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New distribution notes for terrestrial herpetofauna from Morocco

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Abstract. Additional data on the distribution of terrestrial herpetofauna from Morocco are presented, based on fieldwork carried out in March and May 2008. Thirty-eight species were recorded from 78 localities. Some of these represent considerable range extensions for the species, indicating that more prospection is needed to complement the existing knowledge of herpetofauna from this country.

Key words: Distribution, Morocco, reptiles, amphibians

Morocco covers an area of over 400,000 km² in Northwest Africa, and has the highest diversity of herpetofauna in the Western Mediterranean region. Together with Tunisia and Algeria it forms the Maghreb, a well defined biogeographic entity. Including a wide variety of habitats, from Saharan through to Mediterranean, Morocco also has four large mountain ranges – the Rif, Middle, High and Anti-Atlas – that support this diverse fauna. Bons and Geniez (1996) accepted 104 species of which 22% were endemic. Several taxa have been shown to be species complexes since then, and formally split (e.g. Wade 2001). Phylogeographic analyses of herpetofauna from this region, whilst not as extensive as those for European fauna, are becoming more common and indicate that many of the widespread species may also represent species complexes (e.g. Harris et al. 2004, Perera et al. 2007, Carranza et al. 2008, Paulo et al. 2008, Kapli et al. 2008). Although the distribution of many species is relatively well known, for example through the detailed maps from Bons and Geniez (1996), recent notes have reported concsiderable range extensions for several species (e.g. Fahd et al. 2008, Harris et al. 2008), indicating that more fieldwork is necessary to precisely delimit the ranges of many species and subspecies. Here we report the findings of two trips to Morocco, carried out in March and May 2008, both of approximately 2 weeks. A total of 78 localities were sampled (Fig. 1 and Table 1). Whenever a species was observed the coordinates were marked with a GPS. Thirty-eight species of amphibians and reptiles were recorded. Details on the species observed per locality can be found in Appendix 1. Where these are of particular interest, more details are given.

Regarding members of the family Gekkonidae, six different genera were recorded, of which the most common was *Tarentola*. *Tarentola chazaliae* (Mocquard, 1895) was found at two localities (73 and 77). Locality 77 represents one of the most inland populations known for this species, which is generally found only within 25 km of the Atlantic coast (Fig. 2a). *Tarentola mauritanica* (L., 1758) is reported from 17 localities (1, 2, 6, 9, 12, 19, 21, 50, 54, 55, 58, 60, 61, 64, 65, 66 and 77). Al-

Table 1. Localities sampled in the present study. Coordinates are given in WGS84 coordinate system. Location of the sites is represented in Fig.1.

Locality no.	Y coord	X coord	Locality	Region
1	32,525750	-7,862770	Semda	Soukkane
2	32,661010	-7,792980	Chouga	Sidi el Bettach
3	32,609980	-6,282078	Souk-el-Arba	Oued-Zem
4	33,134920	-6,665773	Chênes-Lièges	Rommani
5	33,777550	-7,232630	Bouznika	Bouznika
6	33,956250	-6,850730	Agdal Riyad	Rabat
7	34,024930	-6,717120	Oulad Yakoub	Lalla Hjida
8	34,231310	-6,586040	Kenitra	Kenitra
9	34,208002	-5,691368	Défilé	Sidi Kacem
10	33,548250	-5,326320	Paysage d'Ito	Azrou
11	33,419000	-5,178410	Forêt de Cèdres	Azrou
12	33,159840	-5,065807	Foum Kheneg	Timhadite
13	32,897933	-5,009975	Boulôjoul	Itzer
14	32,579472	-4,855717	Cirque de Jaffar	Jbel Ayachi
15	32,540568	-4,939278	Cirque de Jaffar	Jbel Ayachi
16	32,516782	-5,085085	Tizi-n-Zou	Jbel Ayachi
17	32,442207	-5,988688	Ben-Cherro	Beni-Mellal
18	32,138935	-6,399093	Bin-El-Ouidane	Afourer
19	32,302662	-5,327832	Anefgou	Jbel Iouigharacene
20	32,174810	-5,485892	Plateau des Lacs	Imilchil
21	32,132762	-5,304883	Âit-Taddert	Jbel Alderdouz
22	32,142608	-5,363350	Outerbate	Jbel Alderdouz
23	32,035310	-5,467450	Agoudal	Agoudal
24	31,954770	-5,477080	Agoudal	Agoudal
25	31,801840	-5,466980	Âit Hani	Âit Morrhad
26	31,621420	-5,560500	Todra Gorges	Todra Gorges
27	31,515300	-5,501340	Tinerhir	Tinerhir
28	31,088427	-5,311053	Imi-n-Ouzrou	Bou Gafer
29	30,920678	-5,820107	Nekob	Jbel Sarhro
30	30,995862	-5,816240	Imi-n-Site	Jbel Sarhro
31	30,721920	-6,603030	Aat Saoun	Tansifte
32	30,568290	-6,737910	Tasla	Tansifte
33	30,391810	-6,881710	Talat	Ouisselsate
34	30,175790	-6,875410	Treyfia	Cercle de Ouarzazate
35	31,032400	-7,193380	Tadoula n'Oumrar	Ait Zineb
36	31,112200	-7,312900	Tisseldea	Amerzgane
37	31,129383	-7,343842	Tizirine	Agouim
38	31,308308	-7,368473	Imouzer-des-Glaoua	Tizi-n-Titchka
39	31,302953	-7,395443	Aguelmous	Tizi-n-Titchka
40	31,300025	-7,398088	Aguelmous	Tizi-n-Titchka
41	31,300765	-7,409835	Aguelmous	Tizi-n-Titchka
42	31,197070	-7,446030	Zaouia Imskene	Ighrem N Ougdal
43	31,290860	-7,381420	Immouzer	Zerkten
44	31,371660	-7,398700	Tilnif	Zerkten
45	31,303150	-7,397243	Aguelmous	Tizi-n-Titchka
46	31,204260	-7,867047	Oukaïmeden	Oukaïmeden
47	30,705080	-6,490085	Near Agdz	Agdz
48	30,789937	-7,585535	Tizi-n-Melloul	Jbel Siroua
49	30,789737	-7,584449	Tizi-n-Melloul	Jbel Siroua
50	30,780838	-7,643560	Tizi-n-Tleta	Jbel Siroua
51	30,742860	-7,609675	Jbel Siroua	Jbel Siroua
52	29,452260	-8,059750	Adis	Adis
53	29,369770	-8,199280	Oum el Alek	Akka
54	29,042220	-8,781800	Icht	Ait Ouabelli
55	30,058480	-9,087210	Imi El Had	Cercle de Taroudant
56	30,027700	-9,052010	Biougra	Hilala
57	29,949940	-9,010390	Tifrhelt	Tizi Ntakoucht
58	29,890870	-9,004670	Tioulit	Tioulit
59	29,806200	-8,892920	Imi n'Tanout	Ida Ougnidif
60	29,743450	-8,961100	Taddart	Ammelne
61	29,701700	-8,965460	Aguerd n'Doudad	Tafraout
62	29,512050	-9,062280	Igli	Igli
63	29,580150	-9,395630	Tirhmi	Tighmi
64	29,596260	-10,027530	Mirleft	Arbaa Sahel
65	29,482340	-10,087290	Sidi Mohand Ou Sourou	Mirleft
66	29,376700	-10,159440	Idufkir	Sidi Ifni
67	29,181030	-10,092820	Id Buthaiet	Imi N Fast
68	28,963530	-9,998710	Asrir	Guelmim
69	28,890680	-9,777140	Taouirt Doubiane	Fask
70	28,830690	-9,559100	Targoumaat	Fask
71	28,685840	-9,319120	Assa	Assa
72	28,543880	-10,956740	Tafnidilt	Tan-Tan
73	28,547600	-10,966120	Tafnidilt	Tan-Tan
74	28,485760	-11,341650	Tan-Tan Plage	Tan-Tan
75	28,269270	-11,210670	Dar Chebika	Tan-Tan
76	27,972640	-11,404200	Abteh	Abteh
77	27,873370	-11,488630	Abattekh	Abteh
78	28,027650	-11,356780	El Khaloua	Tan-Tan

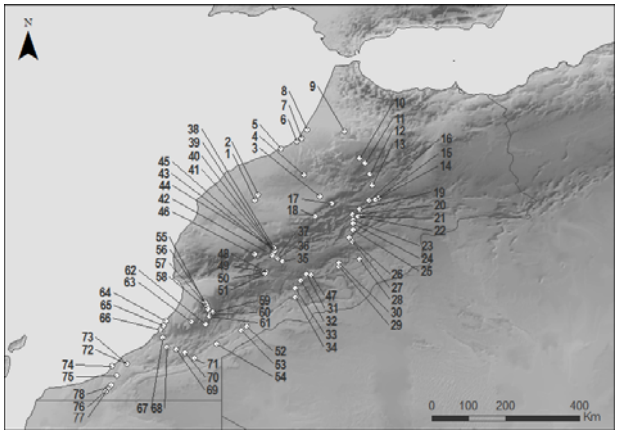

Figure 1. Map of the study area and principal localities sampled (see table 1 for more details).

though two subspecies have been described in Morocco (Bons and Geniez 1996), these do not correspond with genetic differentiation (Harris et al. 2004, Rato et al. 2010), and thus pending more detailed investigations all were recorded only as *T. mauritanica*.

Similarly *Ptyodactylus oudrii* Lataste, 1880 (Localities 25, 28, 36, 37, 56, 59, 60 and 70) appears to be a species complex (Perera and Harris 2010), but currently distinct lineages can only be identified using genetic markers. *Quedenfeldtia trachyblepharus* (Boettger, 1874) and *Quedenfeldtia moerens* (Chabanaud, 1916) were both found at five different localities (21, 41, 46, 50, 51 and 23, 25, 26, 56, 61 respectively). Many of the localities recorded for *Quedenfeldtia* in the region around Jebel Sirwah from Bons and Geniez (1996) are of undetermined species, due to the two species of *Quedenfeldtia* being widely confused prior to the work of Arnold (1990). Our findings confirm that *Q. trachyblepharus* is found in this region (localities 50 and 51). *Saurodactylus brosseti* Bons & Pasteur, 1957 was another widespread species found at 15 localities (1, 2, 18, 26, 55, 56, 57, 59, 60, 62, 63, 64, 65, 72 and 78; Fig. 2b). Locality 26 considerably extends the range of *S. brosseti* by more than 100 km from the nearest previously known populations, and is also one of the few known localities on the southern side of the Atlas Mountains. Recently reported new localities for both *S. brosseti* and *S. fasciatus* (Harris et al. 2008 and this manuscript) indicate that there are more areas where these two species are found within a few kilometres of each other (Fig. 2b). *Stenodactylus sthenodactylus* (Liechtenstein, 1823) were noted at two localities (27 and 74). Locality 27 extends the range of *S. sthenodactylus* more into the foothills of the High Atlas Mountains (Fig. 2c). Several individuals were observed here active at night, in a flat scrub area near the road.

Following the revised taxonomy of Arnold et al. (2007), seven genera of the family Lacertidae were recorded, including three species of *Acanthodactylus* (*Acanthodactylus aureus* Günther, 1903, *Acanthodactylus boskianus* (Daudin, 1802) and *Acanthodactylus erythrurus* (Schinz, 1833)), *Timon tangitanus* (Boulenger, 1881), *Psammodromus algirus* (L., 1758) and *Mesalina guttulata* (Lichtenstein, 1823). *Scelarcis perspicillata* (Dúmeril & Bibron, 1839) was identified at three localities (12, 46 and 51). These corresponded to the *chabanaudi* (localities 12 and 46) and *perspicillata* (locality 51) forms, although subspecies do not always correspond to genetic

lineages in this apparent species complex (Perera et al. 2007). *Atlantolacerta andreanskyi* (Werner, 1929) was found at three localities (41, 46 and 50). This species is endemic to the High Atlas mountains, between 2000 and 3800m, and has quite disjunct populations. Although localities 46 and 50 are close to previously reported localities, they both represent new populations, indicating that *A. andreanskyi* may be found in more high-mountain valleys given additional prospection effort in this rarely-visited region. *Podarcis vaucheri* (Boulenger, 1905) is reported from localities 12, 14, 15, 19, 21, 23, 25, 38, 39, 40, 43, 45, 50 and 51. *Podarcis vaucheri* represents a species complex in North Africa (Pinho et al. 2006, Lima et al. 2009), and in Morocco includes a highly genetically divergent lineage in Jebel Sirwah, locality 51

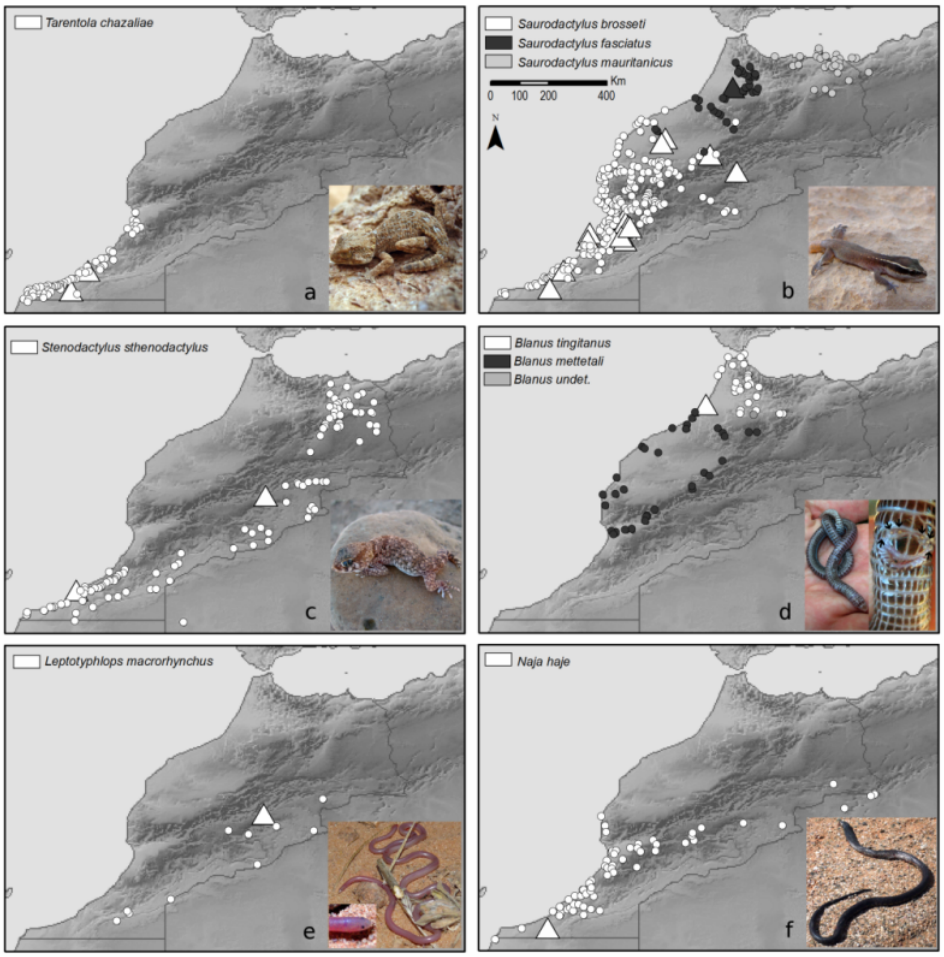

Figure 2. Distribution maps and pictures of some of the species found. Small dots represent previous published records (Bons and Geniez 1996, Harris et al. 2008) and triangles represent the new localities reported. All inset pictures are individuals captured during the field trip. In b) the inset picture corresponds to the individual of *S. brosseti* from locality 26; in d) the image corresponds to the *B. tingitanus* specimen found in locality 8 (see text for more details).

(Pinho et al. 2006). Localities recorded here near Jebel Sirwah, for example locality 50, may represent this "entity", but this remains to be confirmed with genetic markers.

Three species of skinks (Family Scincidae) were recorded. The finding of *Chalcides manueli* Hediger, 1935 at locality 51 is particularly interesting. This population was quite abundant, with several specimens observed along a stream on the Jebel Sirwah mountain. This considerably extends the range of *C. manueli* to the East. At the same time this species was not previously known from altitudes above 256m (Bons and Geniez 1996), while this location is above 2000m. Although *C. montanus* have previously been reported from near this area, the identification as *C. manueli* was confirmed using DNA sequencing (unpublished result). Given the degree of genetic distinctiveness of *P. vaucheri* from this area (Harris et al. 2002, Pinho et al. 2006), and the complex genetic patterns observed in several *Chalcides* species (Carranza et al. 2008) this population clearly deserves to be further studied. *Chalcides lanzai* Pasteur 1967 was found only at locality 11. Considered a subspecies of *C. montanus* until recently, it is currently accepted as a full species (Carranza et al. 2008), being restricted to the high Plateaux of the Middle Atlas. The only other species of skink noted was *Eumeces algeriensis* Peters, 1864, at localities 18 and 63.

Representatives from both families of amphisbaenia known from Morocco were observed. *Trogonophis wiegmanni* Kaup, 1830 (family Trogonophidae) was found at locality 10. *Blanus tingitanus* Busack, 1988 (family Blanidae) was found at locality 8. This endemism is easily recognized from the other species of the same genera present in Morocco, *B. mettetali*, by the number of preanal pores (5-6 in *B. tingitanus* and 8 or more in *B. mettetali*; Busack 1988). Locality 8 extends slightly the southwestern distribution limit of this species (Fig. 2d).

Nine species of snakes were identified, belonging to nine different genera and four different families. From the family Leptotyphlopidae, *Leptotyphlops macrorhynchus* (Jan, 1861) was found at one locality (27). Although widespread in North Africa, in Morocco this unmistakable snake was first recorded only in 1957 (Pasteur and Bons 1957), and only 10 observations have been made to date (Bons and Geniez 1996). This specimen was found at night under a small rock in flat scrub land near a road, along with several *S. sthenodactylus* (Fig. 2e). Five species traditionally assigned to the family Colubridae were found (although alternative taxonomies exist, as noted in Speybroeck et al. 2010). The individual of *Psammophis schokari* (Forskål, 1775) at locality 67 was a road-killed specimen. *Natrix maura* (L., 1758) was found near water in agricultural fields in the surroundings of a small village (locality 21), and had most probably been killed (decapitated) by people from the area. The finding of another snake killed similarly nearby highlights the negative impact of humans on snake populations. Other colubrid snakes found were *Hemorrhois hippocrepis* L., 1758 at locality 3, *Coronella girondica* (Daudin, 1803) at locality 14 and *Macroprotodon cucullatus* (Geoffroy Saint-Hilaire, 1827) at locality 15. A single member of the Viperidae family, *Cerastes cerastes* (L., 1758), was seen at locality 47, crossing a road at dusk. Similarly a *Naja haje* (L., 1758), family Elapidae, was seen at locality 76 basking by the side of a road in the early morning. This was a large specimen for Morocco, well over 1.5m in length. It was deliberately run over by a passing truck just as we approached, again highlighting the negative anthropogenic influence on this species. The low number of observations in southern Morocco (Fig. 2f) probably reflects more limited prospection in this region rather than a relative rareness of the species.

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Appendix 1. Species of amphibians and reptiles found in each locality sampled.

Localities included in this study / Species	*Acanthodactylus aureus*	*Acanthodactylus boskianus*	*Acanthodactylus erythrurus*	*Agama impalearis*	*Atlantolacerta andreanskyi*	*Blanus tingitanus*	*Bufo bufo*	*Bufo mauritanicus*	*Cerastes cerastes*	*Chalcides lanzai*	*Chalcides montanus*	*Coronella girondica*	*Eumeces algeriensis*	*Hemorrhois hippocrepis*	*Hyla meridionalis*	*Leptotyphlops macrorhynchus*	*Macroprotodon cucullatus*	*Malpolon monspessulanus*	*Mesalina guttulata*	*Naja haje*	*Natrix maura*	*Pleurodeles waltl*	*Podarcis vaucheri*	*Psammodromus algirus*	*Psammophis schokari*	*Ptyodactylus oudrii*	*Quedenfeldtia moerens*	*Quedenfeldtia trachyblepharus*	*Rana (Pelophylax) saharica*	*Saurodactylus brosseti*	*Saurodactylus fasciatus*	*Scelarcis perspicillata*	*Stenodactylus sthenodactylus*	*Tarentola chazaliae*	*Tarentola mauritanica*	*Testudo graeca*	*Timon tangitanus*	*Trogonophis wiegmanni*	*Tropiocolotes tripolitanus*	*Uromastyx acanthinura*
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