



TRADE IN HEDGEHOGS (MAMMALIA: ERINACEIDAE) IN MOROCCO, WITH AN OVERVIEW OF THEIR TRADE FOR MEDICINAL PURPOSES THROUGHOUT AFRICA AND EURASIA

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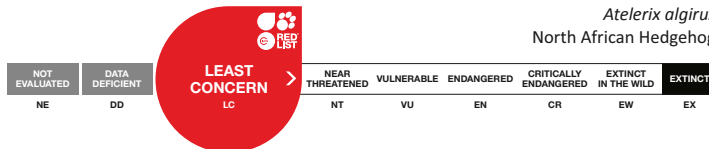
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Abstract: Hedgehogs are traded locally and often in relatively small numbers throughout Eurasia and Africa. We here report on the trade in North African Hedgehog *Atelerix algirus* and to a smaller extent possibly the Desert Hedgehog *Paraechinus aethiopicus* in Morocco, and provide an overview of the global trade in hedgehogs for medicinal purposes. In 2013 and 2014 we surveyed 20 Moroccan cities for a total of 48 times. We recorded 114 hedgehogs (32 alive and 82 skins) for sale in 25 shops in 10 cities, with the largest numbers recorded in Casablanca and Marrakesh. All live hedgehogs were identified as North African Hedgehog but skins could additionally have been of the Desert Hedgehog. Shops often displayed only single hedgehog skins, but occasionally up to 48 skins, and live individuals were mostly traded singly or in pairs. Over 80% of the shops selling hedgehogs were herbalists, selling herbs, spices, oils and animal parts, and both skins and live hedgehogs were intended to supply the demand for traditional ('folk') medicine. At a global scale we found an additional 34 reports of trade in 12 or possibly 13 species of hedgehogs from 23 countries; five studies involving three species in China, South Africa and Benin, included data on the frequency and abundance of hedgehogs in trade, whereas the other studies were qualitative in nature. Market data have limited value in gauging the off-take of hedgehogs from the wild to supply the traditional medicine trade, but we nevertheless urge the continuation of monitoring the trade in hedgehogs in Morocco and indeed elsewhere to ensure it does not become a threat to their survival in the foreseeable future.

Keywords: Conservation, ethno-medicine, folk medicine, northern Africa, wildlife trade.



Atelerix algirus
North African Hedgehog



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Author Contribution: The study was initiated by VN and DB; DB conducted the market surveys; VN conducted the global analysis; VN and DB wrote the paper.

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INTRODUCTION

Hedgehogs (Order Erinaceomorpha) are a group of 16 species distributed throughout Eurasia and Africa and are characterised by their spines and nocturnal activity patterns (Nowak 1999). Four species are endemic to Africa, 10 to Eurasia and two are shared between the two landmasses. At a global level, hedgehogs do not face large amounts of threats, and no species is considered globally threatened (Vulnerable, Endangered or Critically Endangered) or even Near-Threatened according to IUCN Red List of Threatened Species. At the local level some species are exploited for their meat and are used in traditional medicine (some species are bred in captivity and traded as pets, but since this has a very limited effect on wild populations the pet trade is not considered here). Trade in different species for food and medicine has been recorded in Europe and the Near East (Ezer & Arisan 2006; Amori et al. 2008a; Quave & Pieroni 2013), in southern (Molur et al. 2005) and eastern Asia (Li & Wang 1999; Smith et al. 2008; Stubbe et al. 2008), as well as throughout sub-Saharan Africa (Asibey 1974; Carpaneto & Fusari 2000; Ziegler et al. 2002; Whiting et al. 2013), but thus far a comprehensive overview of their trade is lacking. Here we report on the trade in and use of hedgehogs in Morocco based on fieldwork conducted in 2013 and 2014 and we provide a global overview of the trade in hedgehogs based on an extensive literature search.

Morocco is home to two species of hedgehog, the North African Hedgehog *Atelerix algirus*, occurring in the northern half of the country, and the Desert Hedgehog *Paraechinus aethiopicus*, occurring in the south. The North African Hedgehog range includes mainly the Mediterranean Coastal Biotic Zone and the desert Hedgehog's mainly in the Sahara Arid Biotic Zone, with both species living sympatrically in the narrow strip where both zones meet (Happold 2013).

The IUCN Red List of Threatened Species categorises the North African Hedgehog as Least Concern, largely because of its wide distribution and lack of evidence of population declines (Amori et al. 2008b). Likewise, the Desert Hedgehog is listed as Least Concern, because of its wide distribution and presumed large population (Hutterer 2008). While there appear to be few threats to the survival of the Desert Hedgehog, Amori et al. (2008b) list a series of threats for the North African Hedgehog, including an increase in the numbers of roads (leading to roadkill) and habitat loss, as well as individuals taken from the wild to supply the demand for pets, food and medical purposes and to be used in

local witchcraft. They concluded that “the status of this species should be monitored and more data gathered; if there is evidence of declines in population or range in the future, a reassessment will be necessary and uplisting [e.g., to Near Threatened or Vulnerable] may be warranted”.

The aim of our study was to collect both quantitative and qualitative data on the exploitation and use of hedgehogs throughout Morocco to increase knowledge and awareness of the trade in these species and to advocate for better regulation of this trade. Morocco is an important country with regard to wildlife trade, both domestically and internationally as a gateway to Europe, yet the monitoring of wildlife for sale in its open markets has been done only infrequently (van Lavieren 2008; Martin & Perry-Martin 2012; Bergin & Nijman 2014; Nijman et al. 2015).

MATERIAL AND METHODS

Moroccan market surveys

From April–July 2013, April–May 2014 and December 2014 the second author surveyed the markets in 20 cities throughout Morocco. All the cities are within the geographic range of the North African Hedgehog, and the southernmost ones (Agadir, Taroudant and possibly Marrakesh) also in that of the Desert Hedgehog's range. Medinas—distinct, typically walled, city sections in which markets are often found, also known as Old Towns—were surveyed exhaustively for wildlife and markets outside the medinas were visited when learned about. When possible, both daytime and evening surveys were conducted on the same day in order to minimize the chances of stalls or shops being overlooked (Bergin & Nijman 2014). Casual conversations were held with traders about wildlife trade in general and the trade in hedgehogs in particular but we did not systematically interview traders. Eleven markets were visited only once, but others were surveyed up to six times over all three survey-periods. The total survey effort was 48 visits.

Contemporary use of hedgehogs in a global context

We searched Google Scholar and the Web of Science for articles or reports including information on the use of hedgehogs for food ('bushmeat') or as traditional medicine. Key words were hedgehog* AND medicine, and hedgehog* AND bushmeat, as well as each genus (*Erinaceus*, *Hemiechinus*, *Paraechinus*, *Mesechinus*, *Atelerix*) in combination with medicine or bushmeat. Only

studies that were specific in the location (at least at the country level) were included (thus excluding articles that merely stated that “hedgehogs are traded as bushmeat in Africa”). Hedgehogs occur largely allopatrically. When a study did not specify what species of hedgehog was traded this was inferred from the locality (thus in South Africa only the South African Hedgehog occurs); if that was not possible, the study was excluded. We took care to check when hedgehogs were mentioned, but no species was specified, the authors did indeed refer to hedgehogs and not to porcupines. Finally, we were interested in the contemporary exploitation and use of hedgehogs and historic accounts of their use (e.g., Westermarck 1926; Gunda 1962; Lev 2003) were less of relevance. Thus only studies for which the data was collected after 1995 were included. A study was deemed quantitative if survey effort and/or numbers of hedgehogs or their parts were specified otherwise it was considered qualitative.

RESULTS

Trade in Morocco

No hedgehogs were observed in trade in the cities of Sale or Tetouan (both surveyed twice), Asilah, Beninsar, Chefchaouen, El Jadida, Essaouira, Fnideq, Kenitra or Taza (all surveyed once). We recorded 114 hedgehogs for sale in 25 shops in 10 cities, i.e., 32 alive and 82 skins (Table 1). Live individuals were all identified as North African Hedgehog (Image 1) and while it is most likely that the majority of skins were also of this species,



Image 1. Live North African Hedgehog *Atelerix algirus* for sale at a herbalist in Marrakech (June 2013).

potentially they could have been Desert Hedgehog’s (when only the back of the skin is present identifying hedgehogs to the species level becomes difficult).

Casablanca clearly stands out as a significant market, with on average some 20 hedgehogs observed during each of the three surveys. Marrakesh, surveyed five times, had hedgehogs for sale during each survey, with an average of some four individuals per survey. Other markets typically had smaller numbers for sale and hedgehogs were not observed during each and every survey. In Rabat and Oujda about a quarter of the shops selling wildlife had hedgehogs for sale (i.e., 3 out of 12 in Rabat and 2 out of 9 in Rabat), whereas this was about one in 10 in Fez (4/27), Casablanca (4/31) and Marrakesh (5/50).

Table 1. Hedgehogs for sale in the markets of 10 Moroccan cities in 2013 and 2014; shops refer to the number of shops or stalls selling hedgehogs and not to the number of shops surveyed. Live individuals were all identified as North African Hedgehog *Atelerix algirus*; skins could potentially have been either this species or Desert Hedgehog *Paraechinus aethiopicus*.

Town	Coordinates	2013				2014				Total	
		Surveys	Shops	Live	Skins	Surveys	Shops	Live	Skins	Shops	Hedgehogs
Agadir	30.43°N–9.60°W	1	1	0	1	0	-	-	-	1	1
Casablanca	33.50°N–7.60°W	1	3	5	11	2	4	9	34	4	59
Fez	34.00°N–5.00°W	4	2	0	3	2	3	3	5	4	11
Marrakech	31.60°N–8.00°W	3	5	3	6	2	1	1	10	5	20
Meknes	33.90°N–5.60°W	4	1	0	1	2	1	0	1	2	2
Oujda	34.69°N–1.91°W	1	2	2	1	0	-	-	-	2	3
Rabat	34.00°N–6.90°W	4	2	0	6	2	1	5	0	3	11
Safi	32.30°N–9.20°W	1	1	0	2	0	-	-	-	1	2
Tangier	35.80°N–5.80°W	2	1	1	0	2	1	5	0	2	6
Taroudant	30.50°N–8.90°W	1	1	0	1	1	0	0	0	1	1
	Total	23	19	11	32	13	11	23	50	25	114



Image 2. Herbalist stall in Marrakesh, selling a variety of herbs, spices, oils, stuffed animals and animal parts.

Two-thirds of the shops offered single hedgehog skins at a time, but we observed larger numbers on three occasions (8 skins in April 2014 in Marrakesh; 10 skins in June 2013 and 28 skins in April 2014, both in Casablanca) (Fig. 1). The trade in live hedgehogs was less clustered. Half of the shops offered single individuals for sale and the other half two and up to six hedgehogs.

In markets where at least 10 hedgehogs were observed, the proportion of live trade ranged from around 20% in Casablanca and Marrakesh to almost 50% in Rabat. Twenty-one shops were classified as herbalists, i.e., shops containing herbs, spices and oils and frequently animal parts used as decoration or for sale, two in Oudja and Safi as contemporary medicine shops, one hedgehog in Rabat was for sale for food in a vegetable stall, and one in Tangier as a petshop (Image 2). This then suggests that the main purpose of the trade in hedgehogs is to supply the demand for traditional ('folk') medicine, and the vendors indeed backed up this assertion. There was no indication that any of the hedgehogs were imported from other countries and the trade appears to be fully domestic.

Global assessment of hedgehogs in trade

We located 34 contemporary studies on the medical use of or trade in 12 or possibly 13 species of hedgehogs from 23 countries (Table 2). No information on the medical use or trade in Somali Hedgehog *Atelerix sclateri* or Madras Hedgehog *Paraechinus nudiventris*, and possibly Brandt's Hedgehog *P. hypomelas*, was found. Six studies (including ours) were quantitative in nature, reporting on the frequency and abundance of hedgehogs, the others were all qualitative in nature.

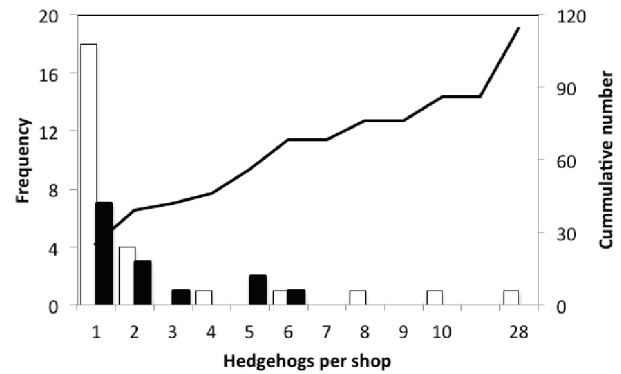


Figure 1. Numbers of hedgehogs (skins, open bars; live, closed bars) sold in individual shops and stores showing that most shops offered single skins for sale but a few eight or more, whereas live animals are mostly offered as single individuals and up to six at a time.

While most reports referred to the trade in hedgehogs specifically for (traditional) medicinal purposes, only six studies mentioned their trade for food.

DISCUSSION

Our surveys show that hedgehogs—primarily the North African Hedgehog but also possibly to a lesser degree the Desert Hedgehog—are traded openly throughout Morocco, with both live individuals and skins present in half of the markets surveyed. Many traders offered smaller numbers at any given time, but some dealt with greater numbers. More than half the hedgehogs we observed were in the cities of Casablanca and Marrakesh and indeed these two cities stand out as important centres for the wildlife trade in Morocco (van Lavieren 2008; Martin & Perry-Martin 2012; Bergin & Nijman 2014; Nijman et al. 2015).

Hedgehogs in Morocco are traded largely to supply the demand for traditional medicine, as they indeed are in other parts of the Mediterranean. Hedgehogs are used as a cure for a variety of illnesses including tuberculosis, haemorrhoids and scrofula (lymphadenopathy of the neck) in Turkey (Sezik et al. 2001; Ezer & Arisan 2006), low sex drive or impotence, fever and malaria in the Levant (Lev 2003), and vaginal complaints by northeastern Italians (Quave & Pieroni 2013). For Morocco the most detailed accounts for the various uses of hedgehogs are given by Westermarck (1926) and Fogg (1941): Inhaling the smoke of a hedgehog skin or its bristles when burned is a remedy for fever, male impotence, and urinary illnesses, and consuming a hedgehog penis, boiled in oil or butter, can cure male impotence. The blood is a cure for ringworm, warts and heals the cracked skin of

Table 2. Overview of global trade in and use of hedgehogs for food and traditional ('folk') medicine (TM); only contemporary studies (post 1995) are included. Most studies were qualitative in nature; for those that were quantitative the abundance and availability of hedgehogs is given

Species	Country	Food	TM	Abundance and availability	Reference
Western European Hedgehog <i>Erinaceus europaeus</i>	Spain		x		González & Vallejo 2014
Northern White-breasted Hedgehog <i>E. roumanicus</i>	Romania		x		Quave & Pieroni 2013
	Albania		x		Pieroni et al. 2014
Southern White-breasted Hedgehog <i>E. concolor</i>	Turkey		x		Sezik et al. 2001; Ezer & Arisan 2006
	Jordan		x		Lev & Amar 2002
Chinese Hedgehog <i>E. amurensis</i>	China		x	4-5 pieces in 1/500 shops in Chengdu; not recorded in six other cities	Guo et al. 1997
	China			2 individuals during 1/12 border inspections in Hong Kong; not recorded in four other cities	Lau et al. 1997
	China	x	x		Li & Wang 1999
Indian Long-eared Hedgehog <i>Hemiechinus collaris</i>	India	x			Molur et al. 2005
	Pakistan	x			Noureen et al. 2012
	China		x		Lapham 2006
Desert Hedgehog <i>Paraechinus aethiopicus</i>	Israel		x		Lev 2003
	Ethiopia		x		Yirga et al. 2011
Indian Hedgehog <i>P. micropus</i>	India	x	x		Molur et al. 2005
	India		x		Mahawar & Jaroli 2008
Brandt's Hedgehog <i>P. hypomelas</i> *	Iran		x		Maghsudi 2007
Daurian Hedgehog <i>Mesechinus dauuricus</i>	China		x		Stubbe et al. 2008
	Mongolia		x		Clark et al. 2006
Shaanxi Hedgehog <i>M. hughii</i>	China	x	x		Smith et al. 2008
North African Hedgehog <i>Atelerix algirus</i> **	Morocco	x	x	32 individuals, 82 skins in 25/331 shops in 10 cities; not recorded in 10 other cities	This study
	Morocco		x		Kapchan 1996
Southern African Hedgehog <i>A. frontalis</i>	South Africa		x	3 parts in 2/19 shops in 1-2/3 cities	Simelane & Kerley 1998
	South Africa		x	7 individuals, 2 skins in 8/32 shops in Johannesburg	Whiting et al. 2013
	South Africa	x	x		Hallam & Mzilikazi 2011
White-bellied Hedgehog <i>A. albiventris</i>	Benin		x	In 89/110 shops in >17/22 markets	Djagoun et al. 2013
	Burkina Faso		x		Chardonnet et al. 2002
	Cameroon				Mawoung 2006
	Ivory Coast	x			Ham 2009
	Guinea	x			Ziegler et al. 2002
	Mali		x		Edwards 2003
	Senegal		x		Ba et al. 2006
	Tanzania	x			Carpaneto & Fusari 2000; Magige 2012
	Uganda	x			Shepherd et al. 2013.

* possibly this species but may include Indian Long-eared Hedgehog *Hemiechinus collaris* ** may include Desert Hedgehog *Paraechinus aethiopicus*

feet. Finally, the boiled flesh of a hedgehog is eaten as a remedy for witchcraft, whereas the bristles can be worn as an amulet against the evil eye.

Currently, hedgehogs are not protected under Moroccan law and the trade as observed in the various markets does not appear to violate any regulations (with respect to protected species, law enforcement in the wildlife markets of Morocco is limited and numerous protected species are openly offered for sale: van Lavieren 2008; Nijman et al. 2015). With few quantitative data on population sizes it is difficult to make any firm statements on the potential effects harvesting hedgehogs has on population numbers. Even less can be concluded on the effects of trade in various other species of hedgehogs. Only for three species (Chinese Hedgehog *Erinaceus amurensis*, Southern African Hedgehog *A. frontalis*, and White-bellied Hedgehog *A. albiventris*) from three countries (China, South Africa and Benin) did we find quantitative data on their trade. As with the data we collected in Morocco for none of these was it possible to establish a firm link between trade, harvest levels, and the impact on local populations. While market data appear to have limited value in gauging the off-take of hedgehogs from the wild to supply the traditional medicine trade, it may nevertheless be worthwhile to continue to monitor the trade in hedgehogs in Morocco and indeed elsewhere as to ensure that this does not threaten the survival of these species.

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