

First data on the diversity of the herpetofauna of the Oum El Bouaghi Region (Northeast of Algeria)

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ABSTRACT

This study aims at providing the first faunistic and ecological data on the herpetofauna of the Oum El Bouaghi region. The observation period was spread over two seasons (2018-2019), from mid-March to the end of October. A total of 18 species of reptiles and 4 species of amphibians have been recorded. The data collected were analyzed in terms of the biogeographical and trophic aspects of the herpetofauna of the study area. The region of Oum El Bouaghi has a great herpetofaunistic diversity, which shows how important it is to ensure its protection.

Key words : Biodiversity, Herpetofauna, Batrachofauna, Oum El Bouaghi, Algeria.

Introduction

The first element of the knowledge of the Maghreb herpetofauna began to emerge at the end of the first half of the 18th century with the first notes by Shaw (1738), who cites some species of reptiles with their common names, and Gervais (1835, 1836), he lists 27 reptile species from the Algiers and Bône region.

In Algeria, the study of herpetofauna began with the notes of (Gervais, 1844; Guichenot, 1850; Strauch, 1862 and Lallement, 1867). In 1891 Boulenger published his catalogue on the Reptiles and Amphibians of Kabylia. Olivier (1894), significantly increased the inventory of reptiles in Algeria. In 1901 Doumergue's work on the reptiles of Orania appeared. Schleich *et al.* (1996) published a huge work (Amphibians and Reptiles of North Africa). Ten years later (2006), Cox *et al.* issued a synthesis on the herpetofauna of Mediterranean countries which took into account the latest taxonomic

changes.

Finally, much more recent works has been carried out, including (Rouag and Benyacoub, 2006); Youcefi., 2012; Mouane, 2013; Mamou *et al.*, 2014 and Beddek, 2017). In comparison with the other North African countries (Bons *et al.*, 1996) for Morocco, the herpetological fauna of Algeria remains poorly known. Studies remain insufficient and certain species still be problematic issues of systematics and identification. As a result, many types of ecosystems in Algeria have yet to be explored to identify the main aspects of herpetological diversity: a complete inventory of species, geographical distribution, the status of populations and their habitats, to identify conservation priorities (Dahamna *et al.*, 2006).

The present study provides the first data on the herpetofauna in Oum El Bouaghi. Indeed, Oum El Bouaghi region occupies a privileged geographical location compared with the Saharian and Mediterranean fauna; however, no work has been devoted

exhaustively to the herpetological richness of this region. Therefore, the main objective of this work is to help draw up a list of the species present and to gain knowledge of different aspects of their ecology to better set conservation priorities.

Materials and Methods

Study Area

Our herpetological observations were carried out mainly in the state of Oum El Bouaghi (Fig. 1). The latter is located in north-eastern Algeria, in the area of the Constantine highlands in the center of the wilayas of eastern Algeria between the line of latitude $36^{\circ} 10' .03$ to the north and $35^{\circ} 24' .34$ to the south and between the lines of longitude $06^{\circ} 10' .45$ to the west and $07^{\circ} 55' .56$ to the east of the Greenwich meridian (Amrane *et al.*, 2009). It covers an area of 763,800 ha or 7638.13 km². The region of Oum El Bouaghi has a continental climate of semi-arid type, with cold winter and hot, dry summer.

Period of Study

This first study took place from a much more exploratory angle of the herpetofauna of the Oum El Bouaghi region. To observe the reptiles, the most favorable period corresponds to the release from winter latency and reproduction, i.e. from the middle of March to the end of October, Rouag (2006)

and that, during two seasons (2018-2019).

Choice of Sites

The lack of information on the distribution areas of the herpetofauna present in Oum El Bouaghi region forced us to choose a random sampling method. Various natural and urban ecosystems were chosen. The choice was made based on two criteria: accessibility and the assurance of safe conditions. For each station, a species is considered to be present if there are adults present during the breeding season, singers, egg-layers, larvae, young metamorphosed animals or animals crushed on roads.

Method of Sampling Reptiles and Amphibians

Reptiles and amphibians are hard animals to observe, and even more difficult to capture (Chirio, 2013). Reptiles prospecting have essentially consisted in moving slowly and silently in transects over 1000 meters long, in homogenous and favorable environments (hedgerows, forest edges, riverbanks, etc.), during the most favorable periods (coming out of the wintering phase, in the morning or on sunny or cloudy days with mild temperatures). During these transects, the species were searched by sight and then photographed. Excavations were also carried out in areas likely to be used as refuge zones. This consisted of removing dead wood, observing at length the inside of bushes and

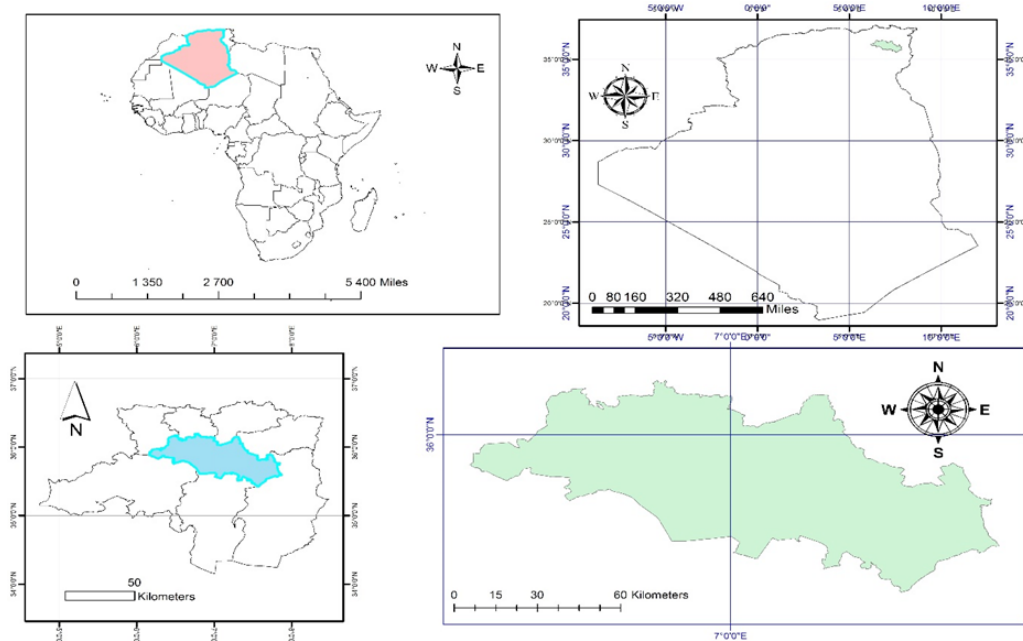


Fig. 1. The geographical location of the study area.

clumps of grass, and lifting and replacing stones (Mamou *et al.*, 2014). The batrachological surveys were preferably carried out at the end of the day and at the beginning of the night under favorable meteorological conditions (absence of wind or weak wind, sufficient air humidity (Albinet *et al.*, 2013). For the capture of amphibians, a small net is used to capture larvae and tadpoles (Dahamna *et al.*, 2006). These methods have been complemented by other so-called 'indirect' techniques. These include the collection and identification of corpses killed on the roads or by farmers in rural or urban areas, the identification of specimens by their molting and finally the auditory detection of singing males.

For species not identified on-site, pre-identification was initiated in the laboratory using the determination keys proposed in the guides by (Schleich *et al.*, 1996 and Mattison, 2014). For confirmation, the following specialist herpetologists were asked to send them photos of unidentified specimens; Beddek Mennad (Center for Functional and Evolutionary Ecology Montpellier, France), UITZ Peter (Virginia Commonwealth University, USA), ESCORIZA Daniel (Universitat de Girona, Spain).

Results

Systematic Inventory

At the end of our surveys, 18 species of reptiles and 4 species of amphibians were identified. The 22 species inventoried are listed in Table 1.

A total of 22 species are inventoried in the study area. They are divided into two classes: amphibians and reptiles. Reptiles include two orders (Tab.1), Squamates and Testudines. The latter is represented by 2 species divided into 2 families, Emydidae and Testunidae. Among the squamates, there is a Trogonophid Amphisbenian, 9 species of saurians distributed in 5 families: Chamaeleonidae (one species), Gekkonidae (one species) Phyllodactylidae (one species) Scincidae (one species), Lacertidae or true lizards (five species). 6 species of ophidians were recorded, including 5 Colubridae, and one species of the family Vipéridae. Among the Amphibians (Table 1), there is 1 Urodele of the Salamandridae family and 3 Anurans divided into 2 different families (Bufonidae and Ranidae).

The reptile class is the most represented with 71.41% of the total species inventoried. These are

Table 1. Taxonomic inventory of the fauna inventoried.

Class	Order	Sub-order	Family	Binomial nomenclature
Reptilia	Squamata	Amphisbaenia Sauria	Trogonophiidae	<i>Trogonophis wiegmanni</i> (Kaup, 1830)
			Chamaeleonidae	<i>Chamaeleo chamaeleon</i> (Linnaeus, 1758)
			Gekkonidae	<i>Hemidactylus turcicus</i> (Linnaeus, 1758)
			Phyllodactylidae	<i>Tarentola mauritanica</i> (Linnaeus, 1758)
			Scincidae	<i>Chalcides ocellatus</i> (Forsk., 1775)
			Lacertidae	<i>Psammmodromus algirus</i> (Linnaeus, 1758)
				<i>Ophisops occidentalis</i> (Boulenger, 1887)
				<i>Acanthodactylus bedriagai</i> (Lataste, 1881)
				<i>Timon pater</i> (Lataste, 1880)
			<i>Podarcis hispanicus</i> (Steindachner, 1870)	
	Serpentes	Colubridae	<i>Malpolon insignitus</i> (Geoffroy Saint-Hilaire, 1827)	
			<i>Hemorrhois algirus</i> (JAN, 1863)	
			<i>Hemorrhois hippocrepis</i> (Linnaeus., 1758)	
			<i>Macroprotodon mauritanicus</i> (Guichenot., 1850)	
			<i>Natrix maura</i> (Linnaeus., 1758)	
			<i>Daboia mauritanica</i> (Gray., 1849)	
	Testudines	Cryptodira	Emydidae	<i>Mauremys leprosa</i> (Schweigger., 1812)
			Testunidae	<i>Testudo graeca</i> (Linnaeus., 1758)
Amphibia	Anura	Neobatrachia	Ranidae	<i>Pelophylax saharica</i> (Hartert., 1913)
			Bufonidae	<i>Bufotes boulengeri</i> (Lataste., 1879)
				<i>Sclerophrys mauritanica</i> (Schlegel., 1841)
				<i>Salamndra algira</i> (Bedriaga., 1883)
	Caudata	Salamandrinae	Salamandridae	

divided into two orders (Testudines and Squamates); the latter is best represented with 15 species covering 8 different families (Table 2). The Testudines order is represented by only 2 species, belonging to 2 different families (9% of the total fauna sampled). Amphibians are poorly represented compared to reptiles with only 19% (Table 2). Batrachological diversity is divided into 2 orders. The Anuran order is represented by 14% of the total fauna (3 species), and the Urodela order with 5% and only one species inventoried.

Biogeographical, Trophic and Protective Statuses

We have assigned ecological statuses for each of the species surveyed to characterize their bio-ecology according to the contexts of the study region.

Biogeographical Affinity

Taking into consideration the biogeographical aspect (Fig. 2), we can see a clear dominance of Mediterranean and West Mediterranean elements with respectively 54.54% and 22.72%, in contrast to North

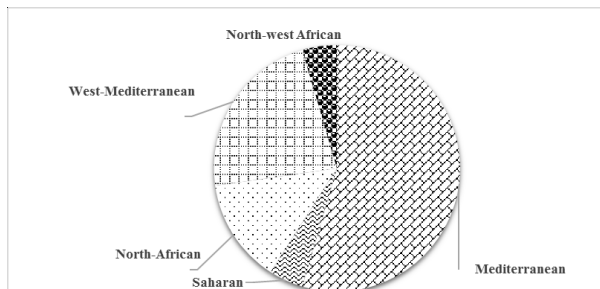


Fig. 2. Biogeographical elements of the herpetofauna of the study area.

African elements which do not exceed the 14% mark. As for the Saharan, North-West African and North Saharan elements, their percentages are of the order of 5% with only one species for each biogeographical element.

Diet

The identified and sampled herpetofauna is classified into 5 trophic categories. The insectivorous category comes first, with 11 species (Fig. 3), representing a little more than half of the total herpetofauna recorded (54.54%). This is followed by the carnivore category with 6 species (27.27%). The category of omnivores comes in third place, with only 3 species, or 13% of the total herpetofauna recorded. Finally, the last two categories are herbivorous and invertebrate consumers with 4.5% each.

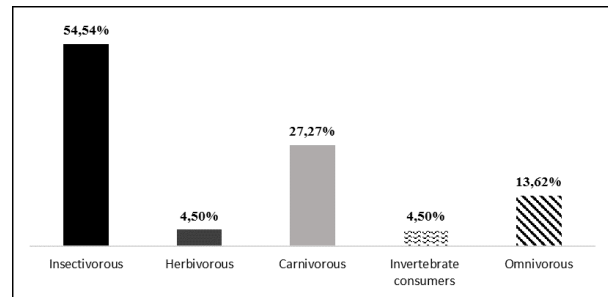


Fig. 3. Percentages of the different trophic categories of the herpetofauna in the study area.

Algerian Conservation Status

Only 9 species (Fig. 4) (40% of the total fauna sampled) are protected by Algerian regulations (JORADP, 2012). These species are *Chamaeleo*

Table 2. Numbers and proportions of amphibian and reptile families recorded.

Class	Order	Family	Genus		Species			
			Number	%	Number	%	%	
Reptilia	Squamata	Trogonophiidae	1	5	1		4.76	
		Chamaeleonidae	1	5	1		4.76	
		Gekkonidae	1	5	1		4.76	
		Phyllodactylidae	1	5	1	71.41	4.76	
		Scincidae	1	5	1		4.76	
		Lacertidae	4	20	5		19.04	
		Colubridae	4	20	5		23.8	
		Viperidae	1	5	1		4.76	
		Testudines	Emydidae	1	5	1	9.52	4.76
			Testunidae	1	5	1		4.76
Amphibia	Anura	Ranidae	1	5	1	14.28	4.76	
		Bufonidae	2	10	2		9.52	
	Caudata	Salamandridae	1	5	1	4.76	4.76	
		Total	20	100	22	100	100	

chamaeleon, *Acanthodactylus bedriagai*, *Timon pater*, *Macroprotodon mauritanicus*, *Testudo graeca*, *Salamndra algira*, *Chalcides ocellatus*, *Psammodromus algirus*, *Mauremys leprosa* (Table 3).

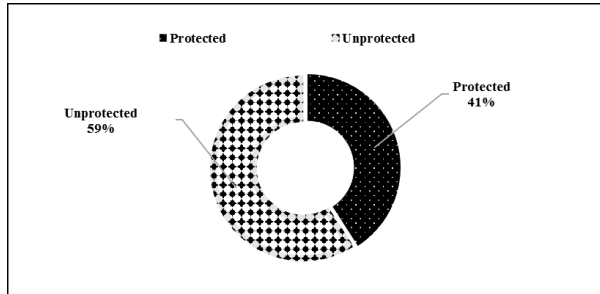


Fig. 4. Percentage of species protected under Algerian law.

Conservation IUCN Status

According to the IUCN analysis, the conservation status varies between the different orders of reptiles and amphibians, in fact 85% of the species sampled have a status of Least Concern (Fig. 5), 15% of the species recorded have a vulnerable status (the two Chelonians and the North African salamander). Finally, only the Moorish viper (*Daboia mauritanica*) is

classified as Near Threatened (Table 3).

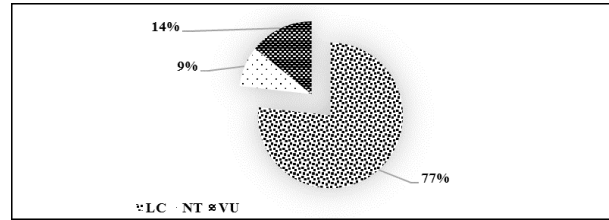


Fig. 5. IUCN conservation status.

Discussion

We note (Table 4) that our region of study contains only 18% of Algeria’s total richness, but in terms of genus and families, we note that it is home to a greater number: 39.02% and 76.92% for genus and families respectively.

According to the study by (Rouag and Benyacoub., 2006) the Reptiles of the El Kala National Park represent 17.17% of the country’s herpetofauna, in the same bioclimatic stage (humid), and at the same latitude (in Bejaia-Northern Kabylia), (Dahamana *et al.*, 2006) were inventoried a total of 17 species. Inventories carried out by (Mamou *et al.*, 2014 and Barkat, 2014) in southern

Table 3. Biogeographical, trophic and protection statuses of the herpetofauna inventoried.

Binomial nomenclature	Biogeographical affinity	Trophic menu	IUCN Status	Algerian Status
<i>Trogonophis wiegmanni</i>	Mediterranean	Insectivorous	(LC)	Unprotected
<i>Chamaeleo chamaeleon</i> *	Mediterranean	Omnivorous	(LC)	Protected
<i>Hemidactylus turcicus</i>	North Saharan	Insectivorous	(LC)	Unprotected
<i>Tarentola mauritanica</i>	Mediterranean	Insectivorous	(LC)	Unprotected
<i>Chalcides ocellatus</i> *	Mediterranean	Insectivorous	(LC)	Protected
<i>Psammodromus algirus</i> *	West-Mediterranean	Insectivorous	(LC)	Protected
<i>Ophisops occidentalis</i>	Mediterranean	Insectivorous	(LC)	Unprotected
<i>Acanthodactylus bedriagai</i> *	Mediterranean	Insectivorous	(NT)	Protected
<i>Timon pater</i> *	Mediterranean	Omnivorous	(LC)	Protected
<i>Podarcis hispanicus</i>	West-Mediterranean	Insectivorous	(LC)	Unprotected
<i>Malpolon insignitus</i>	West-Mediterranean	Carnivorous	(LC)	Unprotected
<i>Hemorrhois algirus</i>	Saharan	Carnivorous	(LC)	Unprotected
<i>Hemorrhois hippocrepis</i>	Mediterranean	Carnivorous	(LC)	Unprotected
<i>Macroprotodon mauritanicus</i> *	Mediterranean	Carnivorous	(LC)	Protected
<i>Natrix maura</i>	West-Mediterranean	Carnivorous	(LC)	Unprotected
<i>Daboia mauritanica</i>	Nord-Ouest africain	Carnivorous	(NT)	Unprotected
<i>Mauremys leprosa</i> *	West-Mediterranean	Omnivorous	(VU)	Protected
<i>Testudo graeca</i> *	North African	Herbivorous	(VU)	Protected
<i>Pelophylax saharicus</i>	North African	Insectivorous	(LC)	Unprotected
<i>Bufo boulengeri</i>	North African	Invertebrates consumers	(LC)	Unprotected
<i>Sclerophrys mauritanica</i>	Mediterranean	Insectivorous	(LC)	Unprotected
<i>Salamndra algira</i> *	Mediterranean	Insectivorous	(VU)	Protected

LC : Least Concern.

(NT): Near Threatened

(VU) : Vulnerable.

*: List of protected species in Algerian legislation.

Table 4. Comparison of the herpetological biodiversity of the Oum El Bouaghi region with that of Algeria.

	Algeria	Oum El Bouaghi	%
Species number	99	18	18.18 %
Genus number	41	16	39.02 %
Family number	13	10	76.92 %

Kabylia revealed the existence of 18 and 15 species respectively. Further south, in the eastern Erg, (Mouane, 2010) counted a total of 25 species. This diversity is surely explained by climatic conditions, as warm climates offer ideal conditions for the existence of well-diversified herpetofauna (Rouag, 2012).

Except for 2 species, almost all of the species listed have been mentioned and inventoried by at least two of the above-mentioned works. The first species is *Daboia mauritanica*, which was only mentioned by (Mamou *et al.*, 2014) in southern Kabylia. The second species is *Acanthodactylus bedriagai*, which does not appear in any of the inventories carried out and cited above. The latter is considered to be endemic to Algeria (Rouag, 2012).

Concerning amphibians, with 4 species inventoried (Table 5), the region of Oum El Bouaghi is home to a third of the total fauna recorded (Cox *et al.*, 2006).

Table 5. Comparison of the batrachological biodiversity of the Oum El Bouaghi region with that of Algeria.

	Algeria	Oum El Bouaghi	%
Species number	12	4	33.33 %
Genus number	9	4	44.44 %
Family number	5	3	60%

As for Kabylia, (Dahamana *et al.*, 2006) recorded a richness of 6 species in the northern part of this region, while (Mamou, 2011 and Barkat, 2014) found 1 and 7 species respectively in the south of this region

Far from Kabylia, in the eastern Erg, (Mouane, 2010) mentions only 2 species of amphibians, *Bufo viridis* and *Rana saharica*.

The diversity of the Algerian batrachofauna is much less important than the diversity of reptiles, a situation which clearly shows the extent to which arid and semi-arid habitats predominate in a large part of the territory (Rouag, 2012).

This diversity in biogeographical affinities can surely be explained by the environmental conditions (especially climatic) that are favourable to the adaptation of these species (Mouane, 2010) because according to Dreux (1972) temperature is a key factor and has a direct impact on the geographical distribution of animal species.

The majority of recorded Saurians are insectivorous (7 species out of 9 recorded), according to (Le Berre, 1989 and Schleich *et al.*, 1996), the majority of lizards feed on insects. Other species classified as insectivorous are *Trogonophis wiegmanni*, *Pelophylax saharicus*, *Sclerophrys mauritanica* and *Salamndra algira*. (Table 3).

All carnivorous species are ophidians. Snakes feed mainly on lizards and small mammals, especially rodents (Gruber, 1992), and even on other snake species (Ophiophagy). According to Nigel and Rob (2001), all ophidian species are carnivorous.

Concerning omnivorous species, three species have been recorded: *Chamaeleo Chamaeleon*, *Timon pater* and *Mauremys leprosa*.

Conclusion

The present study, which is intended to be a pioneering one, has made it possible to know the composition and richness of the herpetological and batrachological population of the region of Oum El Bouaghi. We have been able to reveal the existence of 22 species of amphibians and reptiles.

From a biogeographical point of view, we note a strong dominance of all Mediterranean species.

The trophic classification of the species inventoried is diversified into (5 categories). The herpetofauna inventoried is essentially insectivorous.

Among the fauna sampled, only 9 species are protected by Algerian law, 3 are classified (VU) according to the IUCN, only one species is classified (NT). The rest (18 species) have a status (LC).

In the course of our study, we inventoried a significant number of species, but despite this, the list of species sampled can be further enriched. Indeed, it would be desirable to exploit even more the diversity of biotopes -aquatic and terrestrial- characterizing the region and to increase the number of surveys and in order to sample and inventory species not observed in the study region, but likely to exist there.

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