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Amphibians distribution and habitats in the southwestern region of Saudi Arabia

Abdulaziz R. Al-Qahtani^a, Awadh M. Al-Johany^{b,*}^a Department of Biology, College of Science, University of Bisha, P.O. Box 551, Bisha 61361, Saudi Arabia^b Department of Zoology, College of Science, King Saud University, P.O. Box 2455, Riyadh 11451, Saudi Arabia

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ABSTRACT

This study surveyed 205 wetland sites in the Southwestern Saudi Arabia. We found seven species of amphibians (Anura), which belong to four families: Bufonidae; which includes four species, *Sclerophrys tihamica*; *S. Arabica*, *Duttaphrynus dhufarensis*, and *Bufotes viridis*; Hylidae, represented by only one species, the tree frog *Hyla savignyi*; Ranidae, which represented by one species, *Pelophylax ridibundus* and finally the Dicroglossidae, represented by one species, *Euphlyctis ehrenbergii*. The reasonable amount of rain received in southwest Arabia, and habitat diversity contribute to the relative abundance of amphibians in the region. Five types of wetland habitats were found in the study area. Valley streams, irrigated farms, seasonal ponds, dam reservoir and lagoons of treated sewage water. The current study revealed the wide spread of amphibians in southwestern Saudi Arabia than what had been reported earlier and confirmed the presence of the *Bufotes viridis* at three new sites in Asir Heights. It also showed the wide spread of *S. arabica* in all types of habitats in the southwestern region of Saudi Arabia. Habitat degradation was evident in the region, which might lead to species loss.

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1. Introduction

Despite the geographical location of Saudi Arabia between the temperate and tropical regions and the variations in its climatic conditions, seven species of amphibians were found in Saudi Arabia, four of which are endemic species; (*Sclerophrys arabica*, *S. tihamica Duttaphrynus. dhufarensis*; *Euphlyctis ehrenbergii*), and three of which occur elsewhere in the Palaearctic region (*Bufotes viridis*, *Hyla savignyi*, and *Pelophylax ridibundus*, (Balletto et al., 1985). Few detailed studies have been conducted on the amphibians of southwestern Saudi Arabia (Balletto et al., 1985; Schatti and Gasperetti, 1994; Al-Qahtani, 2011). Although the Southwestern region receive a good amount of rain especially during spring and late summer (Abdullah and Al-Mazrui, 1998) but the quantity and periods are variable which make it hard for

amphibians to flourish in a good numbers in their habitats all year round.

During the last three decades, numerous changings happened in the southern region of Saudi Arabia, such as new roads, city expansions and habitats degradation. These changes have affected natural habitats, especially wetlands and other suitable amphibians habitats (Al-Obaid et al., 2017).

Little information are available about wetlands in Saudi Arabia, their status, role in conservation of different groups, and future changes due to global changes (Tinley, 1994; Newton, 1995; Al-Obaid et al., 2017).

All amphibian species in Saudi Arabia were listed as least concern (LC) in the international union for conservation of nature (IUCN) Red List 2018 (IUCN, 2018). But a big concern for *Bufotes viridis* which is restricted in only three locations in Sodah mountain. The southwestern region, as well as the rest of Saudi Arabia, does not have large fresh water habitats such as lakes, marshes, and rivers, but it does have small different natural and artificial aquatic habitats in the form of valley streams, irrigated farms, dam reservoirs, seasonal ponds and lagoons of treated sewage water which are suitable sites for a number of species of amphibians. Although, Balletto et al. (1985) study was the first comprehensive survey of amphibians of southern Saudi Arabia, the distribution of amphibians seems to be wider than what had been

* Corresponding author.

E-mail address: ajohany@ksu.edu.sa (A.M. Al-Johany).

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reported. The main objective of this study was to determine the various habitats and shed some light on the wider distribution of amphibian in southwestern Saudi Arabia and the importance of wetland conservation as essential habitats for amphibians in the arid region.

2. Material and methods

2.1. The study area

The study area was located in the southwestern region of Saudi Arabia. It consist of five provinces: Jazan, Najran, Asir, Al-Baha, and Makkah province (Fig. 1.). It is bounded by the Red Sea on the west, and Asir escarpment which runs parallel to the Red Sea coast, approximately 70–100 km inland. The western slope of Asir escarpment is very steep, while the area to the east of the escarpment is characterized by large catchments with a mild slope (Abdullah and Al-Mazroui 1998). On the east, the study area is bounded by the Najd Plateau and the Empty Quarter. The Hijaz Plateau bounds the region from the north. The mean monthly

temperature in Tehama coast during winter was 23–34 °C, and 31–41 °C during summer. While it was 07–18 °C in winter and 17–30 °C in summer in the mountainous area of the study region (Al-Qahtani, 2011). The mean rainfall in the high mountain of the study area during the period 1998–2009 was 142.6 and 229.2 mm/y for Al-Baha and Abha, respectively. While it was 60.4 and 128.6 mm/y for the coastal area of Najran and Jazan respectively (Al-Mazroui, 2011).

2.2. Methodology

Amphibian distribution was determined by visiting wetland sites from summer through fall and continued during rainy season in the year 2008–2010. Different methods of surveys and capture were used to record amphibian species in the study region, such as travelling on foot and recording calls of different species during breeding season. Species were captured either by hand or by net. Records of previous known sites were also used to check their continuous presence. All wetland sites were determined by global positioning system (GPS) unit (Garmin international Inc. Olathe, Kansas, USA). All types of wetlands found in the study area were

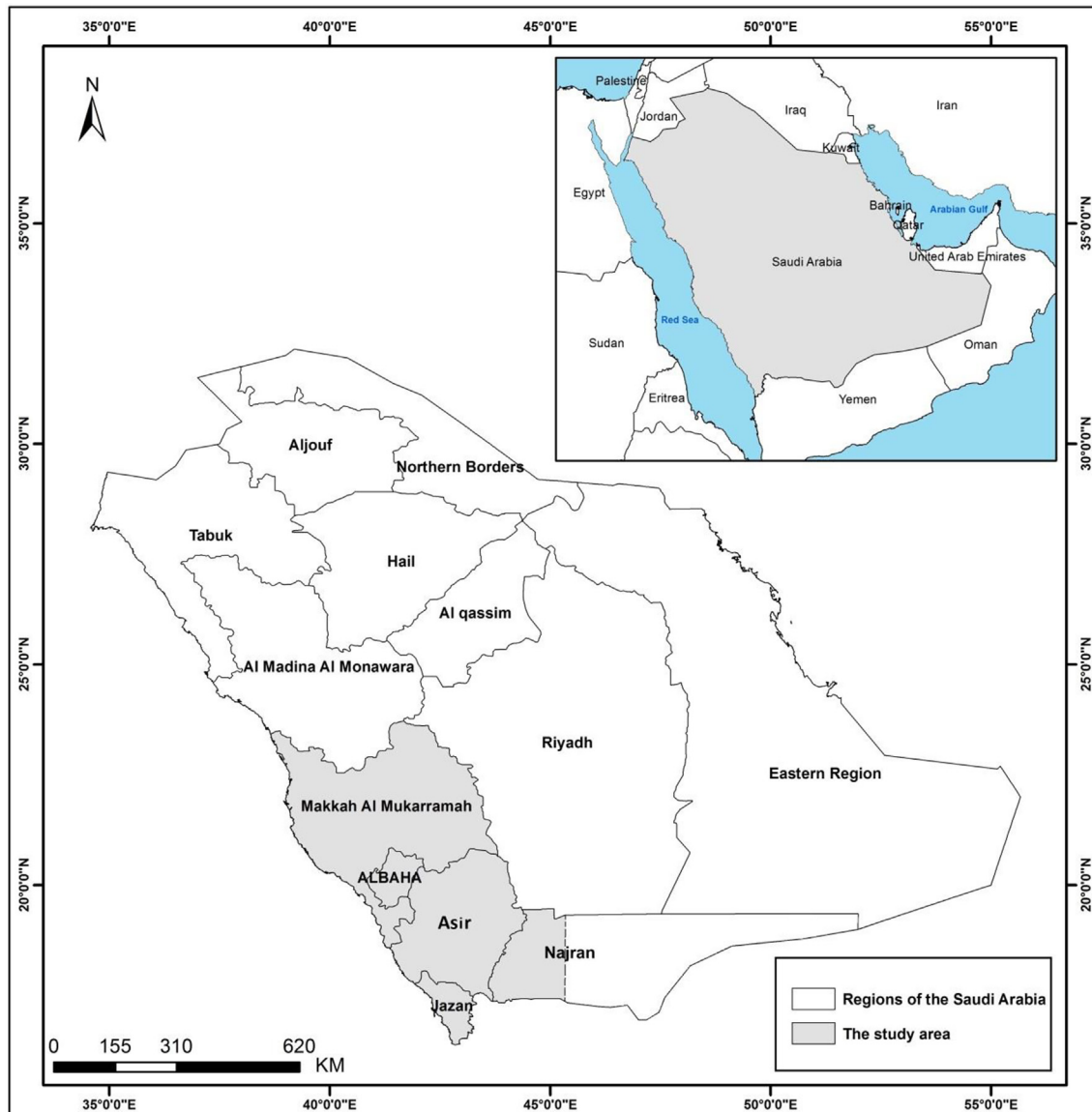


Fig. 1. Study area, showing Makkah, Al-Baha, Asir, Jazan, and the Western part of Najran province.

described and searched. Specimens were identified using [Balletto et al., \(1985\)](#) key. Wetland sites with or without Amphibians were plotted using a geographic information system program (ESRI. Saudi Arabia Ltd, Riyadh, Kingdom of Saudi Arabia). All samples collected were deposited in Zoology Dept. College of Science, King Saud University, Riyadh, Saudi Arabia.

3. Results

In this study we surveyed a total of 205 wetland sites. We found five types of wetland's habitats ([Tinley, 1994](#)) in the southwestern region of Saudi Arabia such as valley streams; seasonal ponds formed after rain; dam reservoirs, irrigated farm, and lagoons of treated sewage water around large cities. Amphibians were found at 197 sites out of the 205 sites ([Table 1](#)).

We found most amphibians occupies valley stream habitats (48.8%), followed by irrigated farms and dam reservoirs (21.0% and 19.5%, respectively). No Amphibians were found in treated sewage water in these habitats. All seven species of Amphibians found in Saudi Arabia were present in the study area ([Fig. 2](#)).

S. Arabica, the Arabian toad: We found *S. arabica* spread all over the study area (41.3% of all sites, [Table 1](#), [Fig. 3](#)) hence, it was the most abundant of all seven species present in the study area. It was found mainly in valley streams, and we also observed the species in 40 out of 84 sites of habitat types. No specimen was found in treated sewage water lagoons. This species was also found in dam reservoir and irrigated farms (17 and 15 sites respectively). The elevation range was 60–2500 m above sea level.

D. dhufarensis, Dhofar toad: This species was observed mainly in irrigated farms (It was found in 11 out of 17 sites). It was also found in valley streams (5 sites), and dam reservoir (One site) ([Fig. 3](#)). The species was wide spread in distribution from Jazan in southern Saudi Arabia to north of Makkah province. Occupied sites were between 55–700 m above sea level.

S. tihamica, Tihama toad: This species was found mainly in Tihama strip where it commonly existed along the coastline of the Red Sea from the southern region of Jazan province till near Al-Leeth area at latitude N 21 00, and the species was not registered in interior areas, since it has not been recorded far from the coastal areas. The species was observed in fourteen sites out of 15 of irrigated farms, and one specimen was found in dam reservoir. All occupied sites were in low range, 13–200 m above sea level ([Fig. 3](#)).

B. viridis, the green toad: This species was the least abundant of all toads in the study area ([Fig. 3](#)). It was found in only three sites in Sodah Mountain 25 km northwest of Abha City. Two sites were in dam reservoir and one in close irrigated farm. No one had reported the presence of this species since the study of [Balletto et al. \(1985\)](#).

This species found to occupy high altitude, where all sites were above 2500 m above sea level.

P. ridibundus the marsh frog: The distribution of this species was limited to only 11 sites ([Fig. 4](#)), six of them were from valley streams, and another four sites were from dam reservoirs, and one site was from seasonal pond. We found *P. ridibundus* in north Al-Baha, about 150 km north of Nimas city. *P. ridibundus* distribution reached only 5.4% of all sites where Amphibians found in the study area. This species occupy habitats range between 2000 and 2600 m above sea level.

E. ehrenbergii, the skipper frog: This species was the second species in terms of abundance after *S. arabica* in the study area. It was found in 45 sites out of 197 sites of the surveyed sites, with an average of 22.2% of all sites. It was found in all five provinces studied ([Fig. 4](#)). The preferred habitat was valley streams, where it was usually seen skipping on the water service. The distribution of the species reaches N 21 00 latitude. Most sites were at low level and range from 40 to 1400 m above sea level.

H. savignyi, the tree frog: This green frog was found in high altitude in Asir and Al-Baha provinces. The species usually found on plants around streams (8 sites), and dam reservoir (10 sites), and less abundant around seasonal ponds. We found the species in 10.8% of the studied sites, and the species was absent in Jazan and Najran provinces. This species prefer high altitude and usually found in sites between 1350 and 2637 m above sea level ([Fig. 4](#)).

4. Discussion

Since the study of [Balletto et al. \(1985\)](#), no comprehensive survey of amphibian of southern Saudi Arabia was done. The contribution of [Schatti and Gasperetti \(1994\)](#) was a list of 61 taxa of the herpetofauna of the region. They concentrated on the status of some agamids and snakes, and reported only three of the seven amphibians in southern Saudi Arabia.

[Balletto et al. \(1985\)](#) work relied mainly on visits of John Gasperetti to the southwestern region of the Kingdom, and on visits of Balletto and Cherchi to Yemen during the period from 1968 to 1984 during which they made several research on Yemen and the Africa's Horn amphibians. Many of their sites were based on museum collections made by different collectors.

This study covered large number of possible amphibian habitats (205 sites), especially on the eastern and northern parts of Asir mountains compared to [Balletto et al. \(1985\)](#) study which covered only 83 sites. The other important finding was the types of habitat occupied by each species of amphibians in the southern region of Saudi Arabia. The peculiar habitat we found in southern Saudi Arabia, was valley stream, which supported around 48.8% of all sites occupied by the seven species. This type of habitat was wide

Table 1
Number of sites where amphibians were found and were not found and percentage of total sites, in the five habitat categories in southwestern region study area. (Number in brackets are total sites studied by [Balletto et al., 1985](#)).

Species/Total	Valley stream	Seasonal ponds	Dam reservoirs	Irrigated farms	Lagoon of treated sewage water	Total sites	Percentage of all sites
<i>S. arabica</i>	40	12	17	15	–	84 (29)	41.3%
<i>D. dhufarensis</i>	5	–	1	11	–	17 (17)	8.3%
<i>S. tihamica</i>	–	–	1	14	–	15 (3)	7.3%
<i>B. viridis</i>	–	–	2	1	–	3 (6)	1.5%
<i>P. ridibundus</i>	6	1	4	–	–	11 (6)	5.4%
<i>E. ehrenbergii</i>	39	–	4	2	–	45 (8)	22.0%
<i>H. savignii</i>	8	4	10	–	–	22 (14)	10.7%
Total Sites with Amphibians	98	17	39	43	–	197(83)	–
Sites with No Amphibians	2	–	1	–	5	8	3.9%
Total All Sites	100	17	40	43	5	205	100%
Percentage of Total Sites	48.8%	8.3%	19.5%	21.0%	2.4%	100%	

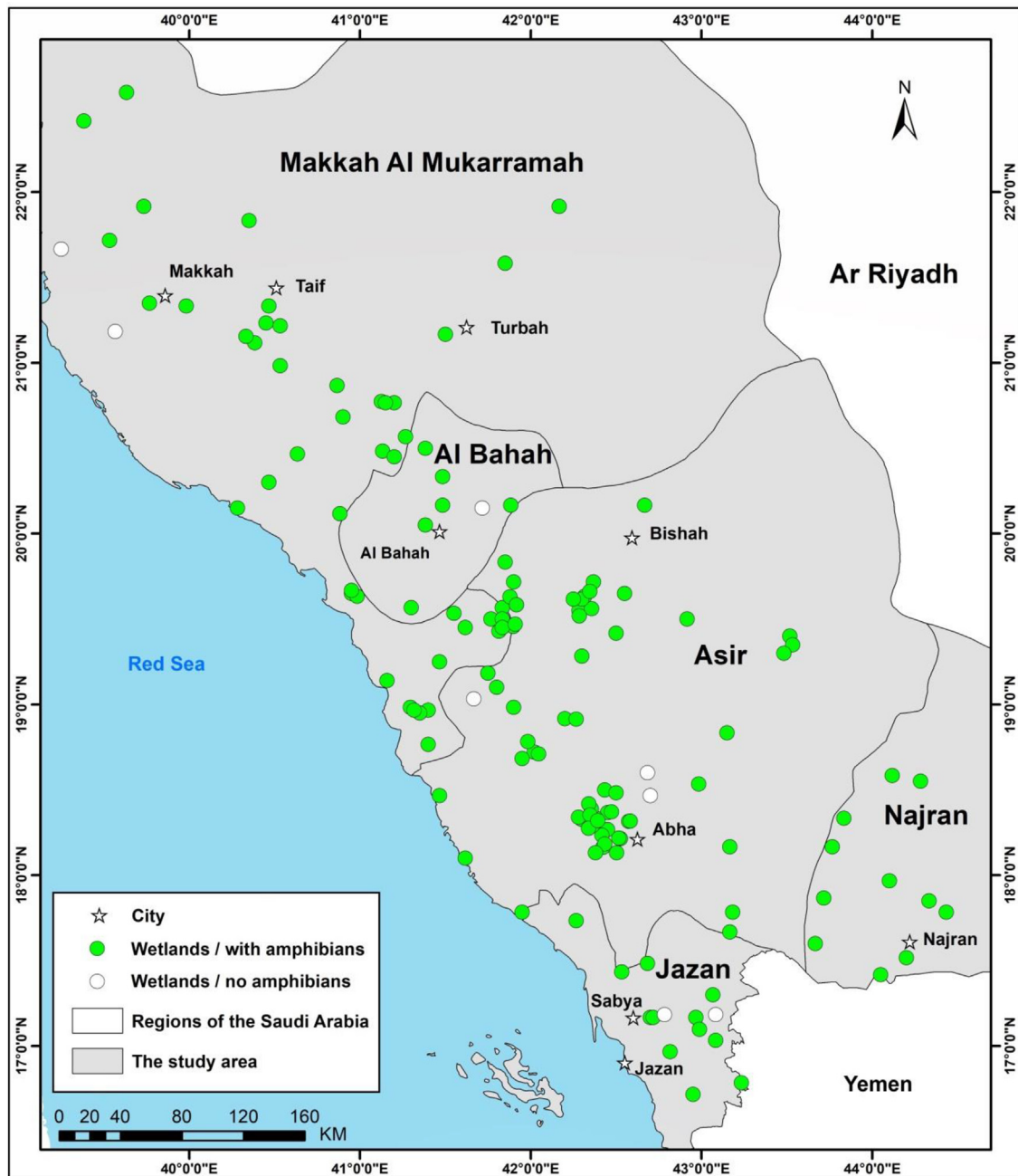


Fig. 2. Distribution of wetland sites in the study area for all seven species. Closed sites are sites where we found amphibians, open circles are sites where no amphibians were found.

spread in the study area probably because the amount of rain received each year and the topography of the study area.

Also this study showed a wide spread of amphibians in the southwestern part of the kingdom in four of five wetlands type in the southern region, mostly in Tihama region and South Western highlands, while the spread was less intensity in the internal plateaus habitat. In southern Saudi Arabian habitats, we found *S. arabica* have a wide spread distribution (41.3% of all sites) followed by *E. ehrenbergii* (22.0%) and the least abundant was *B. viridis* (1.5% of all habitats) which we consider as a big threat to this species.

The common type of habitat occupied by all species was valley streams (48.8%), followed by dam reservoir and irrigated farms, and finally seasonal ponds and none on lagoons of treated sewage water.

S. arabica was found to be the more widespread amphibian species in the study area, where it has been recorded in large areas in Tihama, the south-western highlands series, the interior highlands. Also, it has been recorded in new areas of southwestern part of the kingdom, not mentioned in previous studies just like Tihama, north Najran area, northeast Asir, and for the first time in Al-Khorma area, about 200 km east of Taif. The wide spread of *S. arabica* was reported in other habitat in Arabia (Balletto et al. 1985, Al-Qarni, 2011; Soorae et al. 2013, Al-Johany et al., 2014).

D. dhufarensis was found in three provinces in the study area; Jazan, Asir, and Makkah, and was not found in Al-Baha and Najran provinces. The distribution was in mountainous habitats mainly in irrigated farms and valley streams. Soorae et al. (2013) also found *D. dhufarensis* in mountainous habitat and valley streams.

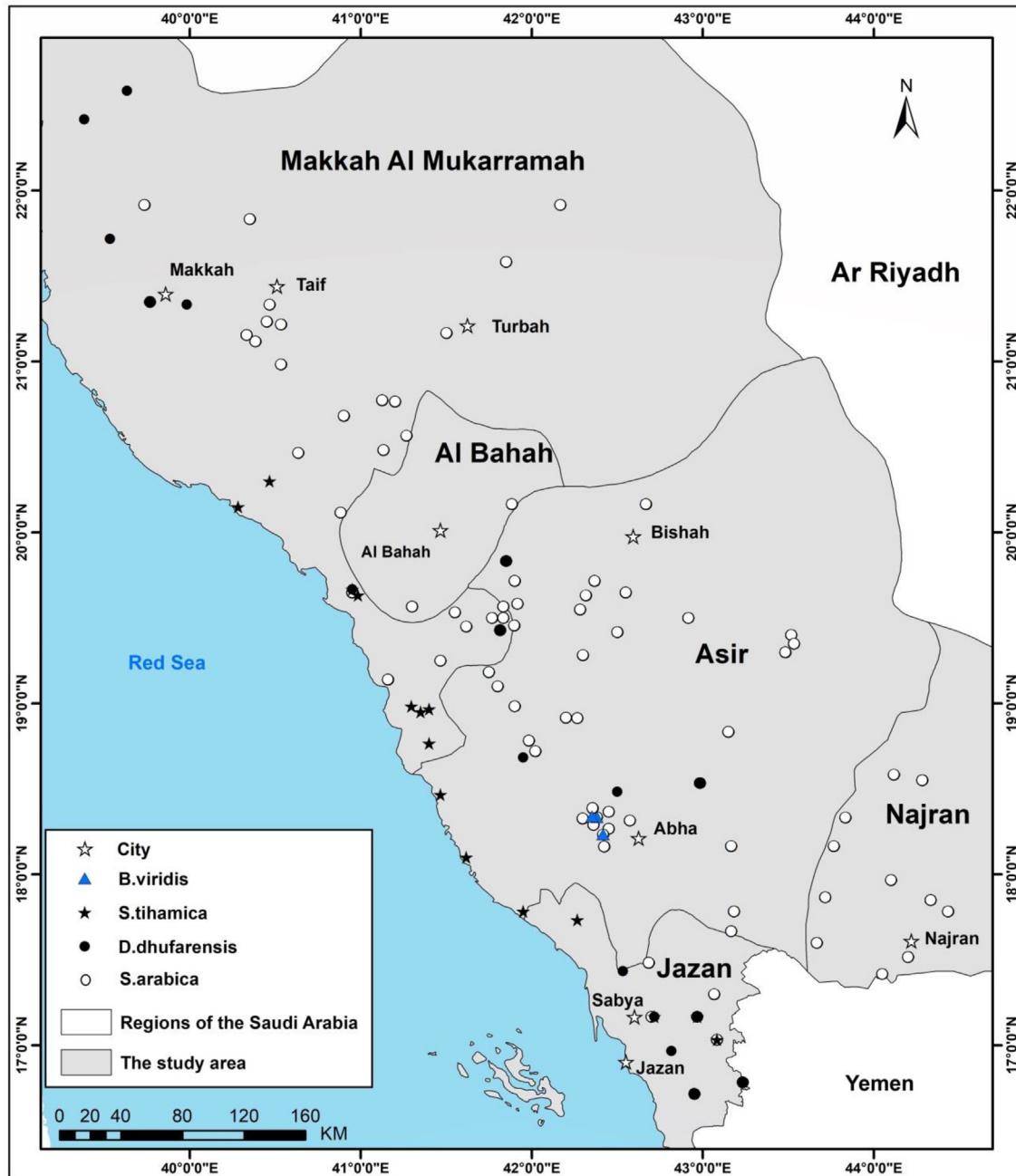


Fig. 3. Locations of sites surveyed where we found *B. viridis*, *S. tihamica*, *D. dhufarensis*, *S. arabica* in the study area.

Al-Johany et al. (2014) also found *D. dhufarensis* in similar habitats in central Saudi Arabia, and they inhabit the same elevation.

Although the presence of *D. dhufarensis* was not large in southern region of Saudi Arabia, the species was widely spread in Arabia habitats (Balletto et al., 1985, Soorae et al., 2013, Al-Johany et al., 2014).

As indicated by Balletto et al. (1985) that *S. tihamica* is restricted in distribution to the Tihama coastal land. This study confirmed the distribution of this species at the coastal area and no specimen were found in high land habitats. *S. tihamica* was not found neither in central Saudi Arabia (Al-Johany et al., 2014) nor in the eastern coast of Saudi Arabia (Balletto et al. 1985, Al-Osaimi, 2016).

This study also confirmed the finding of Balletto et al. (1985) that *B. viridis* is restricted to few locations in Southern region. They found the species in one location in Al-Sodah Mountain and in

three locations in Al-Nimas area about 150 km north. In this study we found the species only in three locations in Al-Sodah Mountain, and it was absent from Balletto et al. (1985) previous locations. We found these locations almost dry and no amphibians were found. Farag and Banaja, (1980) and Schatti, and Gasperetti (1994) were unable to record the existence of *B. viridis* in this region. This situation may indicate that the distribution of this species is very limited in term of habitats and number and should be listed as near threatened (NT) in the IUCN Red List.

According to the previous studies, *P. ridibundus* distribution in the southwest of the Kingdom was restricted to central and southwest Sarawat Mountains and the maximum point of spread for this species was Northern Nimas area (Balletto et al., 1985). We found the distribution expanded around 150 km further North of Al-Nimas. *P. ridibundus* is limited to valley streams, dam reservoirs,

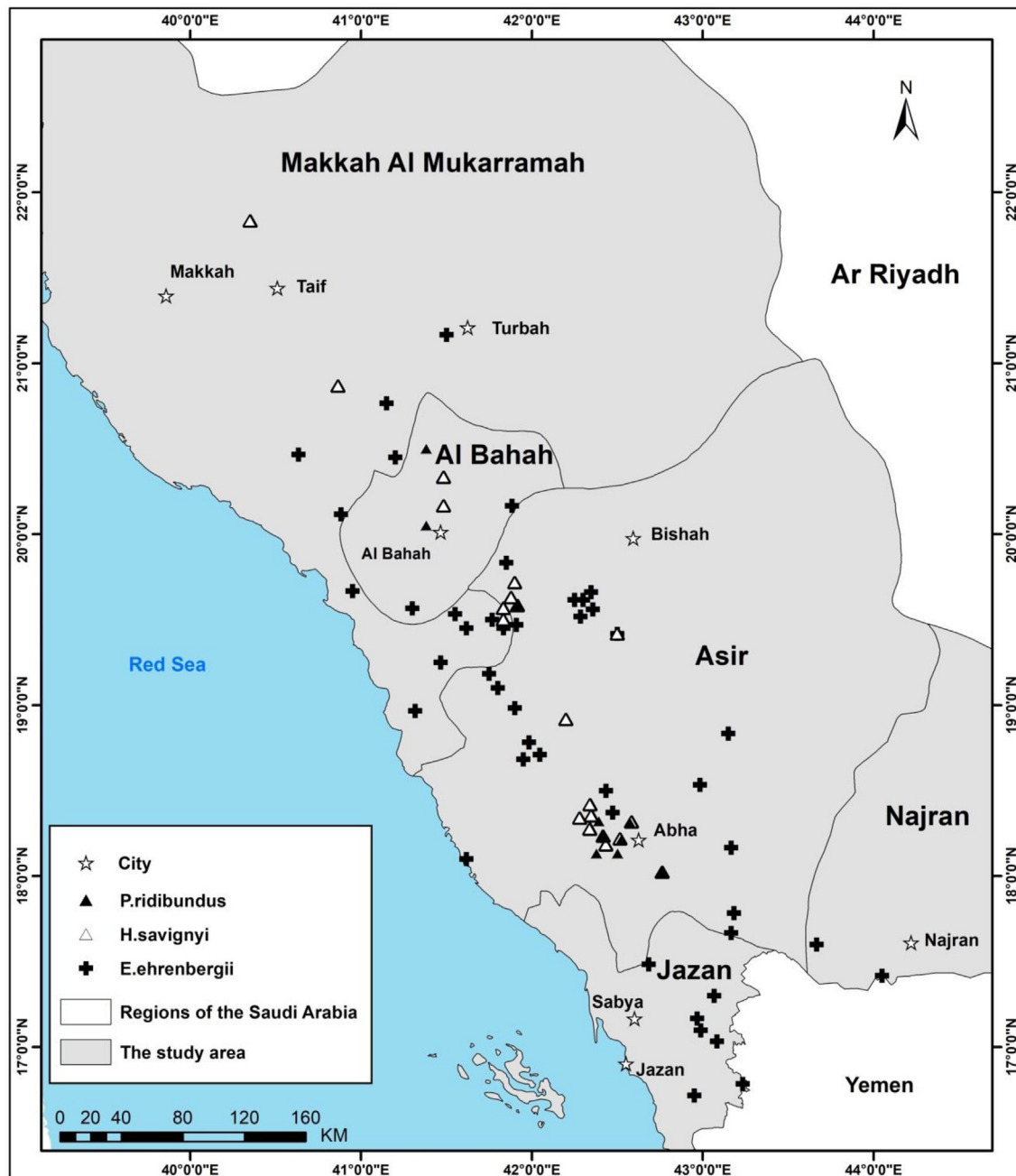


Fig. 4. Locations of sites surveyed where we found *P. ridibundus*, *H. savignyi*, and *E. ehrenbergii* in the study area.

and seasonal ponds, and none in irrigated farms and treated sewage water lagoons. The limited distribution of *P. ridibundus* was reported by Al-Johany et al. (2014) in central Saudi Arabia. Al-Osaimi, (2016) found *P. ridibundus* in many habitats in Al-Hassa and Al-Qatif area. This is due to the availability of water springs and ponds in the area. *P. ridibundus* is Palearctic relict from Europe, Africa, central and western Asia. *P. ridibundus* live in three different geographical areas; in Southwestern highlands (Balletto et al., 1985) central regions of the Kingdom (Al-Johany et al., 2014), and the third area in the eastern Saudi Arabia in Hofuf, Dhahran and Qatif areas (Briggs, 1981, Al-Osaimi, 2016). These areas are different in terms of elevation, climatic conditions and isolated from each other.

The distribution of *E. ehrenbergii* was the second largest in the southern region. It was found in all five regions of the study area and in all types of habitats except lagoons of treated sewage water.

Farag and Banaja (1980) and Balletto et al. (1985) also indicated the wide spread of the species in the southern region. *E. ehrenbergii* prefer low land habitats (40–1400 m) especially valley streams with good amount of water. The presence of *E. ehrenbergii* in Riyadh (Balletto et al., 1985) is doubtful since no other study confirmed its occurrence (Al-Johany et al., 2014).

The tree frog *Hyla savignyi* distribution linked with Sarwat Mountains series. *H. savignyi* dominates most habitats in the study area; it is commonly found in large aquatic habitats such as valley streams and dam reservoir. The southwestern high land has the appropriate temperatures for *H. savignyi* to live and reproduce in large numbers which enabled them to survive in this region (Balletto et al., 1985).

This comprehensive study came after about 3 decades of Balletto et al. (1985) study, and it confirmed the general trend of amphibian's distribution in the southern regions of Saudi Arabia,

with more abundance than what has been reported in previous studies. This study found a notable change of *B. viridis* habitats. Most sites of Balletto et al. (1985) in Northern Asir and Al-Baha were dry with no *B. viridis*.

The relative amount of rain and low temperature were the main reasons for the diverse types of habitats in the southern region of Saudi Arabia. These factors help in wide distribution of amphibians species in the region. On the other hand, many habitats were affected by new development, such as pollution caused by pesticides (Al-Qahtani, 2011), buildings expansion around cities and road construction, and most important by climate change (Al-Obaid et al., 2017). All these factors caused dramatic loss of amphibians habitats, and hence their abundance in particular areas. Urgent work is needed to conserve all types of wetlands in Saudi Arabia in order to conserve the few species in this fragile habitats.

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