Chelonian Conservation and Biology, 2003, 4(3):648–655

Status of *Testudo kleinmanni* and *T. werneri* in Egypt

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ABSTRACT. – **The status of *Testudo kleinmanni* and *T. werneri* and their habitats was assessed in Egypt during surveys that took place between 1994 and 2003. The species have become extinct in most of their former range in the country. The main threats jeopardizing the future survival of these species are: extensive habitat destruction caused by overgrazing, agricultural expansion, urban encroachment and tourist development, and collection for the pet trade. However, a small population of *T. werneri* persists at Zaranik Protected Area, North Sinai, and recent evidence was found for the possible persistence of a small population of *T. kleinmanni* at El Omayed Protected Area on the Western Mediterranean Coast. Conservation measures adopted include protected areas and community-based conservation.**

KEY WORDS. – **Reptilia; Testudines; Testudinidae; *Testudo kleinmanni*; *Testudo werneri*; tortoise; conservation; status; habitat destruction; protected areas; wildlife trade; Egypt**

Testudo kleinmanni Lortet 1883 and *T. werneri* Perälä 2001 are small testudinids inhabiting the fairly arid deserts fringing the coasts of the southeastern corner of the Mediterranean Sea, reaching as far as 120 km inland at some localities (Baha El Din, 1992) (Fig. 1). The species' natural range extends in a narrow strip from the western Negev of Israel in the east to Libya in the west (Anderson, 1898; Flower, 1933; Marx, 1968; Schleich, 1984; Schleich et al., 1996; Bringsøe and Buskirk, 1998; Perälä, 2001). The range of the two species in Egypt is divided by the alluvial fan of the Nile Delta (Fig. 2). The populations west of the Nile Delta inhabit sandy, as well as hard substrates and even hilly country; those east of the Nile are currently largely found in vegetated sand dunes, but have also been reported from rocky country near Cairo.

Perälä (2001) described *T. kleinmanni* populations east of the Nile as a new species (*T. werneri*) based on morphological features. We disagree with this level of taxonomic recognition. Comparative studies of DNA from wild samples of tortoises from Libya, Egypt west of the Nile, and North Sinai suggest that populations east of the Nile may only be distinct at the subspecific level at most (Baha El Din et al., in prep). These results will be presented elsewhere. However, we have agreed for now to use Perälä's nomenclature in this non-taxonomic paper pending full resolution of the taxonomy of these tortoises.

Testudo species in Egypt have been subjected to severe pressures throughout their range, resulting in extirpation from large areas. In Egypt tortoise habitats have been ravaged by severe overgrazing, massive reclamation schemes for agriculture involving large areas of semi-desert, and intensive coastal development for tourism and urban expansion. In addition, vast numbers have been collected for the pet trade (Buskirk, 1985; Attum, 1997). Large numbers of *T. kleinmanni* continue to be smuggled from Libya into Egypt. The species is currently classified as Endangered (IUCN, 2002), but Perälä (In press a,b) has proposed a change of status to Critically Endangered for both *T. kleinmanni* and *T. werneri*, a welcome step.

Published information on the contemporary status of *Testudo* species in Egypt is almost completely lacking. The most recent published report is that by Buskirk (1985), which largely summarized and collated past records of the species in the country. Wenman (1998) provided further anecdotal information on the status of tortoises in the country. The ecology and biology of *T. kleinmanni* and *T. werneri* have been sparsely studied. The only recent systematic observations on *T. werneri* ecology are those from western Negev (Geffen and Mendelssohn, 1988, 1989, 1991) and Zaranik Protected Area (North Sinai) populations (Attum et al., unpubl. data).

The purpose of this paper is to update the available knowledge on the status of *T. kleinmanni* and *T. werneri*, their habitats, threats, and conservation in Egypt. The information presented here is based largely on an unpublished report (Baha El Din, 1994), which summarized the results of an extensive survey in 1994 to assess the status of *T. kleinmanni* (*sensu lato*) in Egypt. This was a prerequisite for developing a proposal to elevate the species from CITES Appendix II to Appendix I, which was successfully submitted by Egypt in 1994. Additional field surveys have also been conducted between 1994 and 2002 in various parts of the species' range in Egypt. Results of these surveys have, in part, led to an ongoing intensive collaborative effort to conserve and conduct research on these species in Egypt, which will be reported elsewhere.

METHODS

The 1994 survey took place between 13 March and 4 June, with about 40 days spent in the field. The basic survey methodology depended heavily on interviewing local people

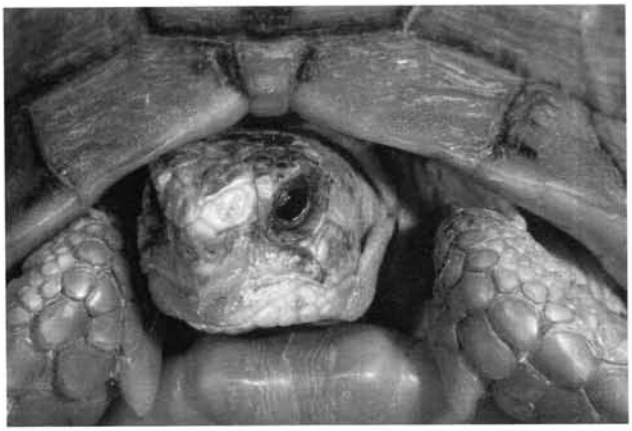

Figure 1. *Testudo werneri* from Zaranik Protected Area, North Sinai, Egypt. Photo by Omar Attum.

to gather information on the occurrence of tortoises and determining the best localities or habitats, where walking surveys could be carried out. In total 8400 km were travelled by car, and 49 walking surveys (23 west of the Nile, and 26 east of the Nile) were carried out at sites selected based on information provided by locals, and on the apparent likely suitability of the habitat for tortoises. An average of about 4 km was walked at each site selected. Most walking surveys were carried out in the morning when tortoise activity is likely to be the highest. The condition of vegetation was noted, and signs of tortoise activity (live or dead animals, tracks or scats) were recorded.

Between 1994 and 2002 numerous visits were made covering almost all parts of the species' range in Egypt (Figs. 3–4). Assessing habitat condition was the main objective of these visits. Local markets, wildlife dealers, and pet stores were also visited to investigate tortoise collection and trade. Between March and May 2000 extensive walking surveys were carried out in and around Zaranik Protected Area, where locals reported wild tortoises. Further surveys were conducted in Zaranik between October 2000 and October 2002 while conducting ecological and population studies on the species.

Study Area. — The Nile Valley naturally divides the two species' range. Our treatment of the investigation of the status of the species followed the same natural division. The coastal area to the west of the Nile is locally known as the Western Mediterranean Coast. Our investigations east of the Nile were restricted to North Sinai, although tortoises have also been recorded from the Isthmic Desert further south.

Western Mediterranean Coast. — This is a coastal desert region, extending 600 km between Alexandria in the east and the Libyan border in the west. The average width of this region is 50 km and it is quite distinct from the remainder of the vast interior of the Western Desert, which lies to the south. The region receives some of the highest precipitation in Egypt, ranging between 70–200 mm annually (almost all falling during winter), and has the country's richest flora (Goodman and Meininger, 1989).

The topography of the Western Mediterranean Coast is fairly uniform and monotonous. The main features are coastal oolitic sand dunes and limestone ridges, followed by saline depressions, a coastal plain of a varied width dissected in places by shallow wadis, and often an inland rocky ridge and plateaus. Further inland the desert is very flat and open, with stony or siliceous sandy substrate. Vegetation is largely dominated by the shrub *Thymelaea hirsuta*. The local distribution of floral communities is highly linked to these physiographic features (Zahran and Willis, 1992).

North Sinai. — Coastal North Sinai is characterized by a low-lying landscape dominated by extensive aeolian sand dune fields, extending an average of about 50 km south of the

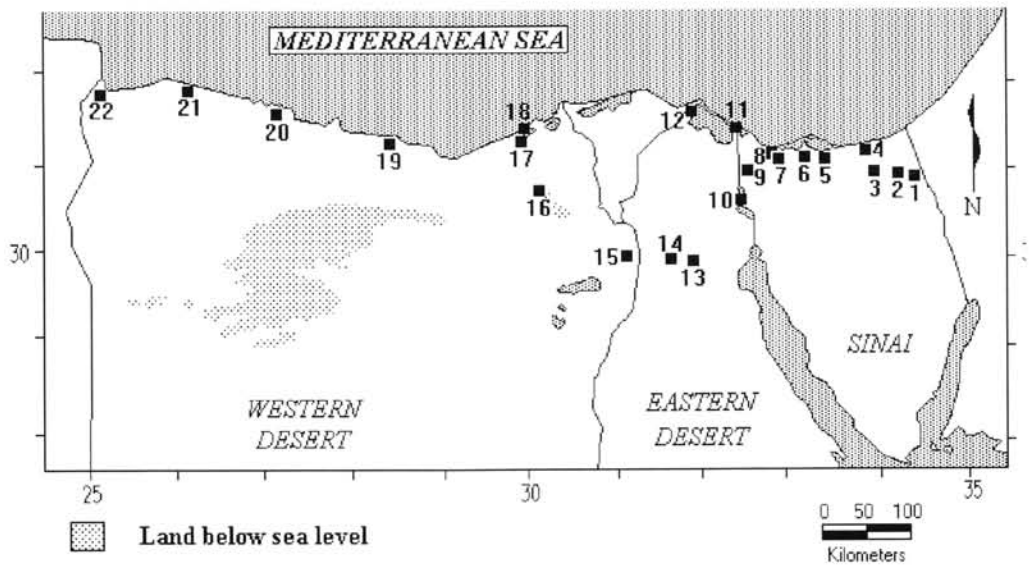

Figure 2. Historical locality records of *Testudo kleinmanni* (*sensu lato*) in Egypt, largely based on Flower (1933), Marx (1968), Buskirk (1985), Baha El Din (1992), and Saleh (1997). 1. Wadi El Amr; 2. Wadi Hareidin; 3. Bir Lahfan; 4. El Arish; 5. El Teloul; 6. Bir El Abd; 7. Katia; 8. Romana; 9. El Qantara; 10. Ismailia; 11. Port Said; 12. Damietta; 13. Bir Gindali; 14. Wadi Digla; 15. Giza; 16. Wadi El Natroun; 17. Maryut; 18. Alexandria; 19. El Daba; 20. Matruh; 21. Sidi Barrani; 22. Salum. Localities 1–9 in the Sinai now refer to *T. werneri*, localities 10–22 refer to *T. kleinmanni* (*sensu stricto*).

Table 1. Localities visited during the study (1994–2000). Site numbers refer to map locations noted in Figs. 3 and 4. Coordinates secured with a GPS at most visited localities. Habitat attributes: 1 = sand plain, 2 = sand dune, 3 = salt marsh and outskirts, 4 = coastal oolitic dunes, 5 = gravel covered plateau, 6 = wadi. Dominant vegetation: A = *Artemisia monosperma*, N = *Nitraria retusa*, R = *Retama raetam*, S = *Stipagrostis scoparia*, T = *Thymelaea hirsuta*, L = *Lycium* sp., Z = *Zygophllum aegyptium*, H = Halophytes. Threats: a = grazing, b = urban encroachment, c = agriculture, d = pulling of vegetation. Evidence of occurrence (tracks, scats, or live individuals) found (yes) or not (no). Local knowledge: 1 = familiar with tortoises but not seen recently, 2 = not familiar with tortoises, 3 = no locals questioned, 4 = tortoises seen recently.

Site No.	Locality	Coordinates	Habitat Attributes	Dominant Vegetation	Threats	Evidence of Occurrence	Local Knowledge
Western Mediterranean Coast (*Testudo kleinmanni*)							
1	SE of El Hammam	N 30°44' E 29°15'	1	T,N	a,c	no	1
2	S of El Hammam	N 30°40' E 29°13'	1	T,N	a,c	no	1
3	El Omayed Protected Area	N 30°45' E 29°10'	1	T,A	a,c	no*	1
4	77 km W of Alexandria	N 30°49' E 29°18'	3,4	H	a,b	no	1
5	E of Sidi Abd El Rahman	N 30°54' E 28°50'	4	H	a	no	2
6	S of El Daba	N 31°03' E 28°26'	2	T	a	no	2
7	S of El Daba	N 30°57' E 28°26'	1	T	a	no	2
8	E of Matruh	N 31°01' E 28°10'	1	T	a	no	2
9	Ras El Hekma	N 31°14' E 27°52'	1,4	T,H	a,b	no	2
10	E Matruh	N 31°09' E 27°34'	5	T	a	no	1
11	43 km SE of Matruh	N 31°06' E 27°30'	5,6	T	a,b	no	2
12	26 km E of Matruh	N 31°10' E 27°22'	5,6	T	a	no	3
13	20 km of Matruh	N 31°23' E 27°04'	3,4	T	a,b,c	no	1
14	SW of Matruh	N 31°12' E 27°05'	1	T	a,c	no	1
15	SW of Matruh	N 31°08' E 27°00'	5	T	a,c	no	2
16	SW of Matruh	N 30°41' E 26°34'	5	T	a,c	no	3
17	SE of Abu Laho	N 31°17' E 26°57'	5	T	a,c	no	1
18	Abu Laho	N 31°22' E 26°55'	5	T	a,c	no	1
19	N of Qattarani	N 31°28' E 26°08'	5	T,A	a,c	no	1
20	N of Qattarani	N 31°28' E 26°15'	5	T,A	a,c	no	2
21	5 km S of Buqbuq	N 31°27' E 25°32'	5	T	a	no	1
22	32 km E of Salum	N 31°28' E 35°18'	2,4	T,N	a	no	4
23	10 km SE of Salum	N 31°26' E 25°11'	5,6	T,N	a	no	1
North Sinai (*Testudo werneri*)							
24	8 km SE of El Gora	N 31°07' E 34°12'	2	A	a,c	no	1
25	El Orga	N 31°01' E 34°17'	2	A	a,c	no	4
26	El Auja	N 30°54' E 34°20'	2	A	a,c	no	1
27	W of El Auja	N 30°52' E 34°16'	2	A	a	no	1
28	Sad El Rawafa	N 30°49' E 34°05'	2,6	A	a	no	3
29	S of Kharruba	N 31°02' E 33°58'	2	A	a,c	no	1
30	Lahfan	N 30°59' E 33°52'	2	A	a	no	4
31	W of El Arish	N 31°05' E 33°47'	2,3	A	a,b	no	1
32	Risan Aneiza	N 30°53' E 33°46'	1,2	S	a,d	no	3
33	El Midan	N 31°01' E 33°35'	2	A	a	no	4
34	S of Risan Aneiza	N 30°47' E 33°34'	1,2	A	a,c	no	2
35	N of Maghara	N 31°43' E 33°20'	2	A	a	no	3
36	E of Zaranik P.A.	N 31°06' E 33°33'	2,3	A	a,d	no	1
37	Zaranik Protected Area	N 31°06' E 33°28'	2,3	A	a,d	yes	1
38	Zaranik P.A. Islands	N 31°07' E 33°25'	2,3	A,N	d	no	1
39	El Roda	N 31°05' E 33°20'	2,3	R	a,d	yes	4
40	SE of El Teloul	N 30°57' E 33°15'	2,3	R	a,d	no	4
41	El Teloul	N 31°02' E 33°14'	2,3	N	a	no	4
42	10 km SE of Bir El Abd	N 30°55' E 33°08'	2	S	a	no	1
43	E of El Nasr	N 31°01' E 32°53'	2	A	a,c	no	1
44	Tofaha	N 30°54' E 32°49'	2	A	a,b,c	no	2
45	El Nasr	N 31°01' E 32°49'	2	A,S	a	no	2
46	N of Romana	N 31°00' E 32°40'	2	A	a	no	2
47	N of Balouza	N 31°00' E 32°49'	2,3	Z,N	a	no	2
48	S of El Shouhat	N 31°01' E 32°30'	2	A	a	no	2
49	25 km E of Ismalia	N 30°33' E 32°30'	2	?	a	no	3

* Evidence discovered later that a few tortoises persist in this area.

Mediterranean. The coast is fringed by extensive salt marshes in parts. To the south the landscape consists of rolling sand and partly stabilized dunes with some halophytic vegetation occurring in interdune troughs. More inland the landscape is flat gravel plains and wadi desert with scattered hills and low mountains. To the east of Wadi El Arish the sand dunes are smaller and usually better stabilized with a greater vegetation cover as a result of increased rainfall. The sand dune belt also becomes narrower further east, connecting with dune fields of the western Negev in Israel.

The vegetation of the dunes is dominated by the shrub *Artemisia monosperma* and to a lesser extent by the grasses *Stipagrostis scoparia* and *Panicum turgidum*. These communities are subject to intense human interference by the

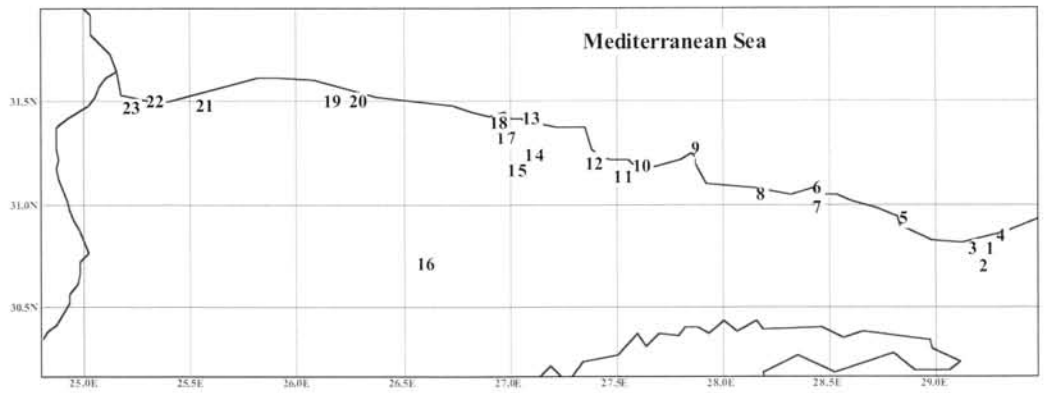

Figure 3. Map of the Egyptian Western Mediterranean Coast showing *T. kleinmanni* localities surveyed between 1994 and 2000. Site numbers refer to Table 1.

harvesting of vegetation and grazing by livestock. In places distant from human settlement, the plant cover may reach up to 70% (Zahran and Willis, 1992).

Rainfall is generally lower than in the Western Mediterranean Coast with an annual average of 97 mm at El Arish, but increasing eastwards to over 120 mm at Rafah (Greenwood, 1997). The amount of rainfall decreases rapidly to the south and west of El Arish.

RESULTS

Current Status

Western Mediterranean Coast. — During the 1994 surveys we found extensive habitat destruction and no *T. kleinmanni* or evidence of their existence (scats, tracks, or dead animals) in any of the surveyed areas (see Table 1 and Figs. 3–4). Although these results indicate the likely extirpation of the species from the greater part of its former range in the region, there are recent indications that small populations still persist in pockets of suitable habitat. In spring of 2002 a single *T. kleinmanni* was found by Mohamed El Essawy in the southern sector of the El Omayed Protected Area (Fig. 3, site 3) in fairly good habitat (M. El Essawy, *pers. comm.*). In winter 2003 he confiscated 5 adult *T. kleinmanni* from a local herder, who had collected them in the vicinity. The region between Salum and Buqbuq (Fig. 3, site 22) is the only other area we identified in the Western Mediterranean Coast where potentially a small population could still persist. Although no tortoises were found, a local herder made a very convincing claim of finding a tortoise in the area during March 1994. The area has fairly healthy vegetation and is lightly populated, with moderate grazing pressure (as of December 1999).

The species has practically disappeared from a 15–20 km strip adjacent to the Mediterranean, west to about Buqbuq (Fig. 3, site 21). It was visually obvious that vast tracts of what probably was previously suitable habitat for *T. kleinmanni* (judging from remnant patches of habitat), have become uninhabitable for the species, and that no animals could survive in these areas. These highly degraded areas were only briefly examined on a few occasions to closely assess their condition, but no walking surveys were carried out. Habitat quality generally declines eastwards of Libya.

The coastal strip (land between the main highway and Mediterranean shore) is the most degraded. East of Matruh much of the land along the coast has been consumed by tourist developments. The main components of the coastal

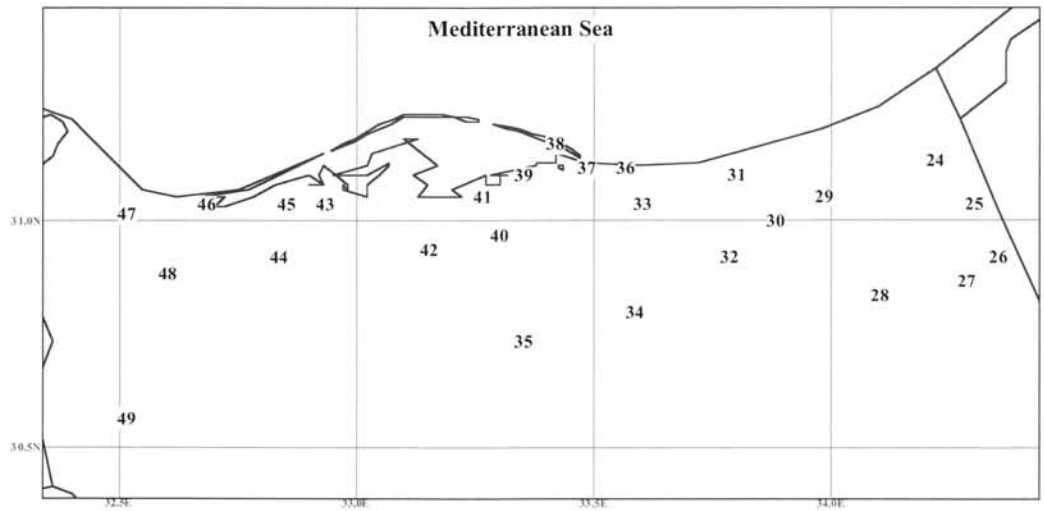

Figure 4. Map of Egyptian North Sinai showing *T. werneri* localities surveyed between 1994 and 2000. Site numbers refer to Table 1.

environment, which are being decimated by these developments, are the littoral oolitic sand dunes on the coast and salt marshes, typically found immediately south (inland) of the coastal dunes. These probably represented prime habitat for *T. kleinmanni* in the past.

South of the coastal highway human activity extends as far inland as rainfall permits for agriculture and grazing, generally concentrated within the first 10 km south of the highway and extending as far as 30 km inland. Most of the habitat within the first 10 km is highly degraded as a result of widespread ploughing and overgrazing. Pockets of habitat still remain in the more arid interior, where rainfall is too little to support cultivation. However, these areas are also overgrazed. Further inland (20–30 km south of the highway) the desert becomes increasingly arid and the plant cover too sparse to provide cover for *T. kleinmanni*. Even in these arid areas grazing takes place, mainly during the winter and spring when annuals are relatively plentiful.

North Sinai. — Testudo werneri appears to have been extirpated from the greater part of its former range in North Sinai. The coastal strip east of El Arish, to between 10–35 km inland from the coast has been almost completely altered and is no longer suitable for tortoises. Beyond 40–45 km inland from the coast, plant cover becomes too sparse for tortoises to survive. This reduction in plant cover is compounded by the effect of overgrazing. There are only a handful of fairly recent records of the species from the region including tracks of several animals on Um El Rumeiat Island in 1985 (Baha El Din, 1992); one female found near Bir El Abd in 1993 (Saleh, 1997), and one male found by a local who collected it near El Telul in 1994 (Baha El Din, 1994).

During spring 2000, we found three very small and isolated subpopulations at Zaranik Protected Area (Fig. 4, site 37), representing the only substantive wild populations known of *T. werneri* in Egypt at the moment, and the first report of either species (*T. kleinmanni, sensu lato*) in the country since 1994 (Baha El Din and Attum, 2000). Surveys conducted in 2001 produced two more subpopulations within the Protected Area. There are also numerous anecdotal reports of individuals of *T. werneri* occurring just west of the boundaries of the Protected Area. These areas will be investigated in the near future. The tortoises typically occur in areas that have visibly greater vegetation cover and higher concentration of annuals than surrounding undulating sand dune habitat. *Retama raetam* bushes or *Artemisia monosperma* shrubs dominate the vegetation in these areas.

There are currently several extended studies of *T. werneri* being conducted in the Zaranik Protected Area. A formal study of the activity, diet, habitat use, and home range size has been in progress since October 2001. In addition, there is also an ongoing mark-recapture study to determine the population sizes of each subpopulation. The short-term results are being analysed and prepared for publication. A noteable aspect of our research program is the involvement of the local community as research technicians and community guards, in which data are collected and the populations are monitored every three days.

Ethnobiology

Testudo kleinmanni is known to locals throughout the Western Mediterranean Coast as *fakarouni* or *fakarouna*, a name used in general reference to chelonians in Libya and other North African countries as well, but is completely unknown to Nile Valley Egyptians. Because of the nature of their profession, herders were the most knowledgeable about the species, as well as other wildlife in their environs. Almost all local inhabitants suggested that *T. kleinmanni* had disappeared from their domain within the last 10–20 years; but that it still occurred somewhere further west than their own region (e.g., at El Hammam, locals suggested that tortoises could still be found at El Daba, while at El Daba, Matruh was proposed as a good place for tortoises, etc.). Most agreed that Libya was a good place for these animals. It was of interest to note that among the local populations of the Western Mediterranean Coast, older individuals were the most familiar with the species, while younger people often did not know the species and did not recognize its local name.

In North Sinai *T. werneri* is known as *lajaah*, an Arabic name also used locally in general reference to most chelonians. As in the Western Mediterranean Coast most children were not familiar with the tortoise. Most adults stated that the tortoise had disappeared within the last 10–15 years.

Current Threats

Agricultural Expansion. — Traditionally, cultivation along the Mediterranean coast was composed of small areas with rain-fed winter cereals, olives, and dates. In recent years the use of machinery, modern irrigation techniques (such as drip irrigation, etc.) and the introduction of drought resistant crops, has facilitated the reclamation of extensive areas of land, extending as far inland as 35 km south of the coast. This recent expansion has destroyed large areas of prime tortoise habitat in the region. The first areas lost were well-vegetated depressions and *Artemisia*-covered sandy plains, both good tortoise habitats. Natural vegetation has also been removed in areas where winter cereals are grown, and to a lesser extent where watermelons are grown during summer.

The completion (in the near future) of El Nasr Canal, from the Delta to El Daba will completely alter the landscape and ecology of the eastern section of the Western Mediterranean Coast. The project, which also involves settling Nile Valley Egyptians on the newly reclaimed land, will lead to a great increase in the human population in the region.

A major reclamation project, known as the North Sinai Agricultural Development Project, supplied by freshwater from the Nile via the El Salam Canal, is planned to eventually reclaim 400,000 acres of land in North Sinai, extending as far east as Wadi El Arish. Most of the land targeted by this project falls within the known range of *T. werneri*, and includes areas of prime habitat for the species. It is expected that, when completed, the project will lead to the loss of most tortoise habitat in the region between the Suez Canal and

Figure 5. Bag of recently confiscated *Testudo kleinmanni* (*sensu lato*) destined for the pet trade. Photo by Omar Attum.

Wadi El Arish, either through direct destruction or through indirect large-scale ecological changes anticipated to take place in the region.

Overgrazing. — This threat was present at every site visited. Sheep and goats compete directly with tortoises over palatable vegetation. Dominant woody perennials, which are not browsed heavily by sheep and goats (such as *Thymelaea hirusta* and *Artemisia monosperma* shrubs), remain while annuals and palatable shrubs are heavily browsed. Almost all sites visited had very few or no annuals left as a result of grazing. Another (indirect) impact of traditional pastoralism is the harvesting of woody shrubs such as *A. monosperma* for fuel and in the construction of semi-permanent settlements. Large areas of the desert are usually denuded of plant cover in the vicinity of Bedouin settlements.

Urban Encroachment and Tourist Developments. — These developments not only lead to the complete destruction of the sites they are built on, but also degradation of vast areas surrounding them. They are impacted by the various activities associated with the construction and operation of these developments (such as quarrying and waste disposal). Urban development is taking place in the Western Mediterranean Coast at a very rapid pace, to the extent that most of the structures found currently along the coasts of the region have been erected in the past 5–10 years.

Pet Trade. — Large numbers of *T. kleinmanni* (and probably *T. werneri*) were collected from Egypt through much of the past century, for sale as pets. This continued until the late1970s, by which time *T. kleinmanni* was extirpated from large parts of the Western Mediterranean Coast and by the late 1980s *T. werneri* was also severely depleted in Sinai. Commercial wildlife traders usually have a network of local inhabitants who collect various species of wildlife for them. Herders are the most likely to encounter tortoises in the wild and collect them. Thus, herders are responsible for collecting the majority of tortoises from Libya and Egypt. Herders are usually familiar with tortoise behavior, habitat, and most importantly, tracks. Herding activity is highest during the period of maximum tortoise activity in the spring, which optimizes the opportunity for herders to find animals.

Between 1990 and 1994 a total of 8381 *T. kleinmanni* were counted in Cairo pet shops and at the animal market in old Cairo. Almost all of these tortoises were from Libya, as stated by the traders and detected from the color and pattern of the animals. The numbers counted only represented a portion of the total trade in these animals in Egypt at the time, given the limited coverage of the market. Between 1995 and 2000 the number of tortoises seen for sale has been greatly reduced, with less than 400 reported in local markets during 1999–2000.

However, there are indications of a growing trend in smuggling *T. kleinmanni* from Libya through Egypt, particularly to eastern European markets (Fig. 5). In April 2001 close to 100 animals were observed at a wildlife dealer's facility in Cairo. A total of 220 animals have been confiscated between May 2002 and May 2003 at Hurghada Airport, which were destined for Romania and Russia. Most recently, in spring of 2003, a shipment of 673 tortoises (*Testudo* spp.) from Libya was intercepted by Egyptian authorities in Alexandria and at Salum, whence Libyan authorities arranged for their repatriation (Khaled El Tayeb, Environmental General Authority, Tripoli, Libya, *pers. comm.*).

Other Threats. — Unregulated vehicular use and military exercises also cause considerable damage to tortoise habitats. Military exercises are also known to destroy *T. werneri* habitat in Israel (Bringsøe and Buskirk, 1998). Military personnel in Egypt often collected tortoises in the past, and may still do so if animals are found.

The introduction of man-made structures, such as telephone poles and buildings, into an otherwise tree-less landscape, provides increased nesting opportunities for the Brown-necked Raven, *Corvus ruficollis*, which is known to prey upon tortoises. Thus, these structures may be potentially increasing predation pressure on the tortoises.

Current Protection Status and Conservation Efforts in Egypt

Legislation. — *Testudo kleinmanni* (*sensu lato*) was given protection status by Ministry of Agriculture Decree 1403 for 1990. According to the environment law 4 for 1994, it is illegal to collect, possess, or sell all protected species of wild animals dead or alive. Enforcement is sporadic, but frequency is on the rise. CITES implementation and screening at airports in particular is also improving, resulting in confiscation of large numbers of animals.

Protected Areas. — Zaranik Protected Area (230 km^2) and El Omayed Protected Area (700 km^2) encompass reasonable sections of the ranges of *T. werneri* and *T. kleinmanni*, respectively, in Egypt. Special note has been given to the conservation needs of these species in the management plans

of both sites. Measures to be taken in the near future will include the construction of grazing-exclusion fences in prime habitats. Two further protected areas are scheduled for declaration in 2003–4 (Salum and El Qasr, both on the Western Mediterranean Coast) under the auspices of a Global Environment Facility and World Bank funded project, which will ensure further conservation measures for substantive and critical portions of *T. kleinmanni* habitat in the region.

TortoiseCare Initiative.—This multidisciplinary project to promote the conservation of tortoises in Egypt has been implemented by a loose coalition of partners, including governmental, non-governmental, and private sector organizations and concerned individuals. The initiative includes a number of different components such as rehabiliation, research, environmental education, and community-based conservation. The latter has involved a Bedouin women's handicraft program launched at Zaranik Protected Area to generate a sustainable source of financial benefit through the production of handicrafts employing tortoise motifs. The craft program is especially vital in raising awareness, as it is often Bedouin women who herd the livestock and thus come in contact with the tortoises.

DISCUSSION

Currently there is little evidence that there are any substantive populations of *T. kleinmanni* existing in the Western Mediterranean Coast. The recent findings of a few individuals in El Omayed Protected Area may only represent scattered individuals. Further surveys in the region are needed. Very small, highly fragmented and isolated populations (or individuals) might also still exist in other pockets of marginal habitats in the transitional zone between the more mesic coastal habitat and the xeric interior. The sparse availability of small annuals and other food items may imply that tortoises would have to forage further and for longer periods, increasing their exposure to additional dangers. Any animals still surviving in these less than optimal habitats are more likely to be exposed to heavy predation or to collection by herders.

The North Sinai populations of *T. werneri* are very small and highly fragmented. Unlike the Western Mediterranean Coast, North Sinai still retains reasonable pockets of habitat. This is perhaps the result of the nature of the landscape, which is mostly dominated by soft sand dunes. This has made access to many areas difficult, and has provided a greater complexity to the landscape, where small patches of habitat can remain fairly well protected (such as in deep interdune plains amidst extensive dune fields). Another reason for more suitable tortoise habitat in North Sinai is the result of the nature of human settlement, which is clustered and concentrated around major urban centers (unlike the Western Mediterranean Coast, where it is highly dispersed and fragmented). This probably leads to concentrated human disturbance, while larger areas remain less disturbed.

It is obvious that *T. kleinmanni* and *T. werneri* have been exterminated from most of their former range in Egypt and are close to extinction. Unfortunately, many of the factors which have led to these declines are still at work, and in some cases are being intensified. The future of the species depends on protecting sufficiently large tracts of their remaining habitat through the establishment of further protected areas and better management of existing ones, working with local people to modify their grazing and pastoral practices, and taking firmer measures to end the trade in these species. Future conservation measures need to include further intensive survey of *T. werneri* and *T. kleinmanni* habitats in Egypt and Libya and the development of a comprehensive conservation action plan, which should span their entire range.

ACKNOWLEDGMENTS

The Wildlife Conservation Society supported the intensive surveys conducted in 1994 and 2000. The 2000 surveys were also carried out as a by-product of research carried out with support from the Chicago Zoological Society. We are grateful to Esther Wenman, Gian Lorenzo, and Andy Highfield who participated in fieldwork and provided important literature. Moustafa Fouda (Director, Nature Conservation Sector, Egyptian Environmental Affairs Agency), Amie Bräutigam (IUCN/SSC), Waheed Salama, Saad Osman (Zaranik Protected Area), Jim Buskirk, John Howes (IUCN/SSC), Ahmed Riad, and Kaori Odani provided support and insight into this study which would not have been possible without their help. Loutfy Boulos kindly identified plant samples for us. The current research has been funded through different stages by Blue Earth Alliance, Columbus Zoo and Aquarium, Rhode Island Zoological Society, Cleveland Metroparks Zoo, Woodland Park Zoo, Chelonian Research Foundation, Maha Energy, and Magellan GPS. Rebecca Rose of the Columbus Zoo and Aquarium and Harmony Frazier of the Woodland Park Zoo have been extremely supportive of the craft program.

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Received: 21 December 2001
Revised and Accepted: 29 July 2003