A herpetofaunal survey of Southern Jordan

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ABSTRACT - A total of 70 herpetofauna species from 3 Orders and 18 Families were surveyed during a period of two years (2005-2007) in Southern Jordan. The Ophidia included Leptotyphlopidae, Typhlopidae, Boidae, Colubdridae, Atractaspididae, Elapidae and Viperidae. The Sauria included Gekkonidae, Chamaeleonidae, Agamidae, Lacertidae, Sincidae, Anguidae and Varanidae. Testudines included Cheloniidae, Dermochelyidae, Emydidae and Testudinidae. The species listed were all resident and mostly found throughout the year. The diversity of terrestrial and aquatic ecosystems in the study area likely encouraged species presence. The results reinforce the necessity for long-term inventory planning in order to understand the ecology and the dynamics of herpetofauna and other wildlife communities in the study area. The increasing human impact on the existing natural resources in Southern Jordan has threatened the ecology and diversity of wildlife species to such a degree that populations of anurans and many reptiles are declining in diversity, status and abundance. The author recommends improving cooperation of different parties to enhance public awareness and to implement environmental laws and legislation to conserve sensitive and rare species of herpetofauna.

SOUTHERN Jordan lies at the juncture of the Levantine and Arabian regions of the Near East. Four main physiographic regions are recognised; (1) Rift Valley, (2) Mountain ranges, (3) Southeastern desert and (4) Marine environment of the Gulf of Aqabah. This affords Southern Jordan a diversified morphology that is reflected in the diversity of its herpetofauna (Amr & Amr, 1983; Arnold, 1983; Disi, 1983; Arnold 1984; Joger, 1984; Disi, 1985; Disi, 1987; Amr, 1988; Amr & Woodbury, 1988; Disi et al., 1988; Arnold 1989; Disi, 1991, 1993; Al-Oran et al., 1994; Amr et al., 1994; Al-Oran & Amr, 1995; Disi, 1996; Al-Oran et al., 1997; Amr et al., 1997; Al-Oran et al., 1998; Amr et al., 1998; Disi et al., 1998).

Southern Jordanian territory, due to its geographical position, creates a crossroad of different zoogeographic realms (Afrotropical, Saharo-Sindian, Oriental and Palearctic), which influence the composition of the Jordanian herpetofauna. Distribution of these biogeographical regions is at its most diverse in the west of Jordan where it is influenced by altitude (Leviton et al., 1992; Werner, 1986, 1988, 1991, 1992; Wittenberg, 1992). The complex mosaic of high mountains, steep slopes and deep wadis has lead to the formation of narrow borders or overlap between individual eco-zones and causes mixing of floral and faunal elements with different biogeographical affinities in individual localities.

Within these eco-zones there are apparent declines and extinction of herpetofauna at a local community level creating a requirement for knowledge of distribution and presence data. The causes of these declines may include habitat loss and degradation, unsustainable use, invasive species, environmental pollution, disease and global climate change (Sindaco et al., 1995; Modry et al., 1998, 1999). Habitat loss appears to be the most serious threat to the herpetofauna of Jordan. Habitat degradation of wetlands by draining and/or pollution also threatens amphibian populations in Jordan.

A variety of herpetological surveys and studies have been conducted in neighbouring countries on species that occur in Jordan. These comparable studies showed that lizards were the most common group of reptiles in terms of species identified or caught. Three anuran species (*Bufo viridis*, *Rana ridibunda* and *Hyla arborea*) that were investigated in the different areas of Turkey also have a wide distribution throughout the Middle East countries (Amr & Amr, 1983; Amr, 1988; Amr & Woodbury, 1988; Amr et al., 1994; Amr et al., 1997; Al-Oran

et al., 1998). In Southern Jordan a number of reptile species are recognized (Disi, 1983; Joger, 1984; Disi, 1985, 1987; Disi et al., 1988, Disi, 1991, 1993, 1996; Disi et al., 1998).

Two species of turtles, the Caspian Terrapin *Mauremys caspica rivulata* and the Terrestrial Spur-thighed Tortoise *Testudo graeca terrestris*, occur in most of the Mediterranean basin and the Middle East, including Jordan (Werner, 1986, 1988, 1991; Leviton et al., 1992; Werner, 1992; Wittenberg, 1992). In spite of the threats facing freshwater turtles worldwide, both species have a reasonably good distribution in Jordan.

Ten species of venomous snakes occur in Israel and Jordan belonging to three families. The most dangerous, and most common, is the Palestine Viper *Vipera palaestinae*. All venomous snake species in Jordan seem to pose a serious threat to humans with several hundred bites being reported every year in Israel and Jordan (Werner, 1986, 1988, 1991; Leviton et al., 1992; Werner, 1992; Wittenberg, 1992).

Data on wildlife species indicate that approximately 500 birds, 100-120 mammals, 400 fish and 120 herpetofauna species are also known from Jordan (Amr & Amr, 1983; Arnold, 1983; Disi, 1983; Arnold 1984; Joger, 1984; Disi, 1985; Disi, 1987; Amr, 1988; Amr & Woodbury, 1988; Disi et al., 1988; Arnold 1989; Disi, 1991, 1993; Al-Oran et al., 1994; Amr et al., 1994; Al-Oran & Amr, 1995; Disi, 1996; Al-Oran et al., 1997; Amr et al., 1997; Al-Oran et al., 1998; Amr et al., 1998; Disi et al., 1998).

METHODS AND MATERIALS

The sites in this study are wide ranging. The study area comprised Aqaba wetland (site I), Ras Al Naqab mountainous land (site II) and Araba Irano-turanian valley land (site III). In the wetland habitat typical vegetation was bordered by tall emergent plants like *Phragmites australis* and *Arundo donax. Tamarix nilotica* covered considerable maritime areas. In the Ras Al Naqab mountainous land vegetation comprised trees and shrubs such as *Juniperus phoenicea, Sarcopoterium spinosa* and *Daphne linearifolium.* In the Araba Valley the vegetation comrpised *Calotrops procera, Salvadora persica* and *Acacia* spp.

Field methodologies used in this study were divided into two occasions;

(1) The main survey period, covering two years (October 2005-September 2007); and
(2) Additional visits that have been conducted after the study period.

Data collected in the field were recorded on survey sheets designed specifically for the purpose. Live traps and aquatic nets were used. Frequent visits and discussions with local people were also used to determine presence and identification of herpetofauna, and their ecological importance in the study area. Visits were carried out both diurnally and nocturnally to detect all species. Examination of amphibian and reptile eggs, their parts and identification was completed in situ. Acoustics and tracks were also used to supplement visual encounter survey. Road kills were also utilised for presence and absence.

Voucher specimens were deposited in the Jordanian Natural History Museum at both Yarmouk and Mutah Universities, and in the Zoologic Museum at Jordan University. A long range of international, regional and even local literature was used to identify species (Amr & Amr, 1983; Arnold, 1983; Disi, 1983; Arnold, 1984; Joger, 1984; Wittenberg, 1984; Disi, 1985; Werner, 1986; Disi, 1987; Werner, 1988; Arnold, 1989; Amr, 1988; Amr & Woodbury, 1988; Disi et al., 1988; Disi, 1991; Werner, 1991; Leviton et al., 1992; Werner, 1992; Wittenberg, 1992; Disi, 1993; Al-Oran et al., 1994; Amr et al., 1994; Al-Oran & Amr, 1995; Sindaco et al., 1995; Disi, 1996; Al-Oran et al., 1997; Amr et al., 1997; Al-Oran et al., 1998; Amr et al., 1998; Disi et al., 1998; Modry et al., 1998, 1999).

Following previous author's style we used a bird recording status and abundance technique that is approximate and qualitative. We adapted it to record herpetofaunal species as follows (Bibby & Marsden, 1998):

1. Resident (R): Generally present all year round.
2. Winter Visitor (WV): Present in winter.
3. Summer Visitor (SV): Present in summer.

4. Passage Migrant (PM): Only present in spring and/or autumn migration periods.
5. Vagrant (V): Migratory species that swerved from normal migratory routes.
6. Unknown (UN): Status unknown.

1. Very Rare (VR): The species seen once or twice.
2. Rare (R): The species seen in very low numbers
3. Uncommon (UC): The species seen in small numbers but more than R.
4. Common (C): The species seen in relatively large numbers.
5. Very Common (VC): The species seen in large numbers.

RESULTS

A total of 70 herpetofaunal species belonging to 3 Orders and 18 Families were recorded in Southern Jordan. The three Orders were; (1) Ophidia - has 7 Families, Leptotyphlopidae (1 species), Typhlopidae (2 species), Boidae (1 species), Colubridae (17 species), Atractaspididae (1 species), Elapidae (1 species) and Viperidae (5 species); (2) Sauria - has 7 Families, Gekkonidae (12 species), Chamaeleonidae (1 species), Agamidae (8 species), Lacertidae (3 species), Sincidae (8 species), Anguidae (1 species), Varanidae (1 species); (3) Testudines - has 4 Families, Cheloniidae (2 species), Dermochelyidae (1 species), Emydidae (1 species) and Testudinidae (1 species).

All the taxonomic categories with their species are listed in Table 1 (Appendix) with their status recognition. The three amphibians belong to a single order and three Families. All were noted to inhabit wetlands, seasonal rainwater pools, rainwater harvesting areas, irrigated canals and wastewater ponds in the study area.

DISCUSSION

The isolated relict natural ecosystems of Jordan are mostly found in the southeastern desert on the border with Saudi Arabia but also in high elevations and deep valleys of the Rum Mountains. The majority of herpetofauna in the Mediterranean eco-zone are of Palearctic origin. Most amphibians and reptiles that inhabit this eco-zone are widely distributed in the eastern Mediterranean region, namely *Rana bedriagae*, *Hyla savignyi*, *Testudo graeca*, *Hemidactylus turcicus*, *Lacerta laevis*, *Typhlops vermicularis*, *Eryx jaculus*, *Malpolon monspessulanus* and several others. However, some of the local reptiles can be considered as endemics, namely *Chalcides guentheri*, *Rhinotyphlops simoni* and *Micrelaps muelleri.*

It is clear that the Mediterranean eco-zone of the Southern Jordan is generally confined to the southwestern highlands, that is typically identified by having the highest rainfall in the region. The vegetation used to be dominated mostly by pine forests at higher altitudes and oak forests at lower elevation. Grazing of numerous herds of domestic animals has lead to secondary, heavily disturbed and rather dry Steppe vegetation. The Irano-Turanian eco-zone is defined mainly phytogeographically and forms a strip of mostly Steppe habitat surrounding the Mediterranean. It is often considered to be a transitional zone between drier parts of the Mediterranean and surrounding eco-zones. Afrotropical (or Sudanian) eco-zone (often referred to as Afrotropical penetration) extends from Al Karama region in the north through the Rift Valley to Aqabah and also to the east, including the sea shore. This zone is typically recognized by the presence of African flora and fauna and by the presence of Arabian herpetofauna. *Phrynocephalus arabicus*, *Coluber elegantissimus*, *Atractaspis engaddensis* are typically confined to this eco-zone.

Relatively humid regions of southwest parts of the Jordanian highlands in Southern Jordan represent the centre of amphibian diversity in Jordan. Unfortunately, this region is also widely affected by urbanisation, agriculture and industry. The distribution of some amphibians, chiefly *Pelobates syriacus* and *Triturus vittatus* is limited in this region and the current occurrence of these species is questionable. *P. syriacus* has not been reported since 1973 and the occurrence of *T. vittatus* still requires confirmation.

The above mentioned overlap of the Jordanian territories hosts surprisingly rich reptile fauna compared to that of neighbouring countries, even at a regional level in the Middle East. Thus far, more than 70 species are known to occur in

Southern Jordan. Interestingly, the occurrence of several reptile species was secured only recently. Among the most recent additions, the presence of *Phrynocephalus maculatus* near Wadi Araba and discovery of a new form of *Lacerta* in Wadi Rum are notable. It is still probable that the list of Southern Jordanian reptiles, as shown in Table 1 (Appendix), is incomplete and thus awaits further additions and revisions. However, despite this it is evident, that our knowledge about the distribution and biology of several species is essentially anecdotal and requires more intense field research.

The overview of typical habitats mentioned herein is not definitive. The eco-zones surveyed during this study can, however, help identify herpetofauna found in certain areas; e.g. prevailing Steppe habitats favour *Trapelus ruderatus* and *Acanthodactylus tristrami.* Also, the Saharo-Arabian eco-zone (Badyiah), covers a major part of the Southern Jordanian inland and depending on the geology, geomorphology, latitude and altitude, can form arid semi-deserts and desert habitats that may limit distribution of certain species because permanent natural water resources are so rare. Various reptile taxa are typical of this eco-zone; e.g. *Trapelus pallidus agnetae*, *Acanthodactylus robustus*, *A. grandis*, *Malpolon moilensis* and *Pseudocerastes persicus.*

The results from this survey reinforce the necessity of long-term inventories in order to understand the dynamics of animal communities in the study area. It is expected that increasing human population, residential and agricultural expansions, intensive and extensive infrastructure, development projects, and poor implementation of environmental legislation are major factors contributing to the gradual decline of biodiversity in the area. The arid to semi-arid environment of Southern Jordan hosts reptile populations comprising desert species that are also found in neighbouring countries, especially on the Sinai Peninsula. Many reptiles recorded in this study resemble species assemblages recorded in other studies from different Middle East countries. These similarities could be attributed to the fact that these countries lie in the east Mediterranean basin where climatic conditions are fairly similar.

The diversity of agro-environments and wetland habitats in Southern Jordan also attracts more insects and other micro-fauna which in turn constitute a major trophic level in the food chain of lizards. The Desert Monitor *Varanus griseus* is among the largest lizards occurring in the area and would need a substantial trophic food chain to support it. Venomous and non-venomous snakes play an ecological role in eliminating pests and harmful animals from the environment. However, this role is not generally acknowledged by many people in the region and often snakes are still persecuted. Solutions to this problem lie in improving education of local communities and in enforcing laws regarding wildlife protection. Ten species of venomous snake belonging to three Families (Viperidae, Elapidae and Atractaspididae) occur in Southern Jordan and much is still to be known about their ecology.

The strategic position of the study area, at the terrestrial meeting point between Asia, Europe and Africa, coupled with its climate and topography means that Jordan receives interaction and spread of flora and fauna from all three continental masses. The diversity of ecological habitats in particular contributes to species diversity. The various ecosystems, including wetlands, sand dunes, natural vegetation and agricultural orchards provide reptiles and amphibians with all their habitat needs for shelter, food and reproduction.

However, the increasing human impact on existing natural resources in Southern Jordan threaten wildlife including herpetofauna. Populations of frogs and many reptiles are potentially declining, with virtually no data to monitor such losses. The current deterioration and drainage of wetland habitats will seriously threaten the existence of wildlife. Human intervention by habitat alteration, drainage of riparian wetlands, water pollution and turtle collection has been reported to endanger the existence of certain populations of herpetofauna. With this in mind, the author recommends improving cooperation of different government and non governmental organisations to enhance the public awareness and to implement environmental laws and legislation to conserve nature and to protect wildlife, especially that of the sensitive and rare herpetofauna of Southern Jordan. Finally, the author recommends

carrying out more field studies on the biodiversity in Southern Jordan.

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APPENDIX

Table 1. List of Reptilia from Southern Jordan.

	Family	Scientific Name	Status	Abundance
OPHIDIA				
	Leptotyphlopidae	*Leptotyphlops macrorhynchus*	R	R
	Typhlopidae	*Typhlops vermicularis*	V	U
		Typhlops simoni	R	C
	Boidae	*Eryx jaculus*	V	C
	Colubdridae	*Coluber elegantissimus*	R	C
		Coluber jugularis asianus	R	C
		Coluber nummifer	R	VC
		Coluber ravergieri	PM	VC
		Coluber rhodorachis	R	R
		Coluber rogersi	R	VR
		Coluber rubriceps	SV	VC
		Coluber schmidti	R	VR
		Coluber ventromaculatus	V	R
		Eirenis coronella	R	C
		Eirenis decemlineata	R	C
		Eirenis lineomaculata	R	VC
		Eirenis rothi	WV	C
		Lytrorhynchus diadema	R	R
		Lytrorhynchus kennedyi	UN	R
		Natrix tessellata	R	VR
		Rhynchocalamus melanocephalus	R	VC
		Spalerosophis diadema cliffordi	UN	VC
		Malpolon monspessulanus insignitus	V	C
		Psammophis schokari	R	C
		Telescopus dhara	V	C
		Telescopus fallax syriacus	R	C
		Telescopus nigriceps	R	R

	Atractaspididae	*Atractaspis microlepidota engaddensis*	R	R
	Elapidae	*Walterinnesia aegyptia*	R	UC
	Viperidae	*Cerastes cersates*	R	C
		Macrovipera lebatina	R	C
		Echis colorarus	R	C
		Pseudocerastes persicus fieldi	R	R
		Vipera palaestinae	PM	VR
SAURIA				
	Gekkonidae	*Bunopus tuberculatus*	R	UC
		Cyrtodactylus scaber	V	C
		Cyrtodactylus kotschyi	R	C
		Hemidactylus turcicus turcicus	R	C
		Pristurus rupestris	R	VC
		Ptyodactylus hasselquistii	V	C
		Ptyodactylus guttatus	R	VC
		Ptyodactylus puiseuxi	R	UC
		Stenodactylus doriae	UN	C
		Stenodactylus grandiceps	R	C
		Stenodactylus sthenodactylus	WV	C
		Tropiocolotes nattereri	R	UC
	Chamaeleonidae	*Chamaeleo chamaeleon recticrista*	UN	VC
	Agamidae	*Laudakia stellio stellio*	PM	UC
		Laudakia stellio brachydactyla	R	C
		Laudakia stellio picea	R	C
		Pseudotrapelus sinaita	R	C
		Trapelus blanfordi fieldi	R	C
		Trapelus pallda haasi	R	C
		Phyrnocephalus arabicus	R	C
		Uromastyx aegyptius microlepis	R	C
	Lacertidae	*Acanthodactylus grandis*	V	C
		Mesalina olivieri schmidti	R	R
		Ophisops elegans	R	C
		Lacerta laevis	R	VR
		Lacerta trilineata israelica	R	R
	Sincidae	*Ablepharus rueppellii*	R	C
		Chalcides ocellatus	R	C
		Chalcides guentheri	R	VC
		Eumeces schneideri pavimentatus	R	C
		Eumeces schneideri schneideri	R	C
		Mabuya vittata	SV	UC
		Ophiomorus latastii	V	VC
		Sphenops sepsoides	R	VC
	Anguidae	*Ophisaurus apodus*	R	C
	Varanidae	*Varanus griseus*	R	UC
TESTUDINES				
	Cheloniidae	*Chelonia mydas*	R	UC
		Eretmochelys imbricata	PM	C
	Dermochelyidae	*Dermochelys coriacea*	R	C
	Emydidae	*Mauremys caspica rivulata*	R	C
	Testudinidae	*Testudo graeca terrestris*	R	C