

# Journal of Chemical, Biological and Physical Sciences



An International Peer Review E-3 Journal of Sciences

Available online at [www.jcbps.org](http://www.jcbps.org)

**Section D: Environmental Sciences**

CODEN (USA): JCBPAT

Research Article

## Comparative study for desert Lizard and River Frog in respond to temperature fluctuations in SAWA Lake-Euphrates River area

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**Received:** 26 December 2018; **Revised:** 17 January 2019; **Accepted:** 26 January 2019

**Abstract:** Very early during the process of data assimilation, it became apparent that too few data were available for some amphibians and reptiles to provide comprehensive reviews of their status especially in their physical limiting factors. It has been, nevertheless, reviewed available data on those taxa, if for no other reason than that the gaps in current knowledge need emphasis. The combination of limited data on many species; the continuing rapid, human induced changes in many Sawa Lake-Euphrates River environments; and the continual appearance of new data of internet indicated that the most useful form that this research could take is one that could be readily modified. In particular, it should facilitate incorporating new info. An essential element of future reviews. We have attempted to structure the environmental relation with this idea in mind by using the temperature factor. Hopefully, that it will induce authors of the Sawa ecological center to fill the essential data gaps so that those exercising stewardship over habitats in which these amphibians and reptiles occur can refine their management plans, and that consultants, legislators, planners, and others will be better advised or give sound advice where it relates to the biology and ecology of these organisms. The present search provides a list of most abundant amphibians and reptiles recorded from Sawa-Euphrates river region in Al-Samawah city from Iraq up to 2018, includes five families of reptiles and four families of amphibians, consist of twenty seven species distributed to seventeen species of reptiles and ten species of amphibians. Tadpole's development was sake in the 15°C up to more than 35°C groups, and survivorship declined to 64% after 200 days. However, 80% of the surviving larvae remained alive after the temperature was increased to 25°C. Of these, 96% reached metamorphosis.

Survivorship of the 20, 25 and 30°C acclimation groups was 85, 96 and 66%, respectively, whereas none survived at 35°C. There was a clear decline in range of reproduction by limiting factor to successful reestablishment of these reptiles by increasing the temperature up to 50 °C.

**Keywords:** Biodiversity, Thermal Effects, SAWA-Lake

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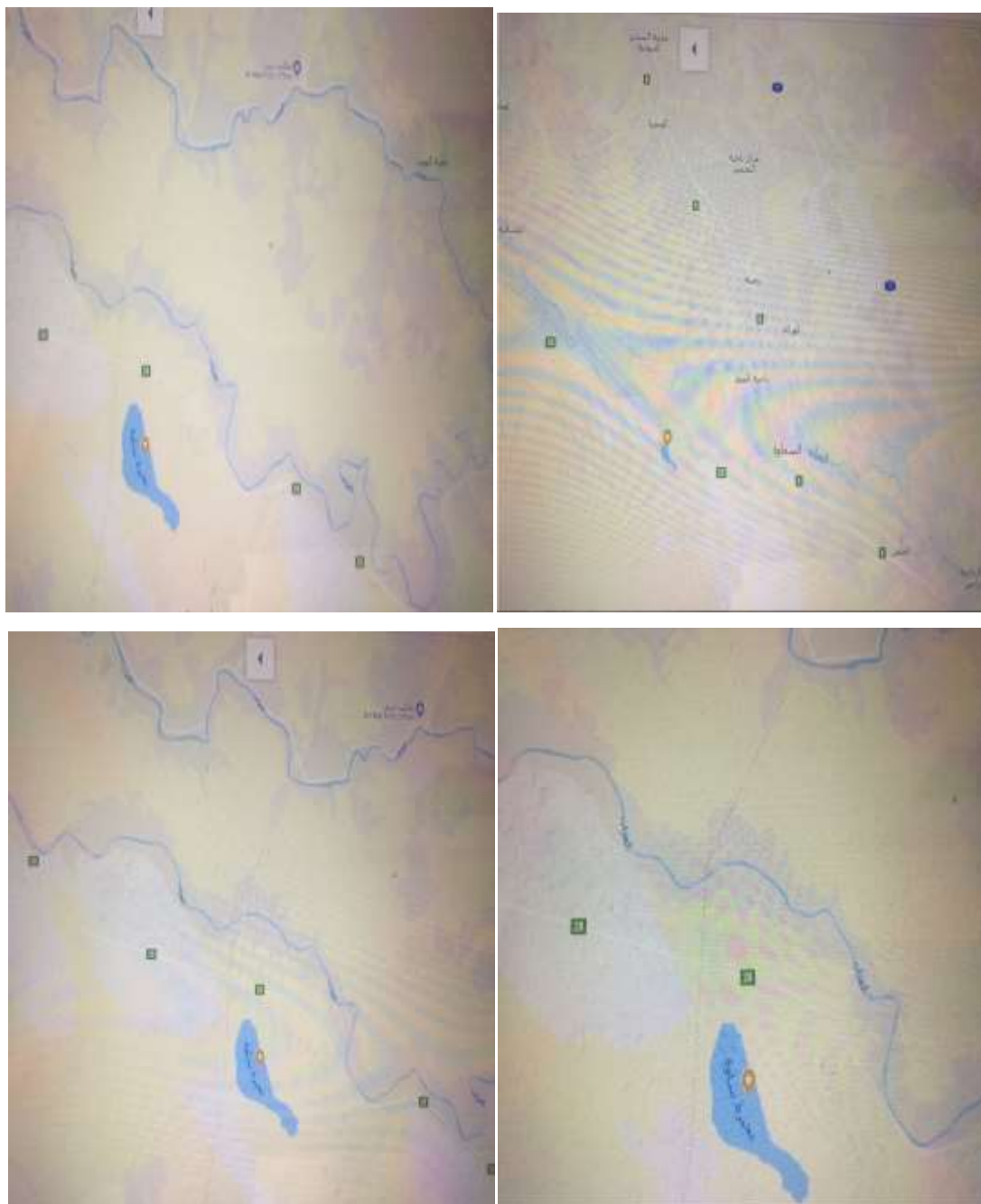
## INTRODUCTION

Temperature is the most specific factor in the behavior and pattern of life of most reptiles and amphibians, the organisms which depend on the surrounded environment in their nutrition and reproduction<sup>1</sup>. Reversibly, the extreme conditions of temperature will be the restricted effector in growth and development of such organisms; it's decreased in higher temperature significantly. Unforgivably human populations expand has significantly impacted native amphibians and reptiles in their habitat<sup>2</sup>.

In Sawa region, where the Euphrates River reaches the margin of desert, two types of environments have been emerged; the desert ecosystem organisms interact directly and indirectly with fresh water ecosystem. The higher mammalian have a great ability to adaptation, rather than its beneficially graced which make it difficult to fellow its behavior naturally comparing to natural physical fluctuations; The reptiles and amphibians is the organisms of choice to study this type of behaviors and patterns of life because of The restricted area of movement, short half-life and shorter cycles of reproduction; in addition to the similarity in methods of eggsbleach<sup>3</sup>.

Geographical description studies that focused on the topographical changes within fifty years ago had been reviewed [Geology survey Agency], comparing with satellite data (GPS), in order to find out biological limited factors for survive of these organisms<sup>4,5</sup>. Many topographical changes induced by natural and industrial factors impacted the nature of this margin environment, especially if we consider that this environment have fluctuations manner originally as its composed. The natural factor extended from the expansion of desert on account of the River bank, the status made the impact changes in the taxa and genera to this environment, adding new types which are normally desert habitants or eliminations others. Likely, the industrial factors had serious changes in Topology, and consequently the biology of this environment, especially the Al-Muthanna cement factories, Salt Factories, Limestone factories. See the **Fig.1**, the GPS picture focused on the region of SAWA Lake-Euphrates River.

The intent of this research was to consider amphibians and reptiles in Sawa Lake-Euphrates River region that were not focused on other than, for some, the limited geographical study with Special Concern status, but that might require reconsideration of their status for various reasons. Just the nature of assembling data for such a synthesis is complex<sup>6,7</sup>. Geographically the lake located on southwest of the city of Samawah, A range between (25-30) Km , astronomer limited study area between latitudes (31,7-31.20) in the north and longitude ( 44.59-45-11) in the east, morphology the lake take irregular oval shape which is closer to the pear fruit, rising from the sea level by about ( 18-20 m) and the level of land adjacent to about 6 meters.



**Figure. 1:** Illustrate the Satellite pictures from Google earth 2018 to region of study Sawa Lake-Euphrates River, describing two branches of Euphrates ( Al-atshan and Al-sabel) near Sawa Lake in desert margin where Salty factories and two cement factories in the region.

**Practical Methods :** Determination of which taxa should included for experiments was the first line in this study, depending on the information preserved in Iraqi Natural history Museum and its periodic, as well as some faculties and departments in Iraqi Universities, which have conducted a research on the field, the taxa had been arranged and prescribed in attempt to make history comparison and recognized the most extension ones, reviewing those data and all available, reports, surveys, and natural diversity data Base from previous and recent studies and books, as well as the internet and

websites that are interested in relevant information regarding the amphibians and reptiles species we have consider as it shown in **table 1**.

**Table 1.** Show the considering species of amphibians and reptiles in SAWA region.

No.	Family	Species	Conservati on Status	Studies
1-	Ranidea	<i>Rana esculenta</i>	LC	<sup>8-10</sup> IUCN,2014a,b,c, <sup>11</sup> Stock <i>et al.</i> ,2001, <sup>12</sup> Hamad, 1985, <sup>3</sup> Khalaf K., 1959, <sup>13</sup> Mahdi N. and George P.V. , 1969, <sup>14</sup> Madi M., 1978, <sup>15</sup> Al-Barazangi, 2015
2-	Ranidea	<i>Rana ridibunda</i>	LC	
3-	Ranidea	<i>Rana macrocnemis</i>	LC	
4-	Hylidea	<i>Hylasavignyi</i>	LC	
5-	Hylidea	<i>Hylaaraborea</i>	LC	
6-	Hylidea	<i>Hylaorientalis</i>	LC	
7-	Bufonidea	<i>Bufoviridis</i>	DD	
8-	Bufonidea	<i>Bufotesvariabilis</i>	LC	
9-	Bofonidea	<i>Bufotessurdus</i>	LC	
10-	Pelobatidea	<i>Pelobatessyriacus</i>	VU	
11-	Agamidae	<i>Saalaroricata</i>	LC	<sup>8-10</sup> IUCN,2014a,b,c, <sup>3</sup> Khalaf K., 1959, <sup>13</sup> Mahdi N. and George P.V. , 1969, <sup>14</sup> Madi M., 1978 <sup>16</sup> Mohammed R.Gh. 2017, <sup>15</sup> Al-Barazangi, 2015
12-	Agamidae	<i>Uromastyxaegyptia</i>	LC	
13-	Agamidae	<i>Trapelusagilis</i>	LC	
14-	Agamidae	<i>Phrynocephalusarabicus</i>	NE	
15-	Schmidts Lizard Lacertidae	<i>Acanthodactylusopheodurus</i>	LC	
16-	Lacertidae	<i>Ophisopselegans</i>	LC	
17-	Lacertidae	<i>Mesalinabrevirostris</i>	LC	
18-	Scincidae	<i>Aplepharusbivittatus</i>	NE	
19-	Gekkonidae	<i>Cyrtopodionscabrum</i>	LC	
20-	Gekkonidae	<i>Bunopustuberculatus</i>	LC	
21-	Gekkonidae	<i>Mediodactylusheteropholis</i>	NE	<sup>17</sup> Afrasiab & Mohammad 2014, <sup>18</sup> Nader & Jawad 1976, <sup>19</sup> IUCN,2006, <sup>3</sup> Khalaf K., 1959, <sup>13</sup> Mahdi N. and GeorgeP.V., 1969, <sup>15</sup> Al-Barazangi, 2015
22-	Colubridae	<i>Telescopusfallax</i>	LC	
23-	Colubridae	<i>Spalerosophisdiadema</i>	NE	
24-	Colubridae	<i>Spalerosophismicrolepis</i>	EN	
25-	Colubridae	<i>Platycephsventromaculatus</i>	NE	
26-	Colubridae	<i>Hemorrhoisravigieri</i>	NE	
27-	Viberidae	<i>Hydrophisgracilis</i>	LC	

CR= Critically Endangered; EN= Endangered; VU= Vulnerable; NT= Near Threatened; LC= Least Concern; DD= Data Deficient; NE= Not Evaluated

To estimate the effect of temperature in number, distribution and reproduction of Toads, lizards and pythons in emerge area of investigation, the field study and records the numbers, watches and behaviors in periods winter –autumn 2018, in hot weather summer (30-50) °C.

The information local conservation status of the Fauna in Iraq are very few so that of the Herpetofauna in Iraq, in this list we used the global conservation status for each species according to the IUCN<sup>10</sup> Red List, the conservation status consist of Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NE), Least Concern 36 (LC), Data Deficient (DD) and Not Evaluated (NE) for the species that did not have a category in the IUCN<sup>10</sup> Red List yet.

Data from the sources were organized into accounts for chooses species that included seven sections: Description, Taxonomic remarks, Distribution, Habitant, Status, and Management recommendation. These species are the most common amphibians belong to different families of the order Anura; consequences species of Lizards in study belong to class Reptilia, order Sequamata; furthermore, sneaks in the same order but in class Ophidia (Linnaeus 1758).

To estimate the effects of temperature in number, distribution, and reproduction of toads and lizards in the area of investigation, the field study and records of number , watches, comparing the behavior, and reproduction from winter 2017-Autumn 2018, in various degrees of temperature including the times of heat waves<sup>20-23</sup>. Tadpoles for all species of investigation have been preserved at same size plastic containers near the rivers and streams for 6 months watching the specimens weakly, in Spring time of reproduction starting from mid-February, at temperature degree rates near 25C , developing of tadpoles to frogs in reproduction time and their movements in water have been recorded correlated with temperature rates. The Lizards and Geckos eggs have been distributed into many temperature regions by changing the position of eggs, in parallel with experiments of amphibians. Repeating the experiments monthly needed cold water for survive in all Spring-Summer months of March, April and May, otherwise, thetadpoles and eggs were have no chance .

## RESULTS AND DISCUSSION

**Biography:** The area of the study lies within two sets of structural systems: Al-Salman range, which belongs to stable pavement, which is in western sections of the region, and the plain in the eastern parts. According to this study, the area is located in the stable pavement, particularly in secondary Al-Shebaja region from desert. The region opens on the Al-atshan stream one of the Euphrates River branches, hydrologically it's contain the Sawa Lake as well; the morphological nature that consist of three ecological environments help in abundance of biodiversity. It's formed from river, salty lake, and artesian wells- desert environments in a range of 25Km, giving an excellent ecology for comparative study of reptiles and toads<sup>6</sup>. The region lies within Palaearticecozone; eight Eco zones classified the organisms that have been evolving in relative isolations over long periods of time, separated from one another by geographic features, such as ocean, broad Deseret, or high mountain ranges that constitute barriers to migration. Two major rivers in the sub region Western Asia of the Palaeartic are the Tigris, rising in the Taurus Mountains of eastern Turkey and the

Euphrates, rising in the mountains of Anatolia. Between these rivers is an ancient area called Mesopotamia, which was also known as the Fertile Crescent. The two rivers join together near Al Qurna in southern Iraq and flow to the Persian Gulf <sup>24, 25</sup>.

**Climate:** The climate of the study area is characterized by extreme extremism at normal temperatures as part of the overall climate of the southern desert of Iraq, a dry and intensely hot summer and a relatively cold, wet winter, with spring and autumn as short transitional periods between the two. The

climate is a typical semi-arid continental type, chiefly characterized by wide diurnal and annual ranges in temperature. Based on the climatic data recorded at Al Samawah station at (11.4 meters) above sea level for the period (2008-2018), **Table (2)** showed that the number of hours of sunrise during the summer months was (13 hours/day), in the winter to reach (8 hours/day). The length of solar brightness may result in high summer temperatures. Samawah recorded the highest rate of air temperature in July and August to reach 56 °C, and the high temperature values resulted in high evaporation rates, which showed a clear water deficit. The maximum recorded temperature is 56°C, while temperatures of 45°C are not unusual occurrences in June, July, and August. The minimum recorded temperature is 11°C in January. Where the region witnessed the lack of rainfall and fluctuation, as the rate of rainfall fell significantly and shortened to few showers in the winter for the months of December and January to the rate of 8 mm per year. Humidity is one of the important climatic factors that determine dryness rates; the relative humidity is usually very low, especially in summer, as it's associated by a positive relationship with rain precipitation, and reverses flux with both evaporation and temperature. The highest rate of relative humidity in December was recorded at 23%. The prevailing trend in the study area was the Northwest winds followed by the southwest hot waves, which ranged from 12m/s in April to 6m/s in July. All these climatic factors of excessive temperature and slow wind speed and lack of relative humidity and low of rainfall to the nider in most months of the year led to high evaporation rates and water deficit in the study area, which adversely affected the wildlife and the biodiversity in the study area significantly led to the threat of life plants, animals, herbs and firstly affected the reptiles and amphibians.

**Table 2:** show the monthly rates of climatic elements and the annual total for region of Sawa-Euphrates period (2008-2018) from Al-Samawahclimate station.

Months	solar brightness	Temperature °C	Humidity %	Wind m/s	Rainfall mm	Evaporation mm
January	8	15	20	5	10	155
February	8.8	20	18	6	8	167
March	9.2	24	16	10	5	280
April	10	32	15	12	0	380
May	11	37	15	10	0	450
June	12.5	45	12	6.1	0	500
July	13	47	12	6.3	0	600
August	11.3	44	13	9	0	500
September	10.5	42	13	10	0	440
October	9	35	14	6	0	380
November	8.5	28	17	7	2	250
December	8.2	18	23	10	6	140

**The biodiversity:** The studies of Herpetofauna achieve principle information in biodiversity; moreover, it may consider the major part of it. In Iraq such studies in lowest rates compared to that of the surrounding countries. The study of reptiles requires effort and patience for long periods and accurate field follow-up in the wilderness as well as the availability of mobile possibilities and other



technical reasons. One of the most prominent authors in the field of Herpetofauna in Iraq is Khalaf<sup>3</sup>; the researchers of the center for research Museum of Natural History play the major role in recording and discovering reptiles and amphibians in Iraq by making the list. The list of Afrasiab and Ali<sup>26</sup> in south of Iraq was useful that recorded a list of snakes in Al-Rumaila. The most recent studies in this field were the Garstecki and Amr<sup>27</sup> whom studied the reptiles in Iraq and surrounding regions.

In this research the distribution of reptiles and amphibians in AL-Samawa city were investigated, by reviewing the old and new data as well as carrying out field work and study of material in the Natural history Museum of Iraq, as well as, many departments and colleges in various universities are discussed. Furthermore, various relevant websites in the Internet that are interested with amphibians and reptiles. The present search provides a list of most abundant amphibians and reptiles recorded from Sawa-Euphrates river region in Al-Samawah city from Iraq up to 2018 illustrated in **Table 1**, includes five families of reptiles and four families of amphibians, consist of twenty seven species distributed to seventeen species of reptiles and ten species of amphibians.

**Effects of thermal acclimation:** An experimental design for studying effects of thermal acclimation has been created, it enables to estimate the survival time, growth, and development of tadpoles, that found grown in streams coming from Al Atshan branch directing to Sawa Lake, in addition to those samples taken from nearest wells, collecting these samples-having 24-days age tadpoles (larvae) from their natural environments by using plastic jars in 1 letter size, from all random collecting points, and putting it in plastic barrels of 100 letter opened from the top, dammed, graduated by letters with mercury thermometer, putting in the same atmospheric conditions of the region. Ten barrels distributed by ( 2 barrels away 5 Km from the lake, 3 barrels in near the national salt-factor, 2 barrels in rocks- holding region and 3 barrels near Al-Atshan branch). Watching the barrels weakly and adding the nutrients which are mainly herpes, clay, and phytoplankton from the same sources by nets. Survival of larvae to metamorphosis is a major contributor to amphibian reproductive success, as is the ability of newly metamorphosed young to reach reproductive age and continue their life cycle<sup>11</sup>. Our experiments with Edible frog *Rana esculenta* larvae, Green toads *Bufo viridus*, and mediterranean tree frog *Hyla araboria* were conducted to control for all biotic and abiotic variables except temperature to provide the best prospects for survival, rapid development and large body size at metamorphosis, other types did not appeared in barrels experiments, may be due to the conditions of experiments that not in situ for them. The tadpoles rear found at 30°C were not significantly smaller than the 25°C group, but developmental time was longer and survivorship lower. Tadpoles successfully metamorphosed at 20°C, but many required >8 months for completion of development. Tadpoles were not able to reach metamorphosis at 15°C, but survivors completed metamorphosis when the temperature was increased to 25°C. Thus, the warmer temperatures that result from seasonal warming and the ability to swim to warmer water near the spring source appear to be important for reproductive success and must be considered in efforts to reintroduce these frogs to habitats in their historical range. Early stage tadpoles initially raised from 21 to 35°C rapidly became thin and were unable to progress through metamorphosis even when temperature was subsequently reduced to 25°C. The thermal history of early development can affect subsequent thermal tolerance, as has previously been shown for *R. pipiens* from Alabama<sup>23</sup>.

Samples have been taken in 500 ml volume for calculating number of growing tadpoles which indicates the survival time in specific temperature weakly by watch class, furthermore, recording the metamorphosis. Biomasses of tadpoles were calculated by drying up the samples and weighing out, **table (3)**. Survival was lower in the 30°C acclimation group than in 25°C group, and none of the tadpoles in the 35°C acclimation group reached metamorphosis. Owing to the lack of development at 15°C, rearing temperature was increased to 25°C over a 50 day period (15→25) to simulate an over-

wintering event show longer time to metamorphosis in the 20 and 30°C acclimation groups relative to the 25°C acclimation group.

**Table 3:** The effects of thermal acclimation on survival to metamorphosis, mass and metamorphosis, Values are given as the mean (range) number of days.

Temperature	Count	survival	Mass mg/ml	Development
10-15°C	40	60%	60±16	20%
15-20°C	60	85%	12000±80	80%
20-25°C	55	96%	5000±100	60%
25-30°C	35	66%	4400±75	10%
30->°C	0	-	-	-

Conservation efforts have been done to maintain the breeding and reintroduction into their native habitats. Successful reestablishment of these lizards and geckoes require continued reproduction in the face of multiple ecological conditions<sup>2613</sup>. The present study was designed to study the reptiles at their native dens by help some farmers and shepherds by flagging it as studying fields, paying for them to keep these dens a life by introducing a meals of dead rats and mice around to ensure that they don't far away from the holes. The periods of study extended from the time of hibernation until the disappearance time in the summer at July and August, through the development and reproduction time of spring. The eggs of Lizards were dragging out in order to distributed over three reproductive region in base of thermal, the cooler at the dens, the second at the margin of holes, the hottest outside; watching their by March and April to estimate their development and survival. It's formed a new pops by 70% inside the dens, and 40% success on the margin, while it's showed less than 10% outside. It's also recorded that the nutrition and growth of these reptiles have been varied effected by increasing the temperature; the diurnal types limited their movement on the morning tour up to 10 O'clock especially in hot waves. Increasing the temperature in hot summer clearly effected the number and types of Lizards and Geckoes in region besides the declining in their growth and development, it has noticed that increasing the number of chining to substitute their skin in year in response to high temperature. The most relevant types in this study werebelonging to families of Gekkanidae, Scincidae, and Agamidae.

The preliminary observations improved that survival at higher temperatures (e.g. 35°C) was rare at exposure to the higher temperature suggest that the developmental stages is also declined in the establishment of reintroduction protocols.

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**On line publication Date: 26.01.2019**