and two anonymous reviewers for their useful and constructive comments.

Literature Cited

Ayé R, Schweizer M, Roth T. 2012. *The Birds of Central Asia*. Christopher Helm, London, England. 336 p.

Bannikov AG. 1971. *Amphibians and Reptiles of the USSR*. Mysl Publishers, Moscow, Russia. 297 p.

BirdLife International. 2016a. *Important bird and biodiversity area factsheet: Karnabchul Steppe*. Available: http://www.birdlife.org [Accessed: 16 February 2016].

BirdLife International. 2016b. *Important bird and biodiversity area factsheet: Northern shore of Aydarkul Lake.* Available: http://www.birdlife.org [Accessed: 16 February 2016].

BirdLife International. 2016c. *Important bird and biodiversity area factsheet: Sarmysh Nature Park*. Available: http://www.birdlife.org [Accessed: 16 February 2016].

BirdLife International. 2016d. *Important Bird and Biodiversity Area factsheet: Tudakul and Kuymazar Reservoirs.* Available: http://www.birdlife.org [Accessed: 16 February 2016].

Bobrov VV. 2005. Independence of the Central Asian Faunistic region (according to the distribution of lizards (Reptilia: Sauria)). *Biology Bulletin* 32(6): 576–589.

Chemonics International. 2001. *Biodiversity Assessment for Central Asia: Regional Overview.* Report submitted to USAID Central Asian Republics Mission. Available: https://www.rmportal.net/library/content/1/118_centralasia/at_download/file [Accessed: 17 February 2016].

Christensen L, Coughenour MB, Ellis JE, Chen ZZ. 2004. Vulnerability of the Asian typical steppe to grazing and climate change. *Climate Change* 63: 351–368.

Cheung SM, Dudgeon D. 2006. Quantifying the Asian turtle crisis: Market surveys in southern China, 2000–2003. *Aquatic Conservation: Marine and Freshwater Ecosystems* 16: 751–770.

Clemann N, Melville J, Ananjeva NB, Scroggie MP, Milto K, Kreuzberg E. 2008. Microhabitat occupation and functional morphology of four species of sympatric agamid lizards in the Kyzylkum Desert, central Uzbekistan. *Animal Biodiversity and Conservation* 31(2): 51–62.

Djamali M, Brewer S, Breckle SW, Jackson ST. 2010. Climatic determinism in phytogeographic regionalization: A test from the Irano-Turanian region, SW and Central Asia. *Flora* 207: 237–249.

Ficetola GF, Stöck M. 2016. Do hybrid-origin polyploid amphibians occupy transgressive or intermediate ecological niches compared to their diploid ancestors? *Journal of Biogeography* 43: 703–715.

Frost DR. 2014. *Amphibian Species of the World: An Online Reference*. Available: http://research.amnh.org/herpetology/amphibia/index.html. [Accessed: 17 February 2016].

Glazirin GE, Shanicheva SC, Shub VE. 1999. *A Brief Description of the Uzbekistan Climate*. 30 Publications, Tashkent, Uzbekistan. 25 p.

Hendrix MS, Davis, GA. 2001. *Paleozoic and Mesozoic Tectonic Evolution of Central and Eastern Asia*. Geological Society of America, Boulder, Colorado, USA. 447 p.

Ikramov EF, Azimov DA. 2004. Helminths of amphibians of the Fergana valley of Uzbekistan. *Parazitologiia* 38: 81–87.

IUCN. 2016. The IUCN Red List of Threatened Species. Version 2016.1. Available: www.iucnredlist [Accessed: 02 July 2016].

Kuzmin SL. 1994. Commercial collection as a threat for amphibian and reptile species of the former Soviet Union. *Species* 23: 47–48.

Lagarde F, Bonnet X, Corbin J, Henen B, Nagy K, Mardonov B, Naulleau G. 2003. Foraging behaviour and diet of an ectothermic herbivore: *Testudo horsfieldi. Ecography* 26(2): 236–242.

Lagarde F, Bonnet X, Nagy K, Henen B, Corbin J, Naulleau G. 2002. A short spring before along jump: The ecological challenge to the steppe tortoise (*Testudo horsfieldi*). *Canadian Journal of Zoology* 80: 493–502.

Lambert MRK. 2002. Preliminary observations on herpetofaunal diversity in the Almaty region, Southern Kazakhstan (September 1998). *Herpetological Bulletin* 79: 7–13.

Lioubimtseva E, Cole R, Adams JM, Kapustin G. 2005. Impacts of climate and land-cover changes in arid lands of Central Asia. *Journal of Arid Environments* 62: 285–308.

Makhmudovich, M. 2006. *Country pasture/forage resource profiles – Uzbekistan*. Food and Agriculture Organisation, Rome, Italy. Available: http://www.fao.org/ag/agp/agpc/doc/counprof/PDF%20files/Uzbekistan.pdf [Accessed: 04 June 2017].

Myers N. 2003. Biodiversity hotspots revisited. *BioScience* 53: 916–917.

Olson DM, Dinerstein E. 1998. The Global 200: A representation approach to conserving the Earth's most biologically valuable ecoregions. *Conservation Biology* 12: 502–515.

Reptile Database. 2016. *The Reptile Database*. Available: http://www.reptile-database.org [Accessed: 16 February 2016].

Robinson JE, Griffiths RA, St John FAV, Roberts DL. 2015. Dynamics of the global trade in live reptiles: Shifting trends in production and consequences for sustainability. *Biological Conservation* 184: 42–50.

Rustamov AK. 1981. Opit otsenki vidovogo yendimizma gerpetofauni Irana, Afganistana i Srednei Azii. Pp. 118–119 In: Editor, Szczerbak NN. *Voprosi gerpetologii*. Nauk SSSR, Leningrad, Russia. 225 p.

Rustamov AK, Shcherbak NN. 1986. *Cierpetogeograficheskoye Raionirovaniye Srednei Azii Izvestiya Akad*. Nauk SSSR, Leningrad, Russia. 87 p.

Schammakov S, Ataev C, Rustamov EA. 1993. Herpetogeographical Map of Turkmenistan. *Asiatic Herpetological Research* 5: 127–136.

Sindaco R, Jeremcenko VK. 2008. *The Reptiles of the Western Palearctic, Volume 1: Annotated Checklist and Distributional Atlas of the Turtles, Crocodiles, Amphisbaenians and Lizards of Europe, North Africa, Middle East and Central Asia*. Edizioni Belvedere, Latina, Italy. 580 p.

Sindaco R, Venchi A, Grieco C. 2011. *The Reptiles of the Western Palearctic, Volume 2: Annotated Checklist and Distributional Atlas of the Snakes of Europe, North Africa, Middle East and Central Asia, with an Update to Volume 1.* Edizioni Belvedere, Latina, Italy. 443 p.

Tuniyev BS, Dusej G, Flärdh B. 1999. Zoogeographic Analysis of the Herpetofauna of South-Western Turkmenistan. *Russian Journal of Herpetology* 62: 125–142.

Wassink A. 2015. *The New Birds of Kazkahstan*. Privately published, Texel, Netherlands. 382 p.

World Wildlife Fund. 2016. *Ecoregions*. Available: http://www.worldwildlife.org/biomes [Accessed: 14 February 2016].

Thomas Edward Martin is a conservation biologist based with Reneco for Wildlife Preservation, UAE. He has an interest in the biogeography and ecology of species inhabiting poorly-explored parts of the tropics and sub-tropics, in particular the steppes of Central Asia and the rainforests of Indonesia.

Mathieu Guillemin is a field biologist based with Reneco for Wildlife Preservation, UAE. He has a long-standing interest in the herpetofauna of the arid zones of North Africa and Central Asia, having spent nearly a decade completing fieldwork in these ecosystems. He currently spends a large part of the year as a project manager in the Betpak-Dala steppe, Kazakhstan.

Valentin Nivet-Mazerolles is a conservation biologist with a wide range of interests, having recently completed varied forms of fieldwork in Morocco, Uzbekistan, Kazakhstan, and Crozet Island in the Southern Indian Ocean. He currently works for the French National Reserve service in the Jura region.

Cecile Landsmann is a field biologist based with Reneco for Wildlife Preservation, UAE. She has worked for many years in the arid steppe ecosystems of North Africa and Central Asia, and has developed a strong broad interest in the ecology of these regions. She currently spends much of her year working as a project manager in Central Uzbekistan.

Jerome Dubos is an experienced conservation biologist who first worked as a field technician in the Central Asian steppes in 2009, and has returned to the region most years since. He also has extensive experience conducting field surveys in France, North Africa, and the Middle East. He is currently working on the LIFE+ Petrels project on Reunion Island, working towards the conservation of the two endemic Petrel species found there.

Rémy Eudeline is an enthusiastic herpetologist and a biology teacher, currently based on Mayotte Island in the Indian Ocean. He has developed a strong interest in the herpetofauna of Mayotte, in particular its poorly-studied endemic blind snakes.

James T. Stroud is a Ph.D. candidate at Florida International University. He has a broad range of research interests, often revolving around investigating how ecological processes may explain evolutionary patterns, most commonly using herpetofauna as model species and study systems. He has extensive herpetological fieldwork experience in Europe, the Neotropics, and South-East Asia.