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Animals traded for traditional medicine at the Faraday market in South Africa: species diversity and conservation implications

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Abstract

In South Africa, animals and plants are commonly used as traditional medicine for both the healing of ailments and for symbolic purposes such as improving relationships and attaining good fortune. The aim of this study was twofold: to quantify the species richness and diversity of traded animal species and to assess the trade in species of conservation concern. We surveyed the Faraday traditional medicine market in Johannesburg and conducted 45 interviews of 32 traders during 23 visits. We identified 147 vertebrate species representing about 9% of the total number of vertebrate species in South Africa and about 63% of the total number of documented species (excluding domestic animals) traded in all South African traditional medicine markets. The vertebrates included 60 mammal species, 33 reptile species, 53 bird species and one amphibian species. Overall, species diversity in the Faraday market was moderately high and highest for mammals and birds, respectively. Evenness values indicated that relatively few species were dominant. Mammal body parts and bones were the most commonly sold items ($n = 2453$, excluding porcupine quills and pangolin scales), followed by reptiles ($n = 394$, excluding osteoderms), birds ($n = 193$, excluding feathers and ostrich eggs) and amphibians ($n = 6$). Most (87.5%) species traded were of least concern using IUCN criteria, although 17 species were of conservation concern. However, a higher than expected proportion of traders (62.5%) were selling listed species, which is a matter for concern and should be monitored in the future.

Introduction

Burgeoning human populations not only put pressure on biodiversity through competition for space and limited resources (Ehrlich, 2009) but also through direct harvest for human consumption (Wilson, 1988). Much of the focus relating to the current global biodiversity crisis is on habitat destruction and the unsustainable use of resources. Conservation practices tend to focus on arresting or ameliorating habitat destruction because biodiversity is conserved as a by-product. What has received far less attention from ecologists and conservation biologists is the harvest of animals for use in traditional medicine. Where rare and endangered (EN) species are concerned, the use of biodiversity for traditional medicine can have potentially significant impacts on local populations that are already under pressure (Simelane & Kerley, 1998; Still, 2003; White *et al*., 2004; Mander *et al*., 2007; Williams, Balkwill & Witkowski, 2007*a*). Some of the more notable examples of harvest for traditional medicine include rhino horns, bear gall bladders and tiger penises for the Asian market (But, Lung & Tam, 1990; Li *et al*., 1995; Still, 2003). Many species of high value in traditional medicine may have low reproductive rates, be long-lived and occur at relatively low densities in the wild. Species with these life-history traits are considered more prone to extinction (McKinney, 1997) and may therefore be less resilient to harvest.

The use of animal parts for the treatment of ailments affecting both humans and livestock has a long and rich history (Lev, 2003). For example, bear gall bladders have been used to treat a variety of ailments in China for over 1300 years (Li *et al*., 1995) while rhino horn has similarly been used in China for over 2000 years (But *et al*., 1990). Traditional medicine in southern Africa falls in to two categories: treatment of medical afflictions 'white medicine' and dealing with ancestral conflict or 'black medicine' (Bye & Dutton, 1991). Traditional healers in southern Africa view health and welfare issues as being tightly linked to supernatural forces, social relationships and an individual's relationship with their ancestors (Bye & Dutton, 1991;

Simelane, 1996). As such, a significant component of traditional healing makes use of the 'magical' properties of plants or animal parts. For example, skins and parts from lions, leopards (Appendix S1) and cheetah confer strength to the bearer, while other animal parts may be used to provide protection against enemies, as a charm in a court case, for intelligence in school children, prosperity and good fortune, to strengthen a relationship, or even to aid an individual committing a crime (Simelane, 1996; Cocks & Dold, 2000; White *et al*., 2004; Mander *et al*., 2007). A large proportion of South Africans believe in the efficacy of traditional medicine and have at some time purchased traditional medicine or consulted a traditional healer (Cunningham & Zondi, 1991; Mander *et al*., 2007). Furthermore, South Africa has a very low ratio of western doctors to patients (Williams, 2007), particularly in rural areas, which leaves very little opportunity for consultation with university-trained medical doctors. By comparison, traditional healers are far more accessible to most of the population (Bye & Dutton, 1991).

The trade in animal parts in southern Africa is thought to be extensive, but is currently poorly understood and only baseline data have been collected for select areas. Furthermore, many of these studies are internal, unpublished reports. Herbert *et al*. (2003) report a comprehensive assessment of the invertebrate trade at the Warwick Triangle traditional medicine market in Durban and also briefly review the trade in animal parts for traditional medicine. Specifically, they report on diversity, monetary values and rough quantities of taxonomic groups that were traded and identify a few select marine invertebrates of conservation concern. Simelane & Kerley (1998) interviewed traditional healers in the Eastern Cape Province of South Africa and found that 31% of vertebrates traded were listed in South African Red Data books. Mander *et al*. (2007) focused on the trade in vultures and identified the demand for traditional medicine as a significant threat to the future viability of several species of vulture. All these studies point to the growing need for baseline data and proper quantification of the trade in animal parts for traditional medicine and whether this trade makes significant use of species of conservation concern.

The purpose of this study was to investigate the trade in animals for traditional medicine at the Faraday traditional medicine market (hereafter Faraday) in Johannesburg, South Africa. We quantified species richness, diversity and quantity of vertebrate and marine invertebrate fauna sold by traders. Finally, we examined the trade of animals in relation to their conservation assessment using IUCN criteria.

Methods

Faraday is the largest informal wholesale and retail market for traditional medicine within the province of Gauteng (Williams, 2003), and the second largest outlet for traditional medicine in South Africa after the Warwick Junction market in Durban (Herbert *et al*., 2003). Previous studies at Faraday have focused on the trade in plant material (Williams, 2003; Williams, Witkowski & Balkwill 2005; Williams *et al*., 2007*a*, Williams, Witkowski & Balkwill, 2007*b*,*c*), but until now, the trade in animal material has not been assessed. A Faraday survey in 2001 revealed that 5% of traders sold only animal parts while 10% sold a combination of plant and animal material (Williams, 2003).

Market survey

We used undergraduate students proficient in local languages (isiZulu, Sesotho) to conduct 45 interviews with 32 traders during 23 visits to Faraday to compile an inventory of animal species available for sale. The survey was conducted between June 2004 and November 2005. Animal identifications were made at the market, although photographs were also taken at most of the stalls as documentary evidence and for identifying some species. Identification to species was further aided by field guides for the major vertebrate groups (birds: Sinclair, Hockey & Tarboton, 1997; reptiles: Branch, 1998; mammals: Stuart & Stuart, 2001). When we totalled species in a particular taxonomic group, we conservatively counted the minimum number of potential species. For example, in the case of 'scrub hare, rock rabbit and unidentified rabbit', we would only count two species. We recorded all domestic animals for sale, but do not include them in any taxonomic counts or in any of the analyses. We treated marine fishes and invertebrate species separately to mammals, birds, reptiles and amphibians, primarily because of the difficulty in identifying the individual species of molluscs, echinoderms, corals and dried fishes. These species were also not included in the diversity analyses, but are discussed separately. Our primary approach was to record observable data and to limit the questioning of the traders due to the difficulties expected with obtaining honest/reliable information, especially concerning the origin of the material. We designed a survey form to list the species, quantities (number of individual organisms) and carcass parts sold. We did not record data on the origin or monetary value of the material. The animal fats and mixtures separately sold in bottles were not recorded because there was no way to verify the identity of the material. Furthermore, some wholesalers of traditional medicine sell 'imitation' fat (often domestic animal fat) to consumers (Cunningham & Zondi, 1991).

Sampling performance

Complete enumeration of species within a study area is generally not feasible and consequently a number of methods have been devised for estimating total species richness from a sample (Chiarucci *et al*., 2003). A challenge for ethno-ecological surveys is establishing the completeness of an inventory and how many more species might be recorded with further sampling of the market (Williams *et al*., 2007*c*). We used incidence-based species richness estimators calculated by the public-domain software EstimateS (version 7.5.1, Colwell, 2006; viz. ICE, Chao 2, first-order jackknife,

second-order jackknife, bootstrap and Michaelis–Menton Means) to estimate the number of species that may have been recorded with further sampling. Incidence-based rather than abundance-based estimators are more suitable for market data because inventories mostly record the presence or absence of species rather than the abundance or quantity present. Furthermore, certain body parts such as porcupine quills, pieces of skin and feathers may be highly abundant, but at the same time may be harvested from a few individual animals, making quantity an unsuitable abundance variable for calculating the estimators.

We assessed the 'best' estimator based on its ability to reach a horizontal asymptote (Toti, Coyle & Miller, 2000; Williams *et al*., 2007*c*). Furthermore, the richness estimates were compared with a list of species compiled from other studies of animals traded for traditional medicine. The list indicated how many more species have been recorded for sale in other markets in South Africa compared with Faraday. A good species richness estimator would therefore not under estimate the total number of potential species in trade and the richness estimate should be at least greater than or equal to the total number of taxa recorded in all current and previous studies. The literature examined to compile the extended list of animals traded was based on Cunningham & Zondi (1991), Simelane (1996), Derwent & Mander (1997), Marshall (1998), Simelane & Kerley (1998), Ngwenya (2001), Crump (2003), Herbert *et al*. (2003), White *et al*. (2004) and Mander *et al*. (2007). The study by Crump (2003) was a rapid assessment of nine traders selling animal parts in Faraday in 2001.

Species richness, similarity and diversity

We calculated species richness, the percentage similarity of species sold by different traders (using the Sørenson index for incidence-based data), species accumulation functions and species diversity indices using EstimateS. These techniques have been effective previously in analysing and interpreting ethnobotanical inventories derived from assessments of resource use in South Africa and South America (e.g. Begossi, 1996; Williams *et al*., 2005; Williams, Witkowski & Balkwill, 2007*c*; Hanazaki *et al*., 2000). We randomized the sample order (i.e. trader order) 50 times to compute the mean statistic at each sample accumulation level and thereby generated smoothed accumulation curves. EstimateS directly computes the Shannon (H'), Simpson ($1/\lambda$) and Fisher's α diversity indices. We used the $-\ln \lambda$ form of Simpson's index (see Williams *et al*., 2005); hence, the data were transformed accordingly. The software does not directly compute Hill's numbers or evenness values; however, the appropriate variables for calculating these indices are an output of EstimateS and these values were subsequently derived using the appropriate formulae indicated in Table 1. Because the values for the diversity indices are computed at each sample accumulation level, it was possible to plot cumulative diversity curves that indicate how the indices perform as more traders were sampled.

Diversity measures take into account two factors: species richness (the number of species, S, in a sample of a specified size) and evenness/equitability (i.e. how uniformly abundant species are in a sample) (Magurran, 1988). S is related to the total number of individuals (n) summed over all S species recorded (Williams *et al*., 2005). As sampling effort increases (e.g. more traders, n, are sampled), more individuals are encountered and more species are likely to be recorded (Hayek & Buzas, 1997). An 'index' of diversity (also called an index of heterogeneity, e.g. Simpson's index) incorporates both richness and evenness into a single value, and is based on the proportional abundance of species in a sample (Ludwig & Reynolds, 1988; Magurran, 1988). Part of the rationale behind calculating species diversity is that the more singletons (species occurring once) there are in a sample, the more one would expect to find at a site and therefore the greater the expected species diversity. The Shannon (H') diversity index measures the average degree of 'uncertainty' in predicting the identity of a species chosen at random from a sample (Ludwig & Reynolds, 1988). The greater the uncertainty, the more difficult it is to predict the identity of a species and therefore the higher the diversity of the sample. The index is sensitive to the abundance of the rarest or least recorded species (Magurran, 1988). Simpson's diversity index ($-\ln \lambda$) also increases as diversity increases and indicates the likelihood that two species chosen at random are the same species. The higher the diversity, the less likely two species chosen at random will be the same species. Simpson's index is sensitive to the abundances of the commonest or most recorded species (Magurran, 1988). Fisher's α is a diversity index sensitive to the sample size, the number of species and the number of species of intermediate abundance. When the number of species is low, α is lower and therefore smaller samples with fewer species usually have smaller values of α (Williams *et al*., 2005). Fisher's α is also a number close to the number of species expected to be represented by one individual (Hayek & Buzas, 1997). Hill's numbers represent the number of species that are abundant (N_1), very abundant (N_2) and most abundant (N_∞) in a sample. These numbers are derived from the Shannon, Simpson and Berger–Parker indices, respectively. Hill's numbers, especially N, can help to indicate which species may be dominant in the market. In order to objectively determine the number of species which are of rare, intermediate or common abundance in the market, Williams *et al*. (2005) recommended transforming Hill's numbers in the following way: the number of common species = N; the number of species of intermediate abundance in the market = N_1–N_∞; the number of 'rare' species (i.e. of low incidence) = $S - N_1$.

Evenness (or equitability) measures are another way of quantifying species dominance in a market. If all species are equally abundant throughout the market, then evenness values would be at a maximum of 1. The evenness value would decrease towards zero if the relative abundances of some species increased and they dominated the stalls in the market. The overall relative abundances of species thus determine the value of an evenness index. We used two

Table 1 Comparisons of selected measures of diversity between animals sold in the Faraday market

Index/measure	Animals ($n=32$ traders) $n=608$	Mammals ($n=32$ traders) $n=305$	Reptiles ($n=31$ traders) $n=178$	Birds ($n=22$ traders) $n=123$
Species richness (S or N_0 or e^{Hmax})	147	60	33	53
Mean S per trader ± SD	25.1 ± 14.7	13.3 ± 7.6	7.1 ± 4.0	4.7 ± 5.2
Shannon (H')	4.49	3.67	2.92	3.67
Simpson ($-\ln \lambda$)	4.22	3.49	2.68	3.60
Fisher's α	61.6	22.4	11.9	35.3
Evenness E1(Shannon J') (H'/H'_{max})[a]	0.90	0.90	0.84	0.92
Evenness E5 (N2-1/N1-1)	0.76	0.83	0.77	0.93
Hill's N1 ($e^{H'}$)	89.1	39.3	18.5	39.3
Hill's N_2 ($1/\lambda$)	68.3	32.9	14.5	36.4
Hill's $N(N/N_{max})$[b]	26.4	13.9	7.7	8.8
Singletons (no. of species occurring once)	57	18	13	26
Mean number of shared species	7.1 ± 4.8 (range = 0–23) $n=496$	4.1 ± 3.1 (range = 0–15) $n=496$	2.5 ± 1.8 (range = 0–6) $n=496$	0.8 ± 1.0 (range = 0–6) $n=300$
Mean percentage Sørenson similarity of species sold by traders	26.7 ± 11.7% (0–62.5%) $n=496$	28.0 ± 15.5% (0–80%) $n=496$	33.4 ± 17.8% (0–85.7%) $n=496$	13.1 ± 14.8% (0–65.7%) $n=300$

[a] $H_{max} = \ln S$ (maximum value of the Shannon index).
[b] N_{max} = the number of individuals of the most abundant species.

evenness indices primarily to better differentiate between datasets if the resultant values from one index were the same. E1 (also called the Shannon J') is the most commonly used index but is sensitive to species richness and singletons (Ludwig & Reynolds, 1988). E5, however, tends to remain constant with sampling variations and tends to be independent of sample size (Ludwig & Reynolds, 1988). The dispersion of species throughout the market (i.e. uniform, aggregated or random) was calculated using the software called 'Species diversity and richness' (version 3.02, 2002; Pisces Conservation Ltd., New Milton, UK).

Species of conservation concern

All vertebrates were checked against 2001 IUCN Red List Categories and Criteria version 3.1 and used in conjunction with the following sources: Minter *et al.* (2004) for amphibians; IUCN (2009, Version 2009.1) for reptiles; Barnes (2000) and Hockey, Dean & Ryan (2005) for birds and Friedmann & Daly (2004) for mammals. We tested whether species of conservation concern (IUCN categories: critically endangered [CR], EN, Vulnerable [VU] or near-threatened) were proportionally as prevalent among traders as species of least concern (IUCN category) using χ^2-tests (two-tailed). Because of low sample sizes, we combined all species of conservation concern to meet the assumptions of the χ^2-tests. A total of 136 species were scored for conservation status and of these, 119 were of least concern while 17 were of conservation concern. Our expected values for the χ^2-test were therefore 0.875 and 0.125, respectively. We also tested for a significant difference in the abundance of body parts (including entire animals) that were being sold, between species of conservation concern and species of least concern. For this test, a total of 922 body parts were assigned to 136 species of which 17 were of conservation concern (64 items) while the remaining 119 species (865 items) were scored as least concern. Therefore, we used expected values of 6.78 items/species under the null hypothesis that species were equally abundant, regardless of their conservation status. For this latter test, we excluded porcupine quills, eggs, feathers, crocodile osteoderms, pangolin scales and teeth, all of which could inflate values for a particular species. In the case of antelope horns, we used the minimum number of individuals necessary to constitute the number of horns (i.e. we divided by two or used half the number plus one if it was an odd number of horns). Because of these measures, the total number of species was less than what was used for the first χ^2-test.

All means are reported ± 1 SD.

Results

Trade in vertebrates

Excluding domestic animals, we identified 147 vertebrate species traded at Faraday, representing one species of frog, 33 species of reptile, 53 species of bird and 60 species of mammal (Appendix S2). Seven domestic mammals were sold by traders: goat, cattle, sheep, horse, donkey, pig and cat (Appendix S2). Of the species identified at Faraday, 41% were mammals (excluding domestic animals), 36% were birds and 22% were reptiles. For South Africa alone, these species counts represent 8% of the reptile fauna (417 taxa, W. R. Branch, pers. comm.), 6% of the bird fauna (841 taxa, Birdlife International, 2009) and 20% of the mammal fauna (299 taxa, Skinner & Chimimba, 2005).

The most taxonomically widespread groups were birds (15 orders, 35 families) and mammals (15 orders, 24 families). Perching birds (order Passeriformes) had the highest number of recorded bird families and species (nine families, 14 species), with each family within this order only represented by one to three species. Among raptors, members of the family Accipitridae were the most frequently recorded in the market (>5 species). The most common mammals identified in the market were carnivores (seven families and 24 species), of which, cats were the most prevalent (five species). The bovids (antelopes and buffalo) were the next most abundant group of mammals (15 species) (Appendix S2). Among reptiles, the squamates (snakes and lizards) were the most common (10 families; 25 species), of which the colubrids (typical snakes) were recorded the most frequently.

The mean number of vertebrate species sold per trader was 25.1 ± 14.7, and ranged from 4.7 ± 5.2 bird species sold per trader to 13.3 ± 7.6 mammal species sold per trader (Table 1). The mean number of 'shared' species (i.e. species that two traders have in common at their stalls) was 7.1 ± 4.8 species per trader (Table 1); hence, the similarity of species sold by traders was relatively low. The Sørenson similarity measure confirms this finding and indicates that species composition at the different traders' stalls is on average only $26.7 \pm 1.2\%$ similar for all vertebrates recorded (Table 1). However, there is greater similarity of reptiles sold (33.4%) between traders compared with birds (13.1%; Table 1). Hence, one is unlikely to find the same bird species being sold by the traders in the market, except for ostriches, owls and a broad spectrum of species from the order Falconiformes. Twelve of the most commonly occurring species were uniformly present throughout the market (Table 2, shaded species; including monitors, python, crocodile and baboon), whereas the remaining species occurred randomly at traders' stalls.

Commonly traded species

The following species were sold by more than 50% of traders: reptiles: rock (50%), and water monitor (59%); nile crocodile (69%); southern African python (72%); puff adder (56%); mammals: chacma baboon (69%); cape porcupine (69%); vervet monkey (50%); warthog (50%) (Table 2). African elephants were also commonly traded (47%, 15 traders). Bird species were not as prevalent as mammals and reptiles, but ostriches and owls were the most commonly recorded avian species (44% and 28% of traders, respectively).

Table 2 Percentage of 32 traders recorded selling species of vertebrates in Faraday

Mammals		Reptiles		Birds	
Common name	% traders (>20%)	Common name	% traders (>10%)	Common name	% traders (>10%)
Chacma baboon	68.8	Monitor spp. (rock and water)	84.4	Ostrich, common	43.8
Cape porcupine	68.8	Crocodile, Nile	71.9	Owl spp.	37.5
Vervet monkey	50.0	Python, southern African	71.9	Dove spp.	25.0
Common warthog	50.0	Tortoise spp.	62.5	Egret spp.	25.0
Duiker spp.	46.9	Puff adder (snake)	56.3	Vulture spp.	18.8
African elephant	46.9	Elapids (snakes)	43.8	Coucal, Burchell's	15.6
Bush baby spp.	43.8	Southern tree agama (lizard)	28.1	Ibis spp.	15.6
Mongoose spp.	43.8	Colubrids (snakes)	28.1	Duck spp.	12.5
Striped polecat	43.8	*Cordylus* spp. (girdled lizards)	21.9	Starling spp.	12.5
Horse	40.6	Terrapin spp.	18.8	Thick-knee spp.	12.5
African buffalo	37.5	Chameleon spp.	15.6		
Rock hyrax,	34.4	Giant legless skink (lizard)	12.5		
Hippopotamus	34.4				
Wildebeest spp.	31.3				
Genet spp.	28.1				
Hyaena spp.	28.1				
Jackal spp.	28.1				
Southern African hedgehog	25.0				
Leopard	25.0				
Aardvark	21.9				
Bat spp.	21.9				
Eland	21.9				
Scrub hare	21.9				
Impala	21.9				
Greater kudu	21.9				

Appendix S2 lists the incidence of all individual vertebrate species. Species in grey shading were uniformly distributed throughout the market; the remaining species were randomly dispersed.

Table 3 Quantity of material and percentage of 32 traders recorded selling marine fish and invertebrate taxa

Phylum	Class	Common name	Part	% of traders	No. of pieces
Chordata	Actinopterygii (ray-finned fish)	Fish spp. (ray-finned fishes, eels)	Whole	56.3	166
	Chondrichthyes (cartilaginous fish)	Fish spp. (sharks, rays and skates)	Whole	12.5	6
Arthropoda	Malacostraca	Crab: marine	Whole	6.3	4
	Insecta	Beetles, grasshoppers	Whole	9	225
Cnidaria	Anthozoa	Coral	Coral	6.3	3
Echinodermata	Asteroidea	Starfish	Shell	40.6	34
	Echinoidea	Shell: urchins	Shell	18.8	140
Mollusca		Shell: molluscs	Shell	31.3	955
	Bivalvia	Shell: clams	Shell	3.1	5
	Cephalapoda	Octopus	Whole	9.4	3
		Cuttlefish	Whole	9.4	45
	Gastropoda	Shells: cowries, limpets and snails	Shell	21.9	120
		Snail: giant land	Shell	43.8	72

Marine fauna and invertebrates

We recorded an array of invertebrates and fishes that we could only identify at a much higher taxonomic level (Appendix S3). Most invertebrates recorded were marine, representing at least four phyla (Table 3). The only non-marine invertebrates were two species of insect and the giant land snail (Appendix S3). Among the marine invertebrates, most were unidentified marine molluscs. Among the fishes, only two were fresh-water species (barbel, catfish) while the remaining were marine. The most common of these were sole (seven traders, 70 individuals). We also recorded relatively low numbers of sharks, rays, skates and eel, and 46 unidentified ray-finned fishes (Appendix S3). Of the marine taxa, ray-finned fish, mollusc and echinoderm shells were sold by 56% of traders (Table 3). Ninety-one per cent of traders sold some marine fauna.

Species richness

The species accumulation curves for mammals, birds and reptiles approached an asymptote and indicate that further sampling of traders would not yield many more new species for the individual vertebrate classes (Fig. 1), hence sampling effort was sufficient. The rate of accumulation of new species was 0.4 new species per trader for reptiles, 0.6 new species per trader for mammals and 1.2 new species per trader for birds (Fig. 1). When the vertebrate classes were combined (All), the curve was less asymptotic and indicates that 1.8 new species were recorded per trader sampled (Fig. 1). Avian species richness was higher than that of reptiles, despite birds having been recorded at the stalls of fewer traders (Table 1, Fig. 1).

At least 232 species of vertebrates (excluding domestic animals) have been recorded as being used or traded for traditional medicine from the Faraday survey (S_{obs}) and the other surveys conducted in South Africa ($S_{literature}$) combined (Table 4). The species identified in Faraday hence represent 63% of the total number of species identified in use or trade in South Africa to date.

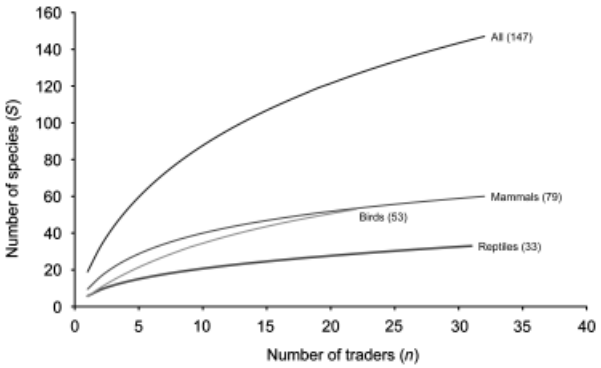

Figure 1 Species accumulation curves for vertebrate animals traded at the Faraday market. Parentheses indicate sample sizes.

The richness estimates generated for all (All) vertebrates ranged from 172 species for the bootstrap estimator to 233 species for the second-order jackknife estimator (Jack 2) (Fig. 2; Table 4). Both bootstrap and Jack 2 were consistently the lowest and highest estimators, respectively, of species richness for all datasets. Because ICE and Chao 2 gave unrealistically high estimates for a smaller number of traders (>300 species for 'All' after 2 traders) and MMRuns predicted >6000 species after 10 traders, the curves of these estimators were not presented and are not considered to be good predictors of species richness. Only the Jack 2 estimator consistently predicted within 0 to +3 species the total number of species recorded to date ($S_{total\ recorded}$) (Table 4); the remainder of the estimators underestimated $S_{total\ recorded}$ by 30–50 species. The Jack 2 estimator thus predicted an 'upper-bound' estimate for the total number of species that might be recorded in the Faraday market over time (Table 4), including opportunistically harvested species that have low use and commercial values.

Species diversity

The overall diversity of the species identified in the Faraday market is medium-high (Shannon $H' = 4.49$; Simpson's

Table 4 Comparison of observed species richness in the Faraday market (S_{obs}), the number of additional species observed/recorded in other surveys ($S_{literature}$) and the estimated species richness predicted by the second-order jackknife (Jack 2) estimator from EstimateS

	Observed species richness		Estimated species richness	
	S_{obs}	$S_{literature}$	$S_{total\ recorded} = S_{obs} + S_{literature}$	Jack 2
All	147	>85	≥232	233
Mammals	60	>23	≥84	87
Reptiles	33	>17	≥50	52
Birds	53	>40	≥93	93
Amphibians	1	>4	≥5	–

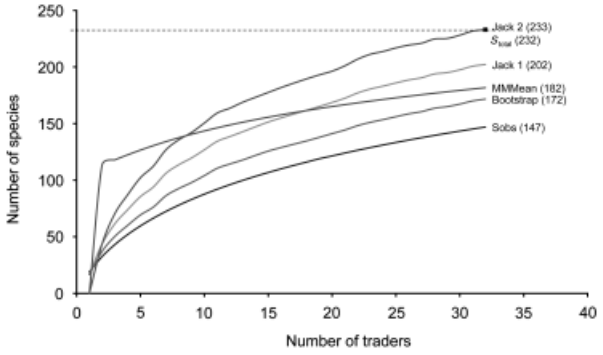

Figure 2 The performance of four incidence-based species richness estimators compared with the observed species accumulation curve (Sobs) for 'All' animals identified in the Faraday market (mammals, reptiles, birds and amphibian). The Jack 2 estimator predicts within one species the total number of species recorded from 10 other surveys (S_{total}) and also the total number of species likely to be recorded in Faraday over time.

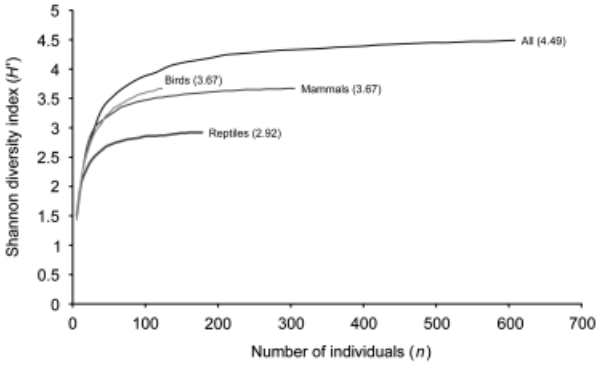

Figure 3 Cumulative diversity curve for the Shannon diversity index (H').

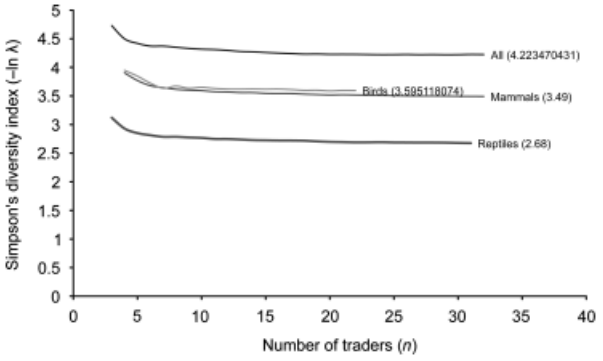

Figure 4 Cumulative diversity curve for the Simpson's diversity index ($-\ln \lambda$).

$-\ln \lambda = 4.23$) (Table 1, Figs 3 and 4). The cumulative diversity curves have reached asymptotes, indicating that the diversity index values would change very little with additional sampling effort (Figs 3 and 4). Within the vertebrate groups, diversity values indicate that there is a greater diversity of birds traded in the markets compared with mammals and reptiles, even though the overall species richness of birds is lower than that for mammals (Table 1, Figs 3 and 4). The higher bird diversity is partly indicative of the higher number of singletons recorded (Table 1).

Overall, evenness values are high, indicating that most species were evenly dispersed throughout the market and that relatively few species were very dominant (Table 1; Table 5). The predominance of crocodile, python and monitor parts within the market accounts for the lower evenness values for reptiles compared with mammals and birds. Of the 33 reptile species identified, eight species (24%) were dominant and were frequently sold at traders' stalls (Table 5). Bird fauna exhibited the least dominance of all the vertebrates with only 15% of the species being of very common occurrence. Forty-nine per cent of bird species were identified only once in the market (Table 5), further confirming the reason for the high diversity values for avian fauna despite the slightly lower species richness values compared with mammals.

Quantity traded and consumption levels

The number of traders selling a species and the quantity of that species in Faraday was significantly positively correlated ($r = 0.91$; $n = 138$; $P < 0.00001$) (Fig. 5). Hence, the more traders that sold a species, the more pieces of it there were likely to be. The correlation excluded 30 eggs, 51 ostrich feathers, 388 porcupine quills, 76 pangolin scales, 266 bovine horns and 84 teeth, as well as 65 crocodile osteoderms. When the aforementioned animal parts were included, the correlation was lower, but still significant

Table 5 Number and percentage of species of rare, intermediate and common occurrence within the Faraday market

	All	Mammals	Reptiles	Birds
Total *S*	147	60	33	53
Very common occurrence	28 (19%)	12 (20%)	8 (24%)	8 (15%)
Intermediate occurrence	62 (42%)	30 (50%)	12 (36%)	19 (36%)
Rare occurrence	57 (39%)	18 (30%)	13 (39%)	26 (49%)

The categories are derived from Hill's numbers N_0, N_1 and N_∞.

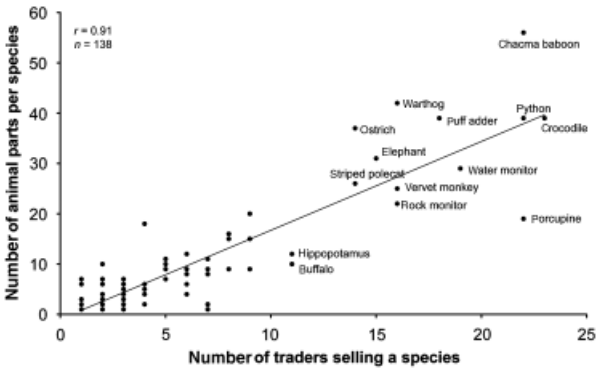

Figure 5 Relationship between the number of traders selling a vertebrate species and the total number of animal parts per species (excluding ostrich feathers, porcupine quills, pangolin scales, bovine teeth and horns and crocodile osteoderms). Species sold by more than 10 traders are labelled.

($r = 0.56$, $n = 146$, $P < 0.00001$). Appendix S3 lists the quantities of each animal part sold per species.

Mammal body parts and bones were present in the largest quantities (2453 pieces, excluding porcupine quills and pangolin scales), followed by reptiles (394 pieces, excluding osteoderms), birds (193 pieces, excluding feathers and ostrich eggs) and amphibians (six parts) (Table 6). Mammal bones were the most prevalent body part recorded. Of the vertebrates, fishes were the most likely to be sold as an intact carcass ($n = 172$, 100%) followed by birds ($n = 152$, 55.7% of all body parts), reptiles ($n = 163$, 35.5%) and mammals (n = 140, 4.8%). Conversely, mammals were the most likely to be sold as individual body parts and mammal bones were the most frequently documented item ($n = 1528$), followed by porcupine quills ($n = 388$), horns ($n = 266$), pieces of skin ($n = 214$) and skulls/heads ($n = 133$). For the reptiles, body parts that were traded in significant numbers included skins ($n = 107$), crocodile osteoderms ($n = 65$) and pieces of chelonian shells ($n = 55$). Feathers ($n = 51$) and eggs ($n = 30$) were the most frequently traded items of bird origin.

On average, traders ($n = 10$) sold to 5–10 customers a day, but this ranged from 2 to 15 customers and went as high as 25 customers on a very busy day.

Conservation status

Most ($n = 119$, 87.5%) species traded ($n = 136$) in Faraday were of least concern (Appendix S2, Table 7). Of the 17 taxa of conservation concern, we recorded a single individual (skull) of a CR species (hawksbill turtle), and a single individual (skull) from an EN species (wild dog). Two traders had parts of a samango monkey (Appendix S3), which, depending on the subspecies, is considered either VU or least concern (Kingdon *et al.*, 2008). Of the remaining 14 taxa, six were VU (one lizard, two birds, three mammals) and eight (two birds, six mammals) were near threatened (Table 7).

Twenty (62.5%) traders sold at least one species of conservation concern (mean = 1.59 ± 1.79, range: 0–6, $n = 32$ traders), which was significantly more than expected (Fisher's exact test $P = 0.067$). However, the proportion of traders selling a particular species was unrelated to its conservation status ($\chi^2 = 0.63$, d.f. = 1, $P > 0.1$; Appendix S2, Table 7). Furthermore, species of conservation concern were not significantly more abundant ($\chi^2 = 1.37$, d.f. = 1, $P > 0.1$; Appendix S3, Table 7) than species of least concern.

Discussion

We provide the first quantification of the trade of animals for use in traditional medicine at the Faraday market in South Africa. Most animals traded were vertebrates, although significant quantities of marine molluscs were also on sale. We identified 147 species of vertebrate, most of which were mammals (41%, 60 taxa), followed by birds (36%, 53 taxa), reptiles (22%, 33 taxa) and a single species of frog. All together, this species richness constitutes *c*. 8.7% of the total frog, reptile, bird and mammal fauna of South Africa (1685 + species total). If frogs (128 species) are excluded, this percentage increases marginally to 9.4%. We separately quantified domestic animals, invertebrates and marine fishes. Parts of seven domestic animals were for sale, but generally only a few individuals of each species and from only a few traders. Therefore, they are likely to be relatively unimportant as a source of medicine. Of the fishes, sole *Austroglossus pectoralis* were the most abundant, followed by box fish and an assortment of dried marine ray-finned fishes that we were unable to identify. Marine molluscs, chiefly gastropods, were sold by about a third of traders and were abundant in the market ($n = 955$). We only documented two species of insect. One trader had a large (>200) batch of CMR bean beetles *Mylabris oculata* (Appendix S3) while three traders had grasshoppers (*Taphronota*) for sale.

Species richness at Faraday was relatively high for a single source for traditional medicine in South Africa. In comparison to the 147 species of vertebrate that were for

Table 6 Number of body parts recorded for vertebrates in the Faraday survey

Mammals		Reptiles		Birds	
Body parts	No. of pieces	Body parts	No. of pieces	Body parts	No. of pieces
Bones: unidentified	1528	Whole (lizards, monitors and snakes)	163	Whole	152
Porcupine quills	388	Skin (Squamata)	107	Feathers	51
Horns	266	Osteoderms (crocodile)	65	Eggs	30
Skin (whole or pieces)	214	Shell/plastron/carapace (Testudines)	55	Skull	13
Whole body/carcass	140	Eggs	22	Leg	11
Skull/head	113	Skull/head	23	Foot	6
Teeth/tusks	84	Python body parts	16	Beak	4
Scales (pangolin)	72	Foot	6	Head and neck	3
Hooves	35	Neck	1	Skin	2
Legs	34	Tail	1	Wing	1
Foot/paw	27				
Intestine	3				
Penis/scrotum	3				
Tails	3				
Jaw	2				
Nose	1				
Total	2913		459		273

Table 7 Vertebrate species of conservation concern according to 2001 IUCN Red List Categories and Criteria version 3.1 that were traded at the Faraday market

Common name	Species	IUCN category	Number of traders	Number of parts
Reptiles				
Hawksbill turtle	*Eretmochelys imbricata*	CR	1	1
Sungazer (lizard)	*Cordylus giganteus*	VU	5	11
Birds				
Southern ground-hornbill	*Bucorvus cafer*	VU	3	3
Caspian tern	*Sterna caspia*	NT	1	1
White-backed vulture	*Gyps africanus*	VU	3	5
Great white pelican	*Pelecanus onocrotalus*	NT	1	1
Mammals				
Samango monkey	*Cercopithecus mitis* ssp.	VU/LC	2	2
South African hedgehog	*Atelerix frontalis*	NT	8	9
Ground pangolin	*Smutsia temminckii*	VU	2	74
Brown hyaena	*Hyaena brunnea*	NT	1	1
Spotted hyaena	*Crocuta crocuta*	NT	4	4
Unidentified Hyaena	–	NT	5	5
Lion	*Panthera leo*	VU	3	3
Serval	*Leptailurus serval*	NT	2	2
African wild dog	*Lycaon pictus*	EN	1	1
Honey badger (Ratel)	*Mellivora capensis*	NT	1	3
Blesbok/Bontebok	*Damaliscus pygargus*	VU (Bontebok)	1	6

We did not identify marine organisms and invertebrates to a sufficient level to assign IUCN categories. See Appendix S2 for detail on the specific parts of the animal that were for sale. Note that the number of parts sold does not equate to the number of animals sold. In the case of the Samango monkey, there are two southern African subspecies, one of which is Vulnerable while the other is Least Concern. We could not distinguish between Bontebok (VU) and Blesbok (LC) skulls. We also include unidentified hyaena because both species in southern Africa are NT. LC, least concern; NT, near threatened; VU, vulnerable; EN, endangered; CR, critically endangered.

sale at Faraday, Simelane & Kerley (1998) reported 44 species (eight reptiles, six birds, 30 mammals) being sold in 19 herbalist shops in the Eastern Cape Province of South Africa. Cunningham & Zondi (1991) examined the trade in animals for traditional medicine in KwaZulu-Natal Province and also review literature reports for South Africa. They report at least 79 species of vertebrate (18 reptiles, 16 birds, 45 mammals), excluding domestic mammals and various marine invertebrates and fishes. More recently, Ngwenya (2001) recorded 132 species of vertebrates (21

reptiles, 32 birds, 79 mammals) in trade across KwaZulu-Natal Province, of which 50 species were in high demand, especially vultures, chacma baboon, green mamba, southern African python, nile crocodile, puff adder, striped weasel and black mamba. In these studies, mammals are the most commonly sold group, followed by similar numbers of birds and reptiles. At Faraday, mammals were also the most commonly traded group, but we found a higher proportion of bird species than reptiles. In contrast to these studies, Herbert *et al*. (2003) focused on the invertebrate trade at a large traditional medicine market in Durban. They report a much greater diversity of marine invertebrates (seven phyla compared with four phyla in our study), which can be explained in large part by Durban's coastal location.

The second-order jackknife estimator (Jack 2) predicted that 233 species (an additional 86 species) could be identified with further sampling in the Faraday market over time (Fig. 2; Table 4). Based on the Jack 2 estimate, the Faraday survey has identified 63% of the total number of species recorded in South Africa to date. Given that samples should aim to record 50–75% of the total richness in a region (Heck, van Belle & Simberloff, 1975), we believe the sampling strategy and the number of traders interviewed to be sufficient and representative. However, estimates of species richness at traditional medicine markets are always conservative because of the large proportion of unidentified material. Of the 3716 animal parts documented at Faraday, 42% were not identifiable at the level of order, 45% not identifiable to family and 53% not identifiable to species. Most (41%) of the unidentified animal parts were various mammal bones and teeth, while 72% of the fish and invertebrates could not be identified at the level of order, 79% were not identified to family and 87% could not be identified to genus. Therefore, species richness is likely to be higher than what we report here because we took a conservative approach to estimating species richness and diversity by not including 'morphospecies' in the analyses (i.e. typological species that could only be identified as mongoose sp., monitor sp., owl sp., etc.). A consequence of this action was a reduction in the total number of singletons and doubletons, variables that are usually positively correlated with diversity and estimates of species richness. The more singletons there are in a sample, the higher the diversity and the greater the total estimated species richness is likely to be. When we included the morphospecies in the analyses, the richness estimate generated by Jack 2 for all (All) vertebrates increased from 233 species (Table 4) to 289 species and the Jack 1 estimator predicted 247 species in trade. Hence, Jack 1 and Jack 2 can be viewed as good lower- and upper-bound estimators, respectively, of vertebrate species richness traded commercially in the Faraday market over time, including opportunistically harvested species. In the absence of morphospecies in the analyses, however, Jack 2 was the only estimator that predicted (within three species) the total number of species that have been identified in South African markets to date. Williams *et al*. (2007*c*) also found that the Jack 1 and Jack 2 estimators were the best lower- and upper-bound estimators, respectively, of plant species richness at Faraday. Furthermore, the diversity and species accumulation curves were all asymptotic or near asymptotic respectively, indicating that further sampling would not significantly change the diversity index or the species richness results with further sampling; hence, a sufficient number of traders were interviewed overall.

In general, there was little overlap in what animal species traders had for sale. Any two traders would generally have less than a third of their species in common and this number was also dependent on taxonomic group. For example, traders had about 33% of reptile species in common but only about 13% of bird species in common. Nine species of vertebrates were traded by more than 50% of traders, five of which were reptiles (rock and water monitor, nile crocodile, southern African python, puff adder) and four of which were mammals (chacma baboon, cape porcupine, vervet monkey, warthog). In the case of birds, there were relatively low numbers of any one species, with the exception of ostrich (44% of traders) and to a lesser extent, owls. A low abundance of any particular bird species coupled with relatively high species richness meant higher species diversity and evenness. By comparison, mammal and reptile diversity indices were lower because of the relative abundance of certain species.

Establishing the impact of traditional medicine on wildlife is notoriously difficult because traders are reluctant to reveal the source of their stock. At Faraday, we were unable to explore this issue and we only obtained a very rough estimate of the number of customers that bought animal parts per day, from 10 traders. Therefore, we had no data on the actual turn-over of specific species and the rate at which stock was replaced. In addition, many traders sell individual bones or pieces of skin making it impossible to determine how many individual animals are being traded in a particular market. For example, at Faraday, traders frequently sold small pieces of elephant skin. Only prohibitively expensive DNA analysis would allow an estimation of how many individual elephants were present in the market and such an undertaking might only be valuable for the most CR species. Another confounding issue is that because traders are also willing to use animals recovered dead from the wild (death by natural causes or for example, by a vehicle) we also had no data on the proportion of live animals that were harvested from the wild specifically for traditional medicine. However, in one instance we observed a live hedgehog (IUCN near threatened) and a batch of recently killed Sungazer lizards (VU). Regardless of these constraints, we were still able to provide a crude assessment of the potential impact of the Faraday market on species of conservation concern by enumerating all parts belonging to threatened species. We documented a single CR species (Hawksbill turtle) and one EN species (wild dog), both consisting of a single skull. The remaining 15 species of conservation concern consisted of a single reptile (VU), four birds (two VU, two near threatened) and ten mammals. Of the mammals, six horns were identified as belonging to either Blesbok (least concern) or Bontebok (VU). While the widespread distribution and greater abundance of Blesbok make them a likely candidate, we can not exclude the possibility

that one or more might be Bontebok. In the case of the Samango Monkey, we were unable to establish the subspecies, one of which is a threatened species. Of the remaining mammals, six were near threatened and two were VU. The seventeen species of conservation concern all occurred at relatively low frequency (excluding pangolin, <4 parts/species). In the case of Pangolin, 74 scales were recorded, which could potentially come from a single individual. Therefore, the trade of species of conservation concern at Faraday is unlikely to pose a significant threat to the viability of any one species. However, our study is a snap-shot in time and given the extensive country-wide trade in animals for traditional medicine, future monitoring is necessary to prevent over-exploitation of threatened species. This is particularly true for animals such as vultures, which are highly prized for traditional medicine, and which can and have been killed in significant numbers during a single event such as poisoning (Cunningham & Zondi, 1991; Mander *et al*., 2007). While we need to respect the individual's need to access traditional medicine, it is in everyone's interest to ensure that these age-old practices are sustainable.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Images from the Faraday market in Johannesburg. a) typical stall; b) a trader's stall consisting of mainly cowrie shells, crocodile osteoderms, porcupine quills, assorted bones and teeth; c) a trader's stall consisting of mainly tortoise shells (*Kinixys* sp.), pieces of elephant skin, giant land snails (*Achatina* sp.) and assorted bones; d) a stall with an assortment of marine fauna including a fresh octopus whose tentacles, when ingested, reportedly prevent infidelity; e) leopard paws; f) various mammal skins including a Samango Monkey (*Cercopithecus mitis* ssp.; extreme left) and a small spotted genet (second from right); g) CMR Bean Beetles (*Mylabris oculata*); and h) assorted bones and skulls.

Appendix S2. Check list of vertebrate species, the number of traders recorded selling each species at the Faraday market, and each species' conservation status. The classification and sequence of orders and families follow Minter *et al.* (2004; frog); Zug, Vitt & Caldwell (2001) and Alexander & Marais (2007) (reptiles); Hockey *et al.* (2005; birds); and Skinner and Chimimba (2005; mammals). See text for details of conservation assessment (2001 IUCN Red Data Lists v 3.1). LC = least concern, NT = near threatened, VU = vulnerable, EN = endangered, CR = critically

endangered. We did not identify marine organisms and invertebrates to a sufficient level to assign IUCN categories, but see Appendix S3 for the quantities of these organisms at Faraday.

Appendix S3. Check list of vertebrate species according to the animal part traded and the number of body parts sold by all traders combined, at the Faraday market. The classification and sequence of orders and families follow Hockey *et al*. (2005; birds); Skinner & Chimimba (2005; mammals); Zug *et al*. (2001) and Alexander & Marais (2007) for reptiles. Invertebrates and fishes are unordered with respect to phylogeny.

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Appendix 1 Images from the Faraday market in Johannesburg. a) typical stall; b) a trader's stall consisting of mainly cowrie shells, crocodile osteoderms, porcupine quills, assorted bones and teeth; c) a trader's stall consisting of mainly tortoise shells (*Kinixys* sp.), pieces of elephant skin, giant land snails (*Achatina* sp.) and assorted bones; d) a stall with an assortment of marine fauna including a fresh octopus whose tentacles, when ingested, reportedly prevent infidelity; e) leopard paws; f) various mammal skins including a Samango Monkey (*Cercopithecus mitis* ssp.; extreme left) and a small spotted genet (second from right); g) CMR Bean Beetles (*Mylabris oculata*); and h) assorted bones and skulls.

a

b

c

d

e

f

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Appendix 2 Check list of vertebrate species, the number of traders recorded selling each species at the Faraday market, and each species' conservation status. The classification and sequence of orders and families follow Minter et al. (2004; frog); Zug, Vitt & Caldwell (2001) and Alexander & Marais (2007) (reptiles); Hockey et al. (2005; birds); and Skinner and Chimimba (2005; mammals). See text for details of conservation assessment (2001 IUCN Red Data Lists v 3.1). LC = least concern, NT = near threatened, VU = vulnerable, EN = endangered, CR = critically endangered. We did not identify marine organisms and invertebrates to a sufficient level to assign IUCN categories, but see Appendix S3 for the quantities of these organisms at Faraday.

FROGS

Family	Species	Common name	IUCN category	Number of traders
Bufonidae	*Schismaderma carens*	Toad, Red	LC	2
Unidentified frogs	-	-	-	1

REPTILES

Classification (Order, Family)	Species	Common name	IUCN category	Number of traders
Testudines				
Pelomedusidae	-	Terrapin, unidentified	-	6
Cheloniidae	*Eretmochelys imbricata*	Turtle, Hawksbill	CR	1
-	-	Turtle, unidentified	-	1
Testudinidae	*Chersina angulata*	Tortoise, Angulate	LC	1
	Kinixys belliana	Hinged Tortoise, Bell's	LC	2
	Kinixys speckii	Hinged Tortoise, Speke's	LC	1
	Kinixys sp.	Hinged Tortoise,	-	1

Classification (Order, Family)	Species	Common name	IUCN category	Number of traders
		unidentified		
	Stigmochelys pardalis	Leopard Tortoise	LC	8
	Homopus sp.	Padloper, unidentified	-	2
	-	Tortoise, unidentified	-	10
Crocodylia				
Crocodylidae	*Crocodylus niloticus*	Nile crocodile	LC	22
Squamata				
Pythonidae	*Python natalensis*	Python, Southern African	LC	23
Colubridae	*Lamprophis aurora*	House Snake, Aurora	LC	1
	Dispholidus typus	Boomslang	LC	6
	Philothamnus sp.	Green Snake, unidentified	-	1
	Pseudaspis cana	Mole Snake	LC	2
	Psammophis phillipsii	Grass Snake, Olive	LC	2
	Psammophis sp.	Sand Snake, unidentified	-	1
	Amblyodipsas sp.	Purple-glossed Snake, unidentified	-	1
	Psammophylax rhombeatus	Skaapsteker, Spotted	LC	1
	Psammophylax tritaeniatus	Skaapsteker, Striped	LC	1
Elapidae	*Dendroaspis polylepis*	Mamba, Black	LC	7
	Dendroaspis angusticeps	Mamba, Green	LC	5
	Dendroaspis sp.	Mamba, unidentified	-	2
	Naja mossambica	Spitting Cobra,	LC	5

Classification (Order, Family)	Species	Common name	IUCN category	Number of traders
		Mozambique		
	Naja sp.	Cobra, unidentified	-	1
	Hemachatus haemachatus	Rinkhals	LC	1
Viperidae	*Bitis arietans*	Puff Adder	LC	18
	Bitis sp.	Adder, unidentified	-	1
Agamidae	*Acanthocercus atricollis*	Agama, Southern Tree	LC	9
Chamaeleonidae	*Chamaeleo dilepis*	Chameleon, Flap-necked	LC	2
		Chameleon, unidentified	-	3
Varanidae	*Varanus albigularis*	Monitor, Rock	LC	16
	Varanus niloticus	Monitor, Water	LC	19
	Varanus sp.	Monitor, unidentified	-	7
Scincidae	*Acontias plumbeus*	Skink, Giant Legless	LC	4
Cordylidae	*Cordylus* cf. *vittifer*	Girdled Lizard, Transvaal	LC	1
	Cordylus giganteus	Sungazer	VU	5
	Cordylus tropidosternum	Girdled Lizard, Tropical	LC	1
	Cordylus warreni	Girdled Lizard, Warren's	LC	2
Gerrhosauridae	*Gerrhosaurus major*	Plated Lizard, Rough-scaled	LC	1
	Gerrhosaurus flavigularis	Plated Lizard, Yellow-throated	LC	1
-	-	lizard, unidentified	-	3
-	-	snake, unidentified	-	13
Unidentified	-	-	-	1

Classification (Order, Family)	Species	Common name	IUCN category	Number of traders
squamates				

BIRDS

Classification (Order, Family)	Species	Common name	IUCN category	Number of traders
Struthioniformes				
Struthionidae	*Struthio camelus*	Ostrich, Common	LC	14
Galliformes				
Phasianidae	*Coturnix coturnix*	Quail, Common	LC	2
Numididae	*Guttera edouardi*	Guineafowl, Crested	LC	2
	Numida meleagris	Guineafowl, Helmeted	LC	2
Anseriformes				
Anatidae	*Thalassornis leuconotus*	Duck, White-backed	LC	1
-	-	Duck, unidentified	-	3
Bucerotiformes				
Bucerotidae	*Bycanistes bucinator*	Hornbill, Trumpeter	LC	1
	-	Hornbill, unidentified	-	1
Bucorvidae	*Bucorvus cafer*	Ground-Hornbill, Southern	VU	3
Coraciiformes				
Alcedinidae	*Alcedo cristata*	Kingfisher, Malachite	LC	1
Cerylidae	*Ceryle rudis*	Kingfisher, Pied	LC	2
-	-	Kingfisher, unidentified	-	1
Coliiformes				
Coliidae	*Colius striatus*	Mousebird, Speckled	LC	2

Classification (Order, Family)	Species	Common name	IUCN category	Number of traders
	-	Mousebird, unidentified	-	1
Cuculiformes				
Centropodidae	*Centropus burchellii*	Coucal, Burchell's	LC	5
Musophagiformes				
Musophagidae	*Tauraco corythaix*	Turaco, Knysna	LC	1
Strigiformes				
Tytonidae	*Tyto alba*	Owl, Barn	LC	4
Strigidae	*Bubo africanus*	Eagle-Owl, Spotted	LC	5
	Asio capensis	Owl, Marsh	LC	3
-	-	Owl, unidentified	-	3
Caprimulgidae	*Caprimulgus* sp.	Nightjar, unidentified	-	1
Columbiformes				
Columbidae	*Streptopelia senegalensis*	Dove, Laughing	LC	6
	Streptopelia semitorquata	Dove, Redeyed	LC	1
	Columba livia	Dove, Rock (Feral Pigeon)	LC	3
Gruiformes				
Rallidae	*Amaurornis flavirostra*	Crake, Black	LC	1
	Gallinula chloropus	Moorhen, Common	LC	1
	Gallinula sp.	Moorhen, unidentified	-	1
	Porphyrio madagascariensis	Swamphen, African Purple	LC	2
Charadriiformes				

Classification (Order, Family)	Species	Common name	IUCN category	Number of traders
Burhinidae	*Burhinus capensis*	Thick-knee, Spotted	LC	4
	Burhinus sp.	Thick-knee, unidentified.	-	1
Charadriidae	*Vanellus armatus*	Lapwing, Blacksmith	LC	1
Laridae	*Sterna caspia*	Tern, Caspian	NT	1
Falconiformes				
Accipitridae	*Buteo rufofuscus*	Buzzard, Jackal	LC	1
	Haliaeetus vocifer	Fish-Eagle, African	LC	2
	Polyboroides typus	Harrier-Hawk, African	LC	1
	Elanus caeruleus	Kite, Black-shouldered	LC	1
	-	Eagle, unidentified	-	2
	Gyps africanus	Vulture, White-backed	VU	3
	-	Vulture, unidentified	-	3
Falconidae	-	Kestrel, unidentified	-	1
	-	hawk/eagle, unidentified	-	2
Ciconiiformes				
Ardeidae	*Bubulcus ibis*	Egret, Cattle	LC	7
	Egretta alba	Egret, Great	LC	1
Scopidae	*Scopus umbretta*	Hamerkop	LC	2
Threskiornithidae	*Threskiornis aethiopicus*	Ibis, African Sacred	LC	3
	Bostrychia hagedash	Ibis, Hadeda	LC	5
Pelecanidae	*Pelecanus onocrotalus*	Pelican, Great White	NT	1
	-	Pelican, unidentified	-	1
Ciconiidae	*Ciconia ciconia*	Stork, White	LC	3
	-	Stork, unidentified (red	-	2

Classification (Order, Family)	Species	Common name	IUCN category	Number of traders
		bill)		
Passeriformes				
Malaconotidae	*Laniarius ferrugineus*	Boubou, Southern	LC	1
	Prionops plumatus	Helmet-Shrike, White-crested	LC	1
Corvidae	*Corvus capensis*	Crow, Cape	LC	1
	Corvus albus	Crow, Pied	LC	3
Laniidae	*Lanius collaris*	Fiscal, Common	LC	3
Pycnonotidae	*Pycnonotus tricolor*	Bulbul, Dark-capped	LC	1
Zosteropidae	*Zosterops virens*	White-eye, Cape	LC	2
Cisticolidae	*Cisticola* sp.	Cisticola, unidentified	-	1
	Prinia subflava	Prinia, tawny-flanked	LC	1
Muscicapidae	*Melaenornis pammelaina*	Flycatcher, Southern Black	LC	2
	Cossypha natalensis	Robin-Chat, Red-capped	LC	1
	Turdus olivaceus	Thrush, Olive	LC	1
Sturnidae	*Lamprotornis nitens*	Starling, Cape Glossy	LC	3
	Lamprotornis sp.	Starling, unidentified	-	1
Passeridae	*Passer domesticus*	Sparrow, House	LC	1
Unidentified birds		-	-	9

MAMMALS

Classification (Order, Family)	Species	Common name	IUCN category	Number of traders

Classification (Order, Family)	Species	Common name	IUCN category	Number of traders
Macroscelidea				
Macroscelididae	*Elephantulus* sp.	Elephant Shrew, unidentified	-	2
Tubulidentata				
Orycteropodidae	*Orycteropus afer*	Aardvark	LC	7
Hyracoidea				
Procaviidae	*Procavia capensis*	Rock Hyrax	LC	11
Proboscidea				
Elephantidae	*Loxodonta africana*	Elephant, African	LC	15
Lagomorpha				
Leporidae	*Lepus saxatilis*	Hare, Scrub	LC	7
	Pronolagus sp.	Rabbit, Rock	LC	6
	-	hare/rabbit, unidentified	-	1
Rodentia				
Bathyergidae	-	Molerat, unidentified	-	2
Hystricidae	*Hystrix africaeaustralis*	Porcupine, Cape	LC	22
-	-	Rodent, unidentified	-	1
Primates				
Galagidae	*Otolemur crassicaudatus*	Bushbaby, thick-tailed (Greater Galago)	LC	6
	-	Bushbaby, unidentified	-	9
Cercopithecidae	*Papio ursinus*	Baboon, Chacma	LC	22
	Cercopithecus mitis ssp.	Monkey, Samango	VU/LC (dependi	2

Classification (Order, Family)	Species	Common name	IUCN category	Number of traders
			ng on ssp)	
	Chlorocebus pygerythrus	Monkey, Vervet	LC	16
Erinaceomorpha				
Erinaceidae	*Atelerix frontalis*	Hedgehog, South African	NT	8
Chiroptera				
-	-	bat, unidentified	-	7
Pholidota				
Manidae	*Smutsia temminckii*	Pangolin, Ground	VU	2
Carnivora				
Hyaenidae	*Proteles cristatus*	Aardwolf	LC	3
	Hyaena brunnea	Hyaena, Brown	NT	1
	Crocuta crocuta	Hyaena, Spotted	NT	4
	-	Hyaena, unidentified	-	5
Felidae	*Felis silvestris*	Cat, African Wild	LC	1
	Caracal caracal	Caracal	LC	1
	Felis catus	Cat, Domestic	-	3
	Panthera pardus	Leopard	LC	8
	Panthera leo	Lion	VU	3
	Leptailurus serval	Serval	NT	2
Viverridae	*Civettictis civetta*	Civet, African	LC	1
	Genetta tigrina	Genet, Large-spotted	LC	6
	Genetta genetta	Genet, Small-spotted	LC	4

Classification (Order, Family)	Species	Common name	IUCN category	Number of traders
	Genetta sp.	Genet, unidentified	-	4
Herpestidae	*Mungos mungo*	Mongoose, Banded	LC	2
	Herpestes ichneumon	Mongoose, Large Grey	LC	1
	Galerella sanguinea	Mongoose, Slender	LC	3
	Ichneumia albicauda	Mongoose, White-tailed	LC	2
	Suricata suricatta	Meerkat	LC	1
	-	Mongoose, unidentified	-	8
Canidae	*Otoycyon megalotis*	Fox, Bat-eared	LC	1
	Vulpes chama	Fox, Cape	LC	1
	Canis mesomelas	Jackal, Black-backed	LC	1
	Canis sp.	Jackal, unidentified	-	8
	Lycaon pictus	Wild Dog, African	EN	1
Mustelidae	*Mellivora capensis*	Badger, Honey (Ratel)	NT	1
	Aonyx capensis	Otter, Cape Clawless	LC	3
	-	Otter, sp.	-	3
	Ictonyx striatus	Polecat, Striped	LC	14
Otariidae	*Arctocephalus pusillus*	Seal, Cape Fur	LC	1
-	-	unidentified, small carnivore	-	1
Perissodactyla				
Equidae	*Equus asinus*	Donkey	-	3
	Equus caballus	Horse	-	13
	Equus burchellii	Zebra, Plains	LC	6
Suiformes				

Classification (Order, Family)	Species	Common name	IUCN category	Number of traders
Suidae	*Potamochoerus larvatus*	Bushpig	LC	2
	Phacochoerus africanus	Warthog, Common	LC	16
	Sus domesticus	Pig	-	2
Whippomorpha				
Hippopotamidae	*Hippopotamus amphibius*	Hippopotamus	LC	11
Ruminantia				
Giraffidae	*Giraffa camelopardalis*	Giraffe	LC	4
Bovidae	*Damaliscus pygargus*	Blesbok/Bontebok	VU (Bontebok)	1
	Syncerus caffer	Buffalo, African	LC	12
	Tragelaphus scriptus	Bushbuck	LC	4
	Sylvicapra grimmia	Duiker, Common	LC	2
	Cephalophus natalensis	Duiker, Red	LC	9
	-	Duiker, unidentified	-	8
	Taurotragus oryx	Eland	LC	7
	Oryx gazella	Gemsbok	LC	3
	Capra hircus	Goat, Domestic	-	1
	Aepyceros melampus	Impala	LC	7
	Oreotragus oreotragus	Klipspringer	LC	1
	Tragelaphus strepsiceros	Kudu, Greater	LC	7
	Tragelaphus angasii	Nyala	LC	3

Classification (Order, Family)	Species	Common name	IUCN category	Number of traders
	Bos taurus	Cattle	-	2
	Redunca arundinum	Reedbuck	LC	1
	Ovis aries	Sheep	-	3
	Antidorcas marsupialis	Springbok	LC	3
	Kobus ellipsiprymnus	Waterbuck	LC	4
	Connochaetes taurinus	Wildebeest, Blue	LC	1
	Connochaetes sp.	Wildebeest, unidentified	-	9
	-	ungulate, unidentified	-	11
Unidentified mammals				25

Appendix 3 Check list of vertebrate species according to the animal part traded and the number of body parts sold by all traders combined, at the Faraday market. The classification and sequence of orders and families follow Hockey et al. (2005; birds); Skinner & Chimimba (2005; mammals); Zug et al. (2001) and Alexander & Marais (2007) for reptiles. Invertebrates and fishes are unordered with respect to phylogeny.

INVERTEBRATES

Classification (Class, Order)	Family	Common name	Animal part	Number of parts
Anthozoa: Scleractinia	-	coral	-	3
Malacostraca: Decapoda	-	marine crab	whole	2
Mollusca	-	various unidentified	shell	934
Cephalopoda: Sepiida	Sepiidae	Cuttlefish (*Sepia* spp.)	whole	45
Cephalapoda: Octopoda	Octopodidae	Common Octopus (*Octopus vulgaris*)	whole	2
			tentacle	2
Bivalvia	-	clam	shell	5
Gastropoda: Sorbeoconcha	Cypraeidae	cowrie (*Cypraea*)	shell	84

Gastropoda: Archaeogastropoda	-	limpit	shell	16
Gastropoda	-	mollusc (various marine)	shell	21
Gastropoda: Pulmonata	-	ocean slugs	whole	20
Gastropoda: clade: Stylommatophora	Achatinidae	giant land snail (*Achatina*)	shell	72
Echinoidea: Cidaroida	Cidaridae	Pencil urchin (*Prionocidaris pistillaris*)	shell	75
Echinoidea: Echinoida	-	sea urchin	shell	65
Asteroidea: Valvatida	-	star fish	whole	34
Insecta: Coleoptera	Meloidae	CMR Bean Beetle (*Mylabris oculata*)	whole	200
Insecta: Orthoptera	Pyrgomorphidae	grasshopper (*Taphronota* sp.)	whole	25

FISHES

Classification (Class, Order)	Family	Common name	Animal part	Number of parts
Actinopterygii: Anguilliformes	Muraenidae	Eel, Moray	whole	2

		eel, unidentified	whole	2
Actinopterygii: Cypriniformes	Cyprinidae	barbel	head	1
Actinopterygii: Tetraodontiformes	Ostraciidae	box fish	whole	30
Actinopterygii: Tetraodontiformes	-	puffer fish/porcupine fish	whole	14
Actinopterygii: Siluriformes	-	catfish	head	1
Actinopterygii: Pleuronectiformes		sole (*Austroglossus pectoralis*)	whole	70
Actinopterygii	-	fish, unidentified	whole	46
Chondrichthyes: Rajiformes	-	rays	whole	3
	Rajidae	skate	whole	1
Chondrichthyes: Selachimorpha	-	shark	jaw	1
			skin	1

FROGS

Family	Species	Common name	Animal part	Number of parts
Bufonidae	*Schismaderma carens*	Toad, Red	whole	2
Unidentified frogs	-	-	whole	5

REPTILES

Classification (Order, Family)	Species	Common name	Animal part	Number of parts
Testudines				
Pelomedusidae	-	Terrapin, unidentified	shell	8
			head	1
			plastron	1
Cheloniidae	*Eretmochelys imbricata*	Turtle, Hawksbill	head	1
-	-	Turtle, unidentified	shell	2
	-	Terrapin/Turtle/tortoise	shell	1
Testudinidae	*Chersina angulata*	Tortoise, Angulate	shell	1
	Kinixys belliana	Hinged Tortoise, Bell's	carapace	2
			shell	2
	Kinixys speckii	Hinged Tortoise, Speke's	shell	1
	Kinixys sp.	Hinged Tortoise, unidentified	shell	1
	Stigmochelys pardalis	Leopard Tortoise	foot	2
			plastron	3
			shell	11
	Homopus sp.	Padloper, unidentified	shell	1
	-	Tortoise, unidentified	shell	14
			carapace	3
			egg	2
			foot	2
			neck	1

Classification (Order, Family)	Species	Common name	Animal part	Number of parts
			plastron	4
Crocodylia				
Crocodylidae	*Crocodylus niloticus*	Nile crocodile	skin	24
			skull	9
			osteoderms	65
			lower jaws	4
			egg	20
			bone	1
Squamata				
Pythonidae	*Python natalensis*	Python, Southern African	skin	22
			body parts	16
			skull	1
Colubridae	*Lamprophis aurora*	House Snake, Aurora	skin	1
	Dispholidus typus	Boomslang	whole	5
			skin	1
	Philothamnus sp.	Green Snake, unidentified	whole	1
	Pseudaspis cana	Mole Snake	whole	3
	Psammophis phillipsii	Grass Snake, Olive	whole	2
	Psammophis sp.	Sand Snake, unidentified	whole	1
	Amblyodipsas sp.	Purple-glossed Snake, unidentified	whole	1
	Psammophylax rhombeatus	Skaapsteker, Spotted	whole	1

Classification (Order, Family)	Species	Common name	Animal part	Number of parts
	Psammophylax tritaeniatus	Skaapsteker, Striped	whole	1
Elapidae	*Dendroaspis polylepis*	Mamba, Black	whole	10
			skin	1
	Dendroaspis angusticeps	Mamba, Green	whole	5
			skin	2
	Dendroaspis sp.	Mamba, unidentified	skin	2
	Naja mossambica	Spitting Cobra, Mozambique	whole	10
	Naja sp.	Cobra, unidentified	skin	1
	Hemachatus haemachatus	Rinkhals	whole	1
Viperidae	*Bitis arietans*	Puff Adder	skin	11
			whole	28
	Bitis sp.	Adder, unidentified	whole	1
Agamidae	*Acanthocercus atricollis*	Agama, Southern Tree	whole	20
Chamaeleonidae	*Chamaeleo dilepis*	Chameleon, Flap-necked	whole	2
		Chameleon, unidentified	tail	1
			whole	3
Varanidae	*Varanus albigularis*	Monitor, Rock	head	3
			skin	10
			whole	9
	Varanus niloticus	Monitor, Water	foot	2

Classification (Order, Family)	Species	Common name	Animal part	Number of parts
			skin	9
			whole	18
	Varanus sp.	Monitor, unidentified	head	2
			skin	8
			whole	3
Scincidae	*Acontias plumbeus*	Skink, Giant Legless	whole	6
Cordylidae	*Cordylus cf. vittifer*	Girdled Lizard, Transvaal	whole	7
	Cordylus giganteus	Sungazer	whole	11
	Cordylus tropidosternum	Girdled Lizard, Tropical	whole	1
	Cordylus warreni	Girdled Lizard, Warren's	whole	10
Gerrhosauridae	*Gerrhosaurus major*	Plated Lizard, Rough-scaled	whole	2
	Gerrhosaurus flavigularis	Plated Lizard, Yellow-throated	whole	1
-	-	lizard, unidentified	whole	7
-	-	snake, unidentified	head	2
			skin	15
			whole	42

BIRDS

Classification (Order, Family)	Species	Common name	Animal part	Number of parts
Struthioniformes				

Classification (Order, Family)	Species	Common name	Animal part	Number of parts
Struthionidae	*Struthio camelus*	Ostrich, Common	beak	1
			egg	28
			feather	30
			leg	2
			skin	2
			skull	2
			toe	2
Galliformes				
Phasianidae	*Coturnix coturnix*	Quail, Common	whole	2
Numididae	*Guttera edouardi*	Guineafowl, Crested	whole	7
	Numida meleagris	Guineafowl, Helmeted	whole	2
Anseriformes				
Anatidae	*Thalassornis leuconotus*	Duck, White-backed	head	1
-	-	Duck, unidentified	foot	2
			whole	2
Bucerotiformes				
Bucerotidae	*Bycanistes bucinator*	Hornbill, Trumpeter	whole	1
	-	Hornbill, unidentified	beak	1
Bucorvidae	*Bucorvus cafer*	Ground-Hornbill, Southern	beak	1
			skull	1
			whole	1
Coraciiformes				
Alcedinidae	*Alcedo cristata*	Kingfisher, Malachite	whole	1

Classification (Order, Family)	Species	Common name	Animal part	Number of parts
Cerylidae	*Ceryle rudis*	Kingfisher, Pied	whole	2
-	-	Kingfisher, unidentified	whole	1
Coliiformes				
Coliidae	*Colius striatus*	Mousebird, Speckled	whole	6
	-	Mousebird, unidentified	whole	1
Cuculiformes				
Centropodidae	*Centropus burchellii*	Coucal, Burchell's	whole	7
Musophagiformes				
Musophagidae	*Tauraco corythaix*	Turaco, Knysna	whole	1
Strigiformes				
Tytonidae	*Tyto alba*	Owl, Barn	whole	4
Strigidae	*Bubo africanus*	Eagle-Owl, Spotted	whole	9
	Asio capensis	Owl, Marsh	whole	3
-	-	Owl, unidentified	foot	1
			leg	1
			whole	1
Caprimulgidae	*Caprimulgus* sp.	Nightjar, unidentified	wing	1
Columbiformes				
Columbidae	*Streptopelia senegalensis*	Dove, Laughing	whole	4
	Streptopelia semitorquata	Dove, Redeyed	whole	2
	Columba livia	Dove, Rock (Feral Pigeon)	whole	3

Classification (Order, Family)	Species	Common name	Animal part	Number of parts
			head	1
Gruiformes				
Rallidae	*Amaurornis flavirostra*	Crake, Black	whole	2
	Gallinula chloropus	Moorhen, Common	whole	1
	Gallinula sp.	Moorhen, unidentified	whole	2
	Porphyrio madagascariensis	Swamphen, African Purple	whole	2
Charadriiformes				
Burhinidae	*Burhinus capensis*	Thick-knee, Spotted	whole	4
	Burhinus sp.	Thick-knee, unidentified.	whole	1
Charadriidae	*Vanellus armatus*	Lapwing, Blacksmith	whole	1
Laridae	*Sterna caspia*	Tern, Caspian	whole	1
Falconiformes				
Accipitridae	*Buteo rufofuscus*	Buzzard, Jackal	whole	1
	Haliaeetus vocifer	Fish-Eagle, African	whole	4
	Polyboroides typus	Harrier-Hawk, African	whole	1
	Elanus caeruleus	Kite, Black-shouldered	whole	1
	-	Eagle, unidentified	whole	2
	Gyps africanus	Vulture, White-backed	whole	5
	-	Vulture, unidentified	foot	2
			head	1
			whole	1
Falconidae	-	Kestrel, unidentified	whole	1

Classification (Order, Family)	Species	Common name	Animal part	Number of parts
	-	hawk/eagle, unidentified	claw	1
			skull	1
Ciconiiformes				
Ardeidae	*Bubulcus ibis*	Egret, Cattle	head	1
			whole	9
	Egretta alba	Egret, Great	whole	1
Scopidae	*Scopus umbretta*	Hamerkop	whole	2
Threskiornithidae	*Threskiornis aethiopicus*	Ibis, African Sacred	whole	3
	Bostrychia hagedash	Ibis, Hadeda	whole	6
			head	1
Pelecanidae	*Pelecanus onocrotalus*	Pelican, Great White	whole	1
	-	Pelican, unidentified	head	1
Ciconiidae	*Ciconia ciconia*	Stork, White	head-neck	1
			skull	1
			whole	4
	-	Stork, unidentified (red bill)	head-neck	2
Passeriformes				
Malaconotidae	*Laniarius ferrugineus*	Boubou, Southern	whole	2
	Prionops plumatus	Helmet-Shrike, White-crested	whole	1
Corvidae	*Corvus capensis*	Crow, Cape	whole	1
	Corvus albus	Crow, Pied	whole	7
Laniidae	*Lanius collaris*	Fiscal, Common	whole	3

Classification (Order, Family)	Species	Common name	Animal part	Number of parts
Pycnonotidae	*Pycnonotus tricolor*	Bulbul, Dark-capped	whole	1
Zosteropidae	*Zosterops virens*	White-eye, Cape	whole	2
Cisticolidae	*Cisticola* sp.	Cisticola, unidentified	whole	1
	Prinia subflava	Prinia, tawny-flanked	whole	1
Muscicapidae	*Melaenornis pammelaina*	Flycatcher, Southern Black	whole	2
	Cossypha natalensis	Robin-Chat, Red-capped	whole	2
	Turdus olivaceus	Thrush, Olive	whole	1
Sturnidae	*Lamprotornis nitens*	Starling, Cape Glossy	whole	4
	Lamprotornis sp.	Starling, unidentified	whole	1
Passeridae	*Passer domesticus*	Sparrow, House	whole	2
Unidentified birds		-	beak	1
		-	feather	21
		-	egg shells	2
		-	head-skull	2
		-	leg	7
		-	whole	5

MAMMALS

Classification (Order, Family)	Species	Common name	Animal part	Number of parts
Macroscelidea				
Macroscelididae	*Elephantulus* sp.	Elephant Shrew, unidentified	whole	4

Classification (Order, Family)	Species	Common name	Animal part	Number of parts
Tubulidentata				
Orycteropodidae	*Orycteropus afer*	Aardvark	foot	3
			skin	3
			skull	1
			whole	1
Hyracoidea				
Procaviidae	*Procavia capensis*	Rock Hyrax	skull	1
			whole	8
Proboscidea				
Elephantidae	*Loxodonta africana*	Elephant, African	bone	3
			foot	1
			penis	1
			skin	25
			tooth	1
Lagomorpha				
Leporidae	*Lepus saxatilis*	Hare, Scrub	head	1
			skin	1
			whole	7
	Pronolagus sp.	Rabbit, Rock	foot	1
			leg	2
			skin	4
			whole	1
	-	unidentified	whole	1
Rodentia				

Classification (Order, Family)	Species	Common name	Animal part	Number of parts
Bathyergidae		Molerat, unidentified	whole	2
Hystricidae	*Hystrix africaeaustralis*	Porcupine, Cape	foot	4
			intestine	1
			nose	1
			quill	388
			skin	11
			skull	1
			whole	1
-	-	Rodent, unidentified	whole	1
Primates				
Galagidae	*Otolemur crassicaudatus*	Bushbaby, thick-tailed (Greater Galago)	skin	1
			whole	8
	-	Bushbaby, unidentified	skin	1
			skull	3
			whole	13
Cercopithecidae	*Papio ursinus*	Baboon, Chacma	bone	4
			foot/hand	8
			skin	10
			skull	20
			whole	14
	Cercopithecus mitis ssp.	Monkey, Samango	skin	2
	Chlorocebus pygerythrus	Monkey, Vervet	skin	3

Classification (Order, Family)	Species	Common name	Animal part	Number of parts
			skull	12
			whole	10
Erinaceomorpha				
Erinaceidae	*Atelerix frontalis*	Hedgehog, South African	skin	2
			whole	7
Chiroptera				
-	-	bat, unidentified	whole	13
Pholidota				
Manidae	*Smutsia temminckii*	Pangolin, Ground	foot	2
			scale	72
Carnivora				
Hyaenidae	*Proteles cristatus*	Aardwolf	skin	3
			whole	1
	Hyaena brunnea	Hyaena, Brown	skin	1
	Crocuta crocuta	Hyaena, Spotted	skin	3
			skull	1
	-	Hyaena, unidentified	skin	2
			skull	3
Felidae	*Felis silvestris*	Cat, African Wild	skin	1
	Caracal caracal	Caracal	skin	1
	Felis catus	Cat, Domestic	skin	3
	Panthera pardus	Leopard	bone	1
			foot/paw	6

Classification (Order, Family)	Species	Common name	Animal part	Number of parts
			skin	5
			skull	3
	Panthera leo	Lion	bone	1
			skin	1
			skull	1
	Leptailurus serval	Serval	skin	2
Viverridae	*Civettictis civetta*	Civet, African	skull	1
	Genetta tigrina	Genet, Large-spotted	skin	3
			whole	9
	Genetta genetta	Genet, Small-spotted	skin	4
			whole	1
	Genetta sp.	Genet, unidentified	skin	3
			whole	2
Herpestidae	*Mungos mungo*	Mongoose, Banded	skin	2
			whole	4
	Herpestes ichneumon	Mongoose, Large Grey	skin	1
	Galerella sanguinea	Mongoose, Slender	skin	5
			whole	1
	Ichneumia albicauda	Mongoose, White-tailed	skin	3
	Suricata suricatta	Meerkat	whole	2
	-	Mongoose, unidentified	head	1
			skin	6
			whole	5
Canidae	*Otoycyon megalotis*	Fox, Bat-eared	whole	1

Classification (Order, Family)	Species	Common name	Animal part	Number of parts
	Vulpes chama	Fox, Cape	whole	2
	Canis mesomelas	Jackal, Black-backed	skin	2
	Canis sp.	Jackal, unidentified	skin	6
			skull	1
			whole	1
	Lycaon pictus	Wild Dog, African	skull	1
Mustelidae	*Mellivora capensis*	Badger, Honey (Ratel)	skin	3
	Aonyx capensis	Otter, Cape Clawless	whole	1
	-	Otter, sp.	skins	4
	Ictonyx striatus	Polecat, Striped	skin	11
			whole	15
Otariidae	*Arctocephalus pusillus*	Seal, Cape Fur	skin	1
-	-	unidentified, small carnivore	skull	2
Perissodactyla				
Equidae	*Equus asinus*	Donkey	hoof	2
			skull	2
	Equus caballus	Horse	hoof	2
			leg	26
			penis	1
			skull	3
			tail	1
	Equus burchellii	Zebra, Plains	hoof	1
			skin	4

Classification (Order, Family)	Species	Common name	Animal part	Number of parts
			skull	3
Suiformes				
Suidae	*Potamochoerus larvatus*	Bushpig	skin	2
	Phacochoerus africanus	Warthog, Common	bone	21
			skin	5
			skull	16
			tooth/tusk	26
	Sus domesticus	Pig	skin	3
Whippomorpha				
Hippopotamidae	*Hippopotamus amphibius*	Hippopotamus	bone	2
			skin	3
			skull	1
			tooth/tusk	19
Ruminantia				
Giraffidae	*Giraffa camelopardalis*	Giraffe	bone	15
			skin	1
			skull	1
			tail	1
Bovidae	*Damaliscus pygargus*	Blesbok/Bontebok	skulls	6
	Syncerus caffer	Buffalo, African	horn	10
			skin	3
			skull	2
	Tragelaphus scriptus	Bushbuck	horn	4

Classification (Order, Family)	Species	Common name	Animal part	Number of parts
			skull	2
	Sylvicapra grimmia	Duiker, Common	horn	30
			skin	1
	Cephalophus natalensis	Duiker, Red	baby/whole	1
			horn	47
			skin	11
			skull	3
	-	Duiker, unidentified	horn	30
			leg	1
			skin	1
			skull	3
	Taurotragus oryx	Eland	horn	5
			scrotum	1
			skin	1
	Oryx gazella	Gemsbok	horn	3
	Capra hircus	Goat, Domestic	skin	1
	Aepyceros melampus	Impala	horn	5
			skin	7
			skull	1
	Oreotragus oreotragus	Klipspringer	skin	1
	Tragelaphus strepsiceros	Kudu, Greater	horn	8
			skull	2
	Tragelaphus angasii	Nyala	horn	2

Classification (Order, Family)	Species	Common name	Animal part	Number of parts
			skin	2
	Bos taurus	Cattle	belly	1
			horn	1
	Redunca arundinum	Reedbuck	horn	1
	Ovis aries	Sheep	jaw	2
			skin	2
	Antidorcas marsupialis	Springbok	hoof	1
			horn	4
	Kobus ellipsiprymnus	Waterbuck	hoof	1
			horn	3
			skin	1
	Connochaetes taurinus	Wildebeest, Blue	horn	2
	Connochaetes sp.	Wildebeest, unidentified	horn	6
			skin	3
			skull	2
			tail	1
Unidentified bovids				
	-	-	bone	20
	-	-	hoof	29
	-	-	horn	105
	-	-	leg	5
	-	-	skin	8
	-	-	skull	9
Unidentified mammals				

Classification (Order, Family)	Species	Common name	Animal part	Number of parts
	-	-	bone	1222
	-	-	carcass	5
	-	-	foot	2
	-	-	intestine	1
	-	-	skin	15
	-	-	skull	4
	-	-	tooth	50
	-	-	vertebra	239