CHAPTER 2

Regional IUCN Red List assessments for South African terrestrial and marine mammals: An overview

For submission to: *Biological Conservation*

Abstract

This paper investigates and compares South African mammals according to their various regional and global World Conservation Union (IUCN) Red List and Red Data Book listings. Recently, the extinction risk of 295 extant marine and terrestrial mammal taxa was evaluated at a regional scale using the latest IUCN Red List categories and criteria. This risk assessment was compared with the risk status in the 2003 global Red List assessment and the 1986 South African Mammals Red Data Book. For the first time in the South African history of regional Red List or Red Data Book assessments, 42 marine mammals were assessed, with the majority being identified as Data Deficient. The regional Red List assessment listed 57 marine and terrestrial mammals as threatened (Critically Endangered, Endangered or Vulnerable), the majority belonging to the Order Insectivora. The regional Red List assessment identified more South African taxa to be threatened than was the case with the global Red List assessment. A large proportion of mammals were identified as regionally Data Deficient, and thus do not have sufficient information to allow for an adequate IUCN Red List assessment at the regional scale. A strong reliance on IUCN Red List category B (distribution/range size in conjunction with severe fragmentation, population structure, continuing decline and extreme fluctuations) and D (taxa with restricted area, or with a small number of breeding individuals) were evident in the regional Red List assessment. It is essential to recognize that the regional Red List assessment can only be considered as provisional and those regional assessments are imperative to allow for the monitoring of changing extinction risk in South African mammals.

Keywords: IUCN Red List, Read Data Book, regional assessments, terrestrial/marine mammals, South Africa

1. Introduction

Growing awareness about the possible extinction of certain taxa is largely attributed to the development of the World Conservation Union's (IUCN) Red List and/or Red Data Book (RDB) concept (Magin et al., 1994). The IUCN Red List was conceptualised by Sir Peter Scott in 1963 and has evolved significantly over the years (Ferrar, 1991; Magin et al., 1994). Red Lists and RDBs are in simple terms, methods for identifying declining taxa, which will allow conservation scientists to establish the nature and extent of such declines introduce conservation actions, research, and the monitoring of such taxa (Ferrar, 1991; Sutherland, 2001; Possingham et al., 2002; Lamoreux et al., 2003).

Red Lists and RDBs contribute to basic research and to the general knowledge of taxa by providing consolidated information, reflecting the probability of decline or loss of a taxon through extinction. The identification of taxa under threat of extinction has proven to be helpful by drawing public focus to these taxa, as well as their declining habitats (Ferrar, 1991; Possingham et al., 2002). The compilation of Red Lists and RDBs are an essential component of modern conservation practice (Sutherland, 2001).

Before 1994, the more subjective Red Data book threatened species categories, used by the IUCN, had been in place, for almost 30 years (IUCN, 1994). The strengths of these pre-1994 Red Data Book categories were their simplicity, modest data requirements and wide acceptance (Todd and Burgman, 1998). These categories were, however, largely qualitative and subjective, and as a result, depended almost exclusively on expert opinion. Consequently, categorisations made by different authorities, from different areas and across RDBs, were inconsistent and did not accurately reflect the actual extinction risks (Mace and Lande, 1991; Master, 1991; Todd and Burgman, 1998).

In 1989, the IUCN Species Survival Commission steering committee started to develop a more objective and quantitative approach that provided the conservation community with a useful methodology for assessing the risk of extinction of species. The 1994 IUCN Red List categories and criteria (version 2.3) marked a shift from qualitative to a more quantitative system (IUCN, 1994, 2001). These Red List categories and criteria were recently reviewed and some modifications were introduced (IUCN, 2001). The categories and criteria (IUCN, 1994, 2001) consider five different aspects of a taxon's life history traits, including information on population and distribution sizes and trends. A taxon, therefore, qualifies for any of the nine IUCN Red List categories (see IUCN, 2001 for

definitions) if it meets any one of the five specified threat criteria (Criteria A-E). These then are used to ascertain the possible threat of extinction to that particular taxon (IUCN, 2001), instead of the traditional "conservation status or assessment" (Smithers, 1986; Proudlove, 2004).

In addition, the 1994 and 2001 IUCN Red List categories and criteria were designed for global assessments of taxa rather than for use in units defined by either regional or national boundaries (IUCN, 2001). Moreover, a global-scale assessment of threat is impractical for regional and local conservation agencies that require extinction risk and threat data at a regional scale to formulate management goals (Gärdenfors, 1996; Freitag and van Jaarsveld, 1997; Gärdenfors et al., 2001). One limitation of applying the global system at a regional scale is that estimating extinction risk in a portion of a taxon's range may be different from the assessment of extinction risk at a global level (Gärdenfors et al., 1999, 2001). This can be expected to impact on the regional threat and conservation category assigned to a taxon for conservation purposes.

Consequently, regional threat assessments are required to provide baseline data that regional and local conservation agencies need to incorporate into their conservation and management programmes**.** It is considered that regional Red Lists would provide a more objective evaluation of the threats facing a taxon at either a national or regional scale (Gärdenfors, 2001). It can also facilitate the inclusion of threat levels into national conservation planning (Master, 1991; Mace, 1995). However, the likelihood of assigning different threat categories to taxa when using regional and/or global assessments has rarely been examined (Gärdenfors, 2001). South Africa, having had Red List assessments at both global and regional scales, offers the ideal opportunity to explore the implications of different scale assessments for highlighting taxa at risk of extinction.

The publication of the first set of national Red Data Books for South African mammals commenced in the 1970s and stemmed from global initiatives (Meester, 1976; Skinner, Fairall and Bothma, 1977; Smithers, 1986; Lamoreux et al., 2003). Smithers (1986) produced the last RDB for South African terrestrial mammals in 1986 and provided assessments on the "conservation status as defined by the International Union for the Conservation of Nature and Natural Resources" (Smithers, 1986). The RDB categories of threat, used by Smithers (1986) provided broad definitions for five threatened categories, of which only two directly indicated the likelihood of extinction (Mace and Lande, 1991; Statterfield, 1996).

No regional South African RDB or Red List assessment for large groups of mammals has been undertaken, since Smithers' (1986) Red Data Book for terrestrial mammals except for some qualitative re-evaluations by Mugo et al., (1995). This prompted the revision and development of an up-dated Regional Red List of all extant South African mammals (RRL; Friedmann and Daly, 2004). This process was conducted according to current IUCN Red List categories and criteria (version 3.1; IUCN, 2001), and also included the first regional assessment for South African marine mammals.

In this paper, we review the three existing IUCN RDB, regional and global Red List threat assessments of South Africa's mammals. We examine the nature and extent of the differences between qualitative and quantitative assessments across the 18-year period from 1986 to 2004, as well as differences between the regional and global assessments. In particular, we focused on whether changes in assessment criteria, changes in our current knowledge of taxa, or actual changes in the extinction likelihood of species were the dominant driving force of change over this period (McIntyre, 1992).

2. Methods

The regional RDB (RRDB) assessments by Smithers (1986) and Mugo et al., (1995), global assessments included in the 2003 global Red List (GRL), and the recent regional Red List (RRL) by Friedman and Daly (2004) were used as source material in the present study. Taxonomy is based on that of the recent regional Red List (Friedmann and Daly, 2004).

*2.1. South African Red Data Book (1986/95) (*hereafter *RRDB)*

A revised list of Red Data Book listed mammals were obtained from the South African Red Data Book of terrestrial mammals (Smithers, 1986) and re-assessments by Mugo et al., (1995) (the latter focused on rodents, lagomorphs and macroscelids). These two assessments were based on the perceived subjective pre-1994 RDB categories (see Smithers, 1986). The five categories identified and fully defined by Smithers (1986) were: Endangered (E), Vulnerable (V), Rare (R) Indeterminate (I), and Out of Danger.

2.2. Global Red List (2003)

Information on the global 2003 IUCN Red Listing (from now on GRL) for South African mammals was extracted from the IUCN Red List website (IUCN, 2003). The IUCN (2001) Red List categories

are fully defined therein, including the "threatened" categories: Critically Endangered (CR), Endangered (EN), and Vulnerable (VU). Additional categories, that can be defined as "non-threatened" categories included: Near Threatened (NT), Data Deficient (DD), Least Concern (LC), and Not Evaluated (NE) (IUCN, 2001). The IUCN (2001) categories also included the Extinct (EX) and Extinct in the Wild (EW) classifications. The IUCN Red List assessment uses five different criteria (A-E) that are derived from a wide set of attributes. These include: rates of population decline (criteria A), changes in distribution/range sizes in conjunction with severe fragmentation, population structure, continuing decline and extreme fluctuations (criteria B), population size in conjunction with continuing decline (criteria C), population size (criteria D), and probability of extinction (criteria E) (IUCN, 1994, 2001).

2.3. South African Regional Red List (2004)

Information for the regional IUCN Red List (hereafter referred to as RRL) assessment was obtained from the regional Red List for South African mammals (Friedmann and Daly, 2004). All extant terrestrial and marine mammals were assessed at a regional level according to the IUCN Red List categories and criteria in version 3.1 of IUCN (2001). Red List assessments were undertaken for all extant taxa within South African borders, excluding Lesotho and Swaziland, but included mammals from the sub-Antarctic Prince Edward Islands.

2.4. Analysis

Comparisons between the respective RRDB (1986/95), RRL (2004) and GRL (2003) assessments focused on different taxa assessments, categories and criteria at specific taxon, Family, and Order levels relating to the risk of extinction in the near future. The various criteria that were assigned to each taxon were explored for both the RRL and GRL assessments. The interpretation of results dealing with comparisons among taxa, between lists from different areas or lists from different time eras should be approached with caution (Possingham et al., 2002). To allow for comparisons among taxa, lists and across time, "metrics [information] from threatened taxa lists should be scaled to account for the number of taxa that were assessed, and for the number for which there was sufficient data to make an assessment" (Possingham et al., 2002). For the current study, the proportion of threatened taxa per RRDB (1986/95), RRL (2004), GRL (2003), threat category per specific Order, as well as the proportions of all taxa assessed were derived and presented.

In accordance with the 2001 IUCN Red List categories and criteria, the term "taxon" (pl. taxa) is used in this study to represent species, sub-species or sub-populations (IUCN, 2001).

3. Results

3.1. RRDB assessment (1986/95)

Eighty one extant listed taxa (species and subspecies) were extracted from the RRDB (Smithers, 1986; Mugo et al., 1995) and corresponded with the mammal taxonomy used in the more recent RRL (2004) assessment, allowing for a revised list of RRDB assessed mammals (Appendix 1). From the derived RDB listing, three mammal taxa were listed to be Endangered (E), 12 Vulnerable (V), 28 Rare (R), five Out of Danger (O), and 33 Indeterminate (I) (taxa counts adapted from Smithers 1986) were listed in accordance with the 1986 RRDB categories (Table 1; Appendix 1). If one accepts Endangered (E) and Vulnerable (V) as being "threatened" (see Rebelo and Tansley, 1993), 15 taxa from the 243 recognised taxa were threatened (6.17%). The three taxa listed as Endangered were the African wild dog (*Lycaon pictus*), the riverine rabbit (*Bunolagus monticularis*), and the roan antelope (*Hippotragus equines*). In general, the majority of the 81 listed taxa in the RRDB were recorded as Rare (40.74%) or Indeterminate (34.57%). Most of the taxa ranked as Rare, were either found in the Order Carnivora, Artiodactyla, or Rodentia. Mainly the smaller mammals, e.g. the Chiroptera (100%) and Insectivora (78%) contributed most taxa to the Indeterminate (I) category (Table 1).

3.2. GRL assessment (2003)

The GRL listed 271 mammals (24 of the 295 taxa in the 2004 RRL were not evaluated in this global list) known to occur in South Africa, with 43 taxa (15.87%) classified as globally threatened (threatened includes: Critically Endangered (CR), Endangered (EN), and Vulnerable (VU)). These threatened taxa were

Table 1. Summary outline of the updated regional Red Data Book (RRDB) assessments per Order of the 81 taxa of the Red Data Book assessments for terrestrial taxa occurring in South Africa (Smithers, 1986; Mugo et al., 1995). RDB categories Endangered (E), Vulnerable (V) Rare (R), Out of Danger (O) and Indeterminate (I). Number of taxa in parenthesis in RRDB column are according to the published assessments by Smithers (1986). The three extinct taxa were not included in current analysis.

Order	**E**	**V**	**R**	**O**	**I**	**Total**
Artiodactyla	1	3	6	0	0	10
Carnivora	1	2	9	1	0	13
Chiroptera	0	0	0	0	17	17
Hyracoidea	0	0	1	0	0	1
Insectivora	0	2	2	0	14	18
Lagomorpha	1	0	0	0	0	1
Macroscelidae	0	0	1	0	0	1
Perissodactyla	0	2	0	0	0	2
Pholidota	0	1	0	0	0	1
Primates	0	0	2	0	0	2
Proboscidea	0	0	0	1	0	1
Rodentia	0	1	7	3	2	13
Tubulidentata	0	1	0	0	0	1
Grand Total	3 (3)	12 (14)	28 (25)	5 (2)	33 (45)	81 (89)

Table 2. Summary outline per Order of the 295 taxa of the global IUCN Red List (GRL) assessments for taxa occurring in South Africa (IUCN, 2003). IUCN Red List categories ranged between that of IUCN Red List version 2.4 and 3.1. The following abbreviations are used within the table: Critically Endangered (CR); Endangered (EN); and Vulnerable (VU), Near Threatened (NT) (also including Lower Risk/near threatened (LR/nt)), Data Deficient (DD), Lower Risk/conservation dependant (CD) and Least Concern (LC) (also including the old Lower Risk/least concern (LR/lc) category) and Not Evaluated (NE).

Orders	**CR**	**EN**	**VU**	**Threatened Total**	**NT**	**DD**	**CD**	**LC**	**NE**	**Total**
Artiodactyla	0	0	1	1	0	0	25	7	0	33
Carnivora	0	1	4	5	1	0	1	28	3	38
Cetacea	0	3	2	5	0	16	13	4	4	42
Chiroptera	0	0	4	4	10	0	0	33	3	50
Hyracoidea	0	0	1	1	0	0	0	2	0	3
Insectivora	3	1	9	13	0	0	0	13	7	33
Lagomorpha	0	1	0	1	0	0	0	6	0	7
Macroscelidae	0	0	3	3	0	0	0	4	0	7
Perissodactyla	1	2	1	4	1	0	0	1	0	6
Pholidota	0	0	0	0	1	0	0	0	0	1
Primates	0	0	0	0	0	0	0	6	1	7
Proboscidea	0	1	0	1	0	0	0	0	0	1
Rodentia	0	1	4	5	5	2	0	48	6	66
Tubulidentata	0	0	0	0	0	0	0	1	0	1
Grand Total	4	10	29	43	18	18	39	153	24	295

categorised mainly within the Vulnerable (VU) category (29 taxa, Table 2) (IUCN, 2003). Ten taxa were listed as Endangered (EN) including some of the following taxa: Visagie's golden mole (*Chrysochloris visagiei*), van Zyl's golden mole (*Cryptochloris zyli*), Juliana's golden mole (*Neamblysomus julianae*), and the south-central black rhino (*Diceros bicornis minor*). Eighteen taxa were listed as Near Threatened (NT) and another 18 as Data Deficient (DD). Thirty-nine taxa retained the old 1994 Low Risk conservation dependant (LR/cd) category. Twenty-four taxa (subspecies and newly described taxa) were not evaluated (NE) at the global level (Table 2, Appendix 1).

Taxa from the Orders Perissodactyla, Insectivora, and Macroscelidae were found to have the highest proportion of threatened taxa per Order with 66.67%, 39.39% and 42.87% threatened taxa, respectively. Similarly, the Order Chiroptera had the highest proportion (20%) of taxa considered to be Near Threatened (NT) at a global scale. Of all South African marine mammals, the Order Cetacea contained the highest proportion of globally Data Deficient (DD) taxa listed (Table 2).

The highest number of threatened taxa as a proportion of the assessed taxa in the GRL list were of the Order Insectivora, with 13 insectivore taxa (32.23%) being identified as threatened, nine as Vulnerable (VU), one as Endangered (EN), and three Critically Endangered (CR) (Table 2).

3.3. RRL assessment (2004)

The Regional Red List assessed 295 taxa, identifying 57 (19.32%) threatened mammals (CR = 10, EN = 18 and VU = 29) (Table 3). Thirty-eight (12.88%) mammals were identified as regionally Near Threatened, as well as 53 taxa (17.9%) being listed as Data Deficient. For more detail of taxa assessments see Appendix 1.

The highest proportion of threatened taxa per Order, were recorded within the Pholidota (100%), Perissodactyla (66.67%), and the Primates (42.86%). However, in terms of the absolute number of taxa assessed, the highest proportion of threatened taxa was found within the Orders Insectivora and Chiroptera. The Order Chiroptera also contained the highest number of Near Threatened taxa in absolute numbers in the regional assessment. The Cetacea had the highest proportion of Data Deficient taxa. Twenty three (54.76%) of the 42 taxa assessed in the Order Cetacea were assessed as DD. The Orders Insectivora and Macroscelidae also had a large proportion of taxa listed as Data Deficient. Overall, 14 Insectivora (42.42% of the Insectivora assessed) were threatened, five were regarded as CR and all belong to the Family Chrysochloridae.

3.4. Comparisons across assessments

3.4.1 Comparisons of RRDB and Red Lists (RRL and GRL)

Table 4a correspond to comparisons of the variation found between RRDB (1986) taxa with regard to RRL (2004) placement. The three RRDB (1986) Endangered (E) taxa were still listed in the threatened RRL (2004) categories (Table 4a; Appendix 1). Of the 12 Vulnerable (V) RRDB taxa, eight remained in a threatened RRL criterion, with two taxa being identified as RRL Near Threatened (the honey badger, (*Mellivora capensis*), and the Namaqua dune mole-rat (*Bathyergus janetta*)). Two Vulnerable RRDB taxa, the aardvark (*Orycteropus afer*), and the African wild cat, (*Felis silvestris*), were both classified as RRL Least Concern (LC). Of the 28 Rare (R) RRDB taxa, various taxa were classified in the RRL as Endangered or Vulnerable (Table 4a; Appendix 1). The Rare RRDB Meller's mongoose (*Rhynchogale melleri*), African weasel (*Poecilogale albinucha*), and Selous' mongoose (*Paracynictis selousi*), were listed as Data Deficient by the RRL. Of the 33 Indeterminate (I) RRDB taxa, five were still deemed regionally Data Deficient, and additional 22 Data Deficient assessed terrestrial taxa and 23 Data Deficient marine RRL taxa, were identified, which were not previously assessed by the RRDB (Table 4a; Appendix 1). In addition, three of the Out of Danger (O) RRDB taxa were listed as Least Concern taxa in the RRL, whereas two were classified as threatened by the GRL (African elephant, (*Loxodonta Africana*) (EN A1b) and spectacled dormouse (*Graphiurus ocularis*) (VU A1cd) (Appendix 1)). The cheetah (*Acinonyx jubatus*), was regarded in the RRDB to be Out of Danger (O), and yet both the GRL and RRL listed it as threatened (VU C2a(i) and VU D1, respectively).

Table 3. Summary outline per Order of the 295 taxa with regional Red List (RRL) categorisation. IUCN Red List categories correspond to that of IUCN Red List version 3.1 (Friedmann and Daly, 2004). The following abbreviations are used within the table Critically Endangered (CR); Endangered (EN); and Vulnerable (VU), Near Threatened (NT), Data Deficient (DD), and Least Concern (LC).

Order	**CR**	**EN**	**VU**	**Threatened Total**	**NT**	**DD**	**LC**	**Total**
Artiodactyla	0	2	5	7	1	0	25	33
Carnivora	0	2	2	4	7	3	24	38
Cetacea	0	2	4	6	1	23	12	42
Chiroptera	2	2	6	10	18	3	19	50
Hyracoidea	0	0	1	1	0	0	2	3
Insectivora	5	4	5	14	4	14	1	33
Lagomorpha	1	0	0	1	0	0	6	7
Macroscelidae	0	1	0	1	0	2	4	7
Perissodactyla	1	1	2	4	0	0	2	6
Pholidota	0	0	1	1	0	0	0	1
Primates	0	1	2	3	0	0	4	7
Proboscidea	0	0	0	0	0	0	1	1
Rodentia	1	3	1	5	7	8	46	66
Tubulidentata	0	0	0	0	0	0	1	1
Grand Total	10	18	29	57	38	53	147	295

Table 4a. Comparisons of the variation found between RRDB (1986) taxa with regard to RRL (2004) placement. RDB categories Endangered (E), Vulnerable (V) Rare (R), Out of Danger (O) and Indeterminate (I). Critically Endangered (CR); Endangered (EN); and Vulnerable (VU), Near Threatened (NT), Data Deficient (DD), and Least Concern (LC).

Categories	RRDB 1986	E	V	R	I	O
RRL 2004						
CR		1	1	1	4	-
EN		1	1	5	4	-
VU		1	6	6	7	2
NT		-	2	4	12	-
DD		-		3	5	-
LC		-	2	9	1	3

Table 4b. Comparisons of the GRL (2003) taxa with regard to RRL (2004) placement. The following abbreviations are used within the table: Critically Endangered (CR); Endangered (EN); and Vulnerable (VU), Near Threatened (NT) (also including Lower Risk/near threatened (LR/nt)), Data Deficient (DD), Lower Risk/conservation dependant (CD), Least Concern (LC) (also including the old Lower Risk/least concern (LR/lc) category) and Not Evaluated (NE).

Categories	GRL 2003	CR	EN	VU	NT	DD	LC	CD	NE
RRL 2004									
CR		2	1	3	1	-	1		2
EN		-	3	3	-	-	3	2	7
VU		2	2	8	5	2	6	3	1
NT		-		6	5	1	19	2	5
DD		-	2	2	1	14	22	5	7
LC		-	2	7	6	1	102	27	2

3.4.2. Comparison of GRL and RRL

Ninety-eight taxa were assigned a higher RRL category than their allocated GRL category, with 33 of these 98 taxa being classified as threatened (VU, EN, or CR) at the regional scale and either near threatened (NT), Least Concern (LC), Not Evaluated (NE), or Low Risk Conservation Dependant (LR/cd) at a global scale (Table 4b, Appendix 1). Thirty-one GRL taxa dropped in category when compared with the RRL, with 19 globally threatened taxa not deemed to be threatened regionally. This shift was in most cases the result of up to date regional information being incorporated in the regional assessments, and as well as stable population trends for a number of taxa within the borders of South Africa (see Friedmann and Daly 2004 for more detail). Four taxa were awarded a regional Data Deficient (DD) category shifting from a GRL threatened category, and 34 regionally DD taxa were placed in the GRL not threatened categories (LC, NE, LR/cd) with 14 taxa remaining DD.

Taxa that made the largest shift between categories were in many cases new taxa, not previously assessed (GRL - NE), and were classified as RRL CR (Ongoye red squirrel, (*Paraxerus palliatus ornatus*) and the Pretoria sub-population of the Juliana's golden mole, (*Neamblysomus julianae*) (Table 4b, Appendix 1)). Seven GRL NE taxa were identified as RRL EN, one NE taxon being regionally VU, five NE taxa being identified NT and seven NE taxa being categorized as DD (Table 4b; Appendix 1). The GRL taxa that made the largest shift between categories, from EN (both cases) to RRL LC, were the Barbour's rock mouse (*Petromyscus barbouri*) and the African elephant (*Loxodonta africana*).

3.5. Use of IUCN criteria in assessments

No comparison with the RRDB assessment was feasible as this approach does not employ quantitative data and criteria for determining threat status.

Of the criteria used by the GRL, criterion B was used most often (19 times – 44.18%), with criterion A being implemented second most (13 times – 30.23%) (Table 5). Criterion A refers to a marked reduction in population size. Criterion B is used to qualify taxa with a restricted distribution (either extent of occurrence or area of occupancy), which are showing a decline, becoming fragmented or showing marked fluctuations in abundance (Mace and Balmford, 2000; IUCN, 2001).

Table 5. Summary of the various criteria from the global 2002 IUCN Red List (GRL) and the regional Red List (RRL) applied for the 295 mammal Red List assessments. Criterion A refers to a marked reduction in population size. Criterion B is used to qualify taxa with restricted distribution (either extent of occurrence or area of occupancy) showing decline, fragmented or marked fluctuations in abundance (Mace and Balmford 2000; IUCN, 2001). Criterion C covers taxa showing a continuing decline in fragmented, fluctuating or isolated populations (IUCN, 2001). Criterion D include taxa with restricted area, or else if the number of breeding individuals is very small. Criteria E require evidence from qualitative assessments (e.g. Population Viability Analysis PVA) (Mace and Balmford, 2000). For a proper outline of criteria, consult IUCN (2001) or http://www.redlist.org

IUCN Red List Criteria	**GRL**	**RRL**
A	13	4
A, B	0	1
A, C	0	1
A, D	3	0
B	19	18
B, C	0	2
B, D	0	2
C	5	8
C, D	0	1
D	3	20

4. Discussion

4.1. Red Data Book and Red List comparisons

4.1.1. Regional assessments

The incorporation of the new quantitative Red Listing criteria of the IUCN increased the number of threatened mammal taxa in South Africa from nearly 7% (RRDB 1986/95) to nearly 20% of all mammals deemed to be threatened with extinction (RRL 2004). The RRDB categories (Smithers, 1986) provided broad definitions, of which only two categories directly indicated the likelihood of extinction (E and V; Mace and Lande, 1991; Statterfield, 1996). For the most part, these categories have been considered to be subjective, and as a result, categorisations do not accurately reflect the actual extinction risks (Mace and Lande, 1991). The application of the new Red List criteria presented not only threat categories, criteria and sub-criteria describing the t risk of going extinct, but also allowed the inclusion of more relevant population size and trends, and geographic range data. These categories and criteria (IUCN, 1994; 2001) are supported by decision rules related to range, population size and population history (Todd and Burgman 1998; Burgman et al., 1999; IUCN, 2001), which provides an explicit and objective framework for the classification of taxa according to their extinction risk as opposed to the traditional RRDB categories (Statterfield, 1996; IUCN/SSC, 1999). The relative objectivity of the new listing criteria (IUCN 1994; IUCN 2001) makes them an excellent tool for observing changes in the "threat of extinction" over time and for providing a more systematic, transparent, and informative approach to the threat listing of taxa (IUCN/SSC 1999; IUCN, 2001) while, most importantly, still providing some room for uncertainty (Todd and Burgman, 1998; Akçakaya et al., 2000; Gärdenfors, 2001; Lamoreux et al., 2003).

4.1.2. Global and regional assessments

Comparing the RRL with GRL assessments demonstrated that from a regional perspective, more taxa are deemed threatened (19.37%) than estimated by the GRL (15.87%). Evidence from the current study match general findings that regional Red List assessments can expect a higher percentage of threatened taxa than global Red List assessments (Gärdenfors et al., 2001). The reason for this may be that smaller countries have smaller populations (fewer locations) and the probability of local extinction is generally higher in smaller populations (Gärdenfors et al., 1999).

Similarly, the number of regional NT and DD listed taxa increased noticeably at the regional assessment level in comparison with the GRL NT and DD listed taxa, indicating that various taxa were either bordering on being classified as threatened (i.e. NT) or that too little information was available at a regional scale for an appropriate assessment. The IUCN (2001) states that "…a taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk…" and should usually be applied as a last resort. If this is the case, the 52 Data Deficient taxa identified in the South African RRL (29 of which are terrestrial), urgently require research to gain an insight into these DD listed taxa's life history traits for consistent and authentic Red List assessment in future, both at the regional and global scale.

Studies are urgently required especially on the smaller, less charismatic and lesser-known carnivores, rodents, several bats, and most importantly, almost all cetaceans. It is has been reported that there is severe conservation bias towards larger more charismatic taxa, which are usually awarded the majority of resources for research and conservation (Polishchuk 2002). In general, even the basic life history and habitat requirements of the smaller taxa are unknown due to their scarcity and cryptic nature (Meester, 1976; Ceballos and Brown, 1995; Entwistle and Stephenson, 2000, Mickleburgh, 2000), which hinders quantitative data-intensive threat assessments such as the IUCN Red List assessments (Mace, 1995; Mickleburgh, 2000; Keith and van Jaarsveld, 2002). It is troublesome that at a regional scale, general population and life history data are very limited for most South African mammals (large number of DD taxa), even for the more charismatic "well known" mammals such as the cheetah. Furthermore, what is even more disconcerting is that Possingham et al. (2002) noted that South Africa's Red Lists are some of the most complete among African countries, further illuminating the potential shortfall of suitable data from neighbouring African countries, as regional information usually feeds into global IUCN Red List assessments (Rodriquez et al., 2000; Hilton-Taylor et al., 2000; Gärdenfors et al., 2001).

4.1.3. Extinction risk trends and patterns

With the recent RRL threat assessments being the first South African mammal assessment using the latest Red List categories and criteria, information on the regional trends in risk of extinction will only become apparent after the next proposed regional Red List assessment in *c.*2009. A likely stabilisation of the IUCN Red List categories and criteria (Garnett et al., 2003) will allow for a more appropriate comparison of categories and criteria over time, to permit insight into changes in extinction probability

of many taxa (Avery et al., 1995; Garnett et al., 2003). It is also important to monitor taxa that make large shifts across Red List categories between regional Red List assessments (e.g. assessment shifts between the RRDB and RRL assessments). Taxa of concern for the current study are the cheetah, the African wildcat, the aardvark and the black-footed cat, which all made large shifts between the regional RRDB and RRL assessments. Rather than a change in extinction risk, these changes are most likely due to either an increase in knowledge and probably most likely the result of changes in the assessment criteria (Possingham et al., 2002; Garnett et al., 2003). Several taxa (e.g. Barbour's rock mouse (*Petromyscus barbouri*), Cape rock elephant shrew (*Elephantulus edwardii*), and Smith's rock elephant shrew (*Elephantulus rupestris*)) dropped from the GRL threatened categories to LC in RRL mainly due to the increase of relevant and up-to-date information, allowing for a decrease in suspected risk assessment (Friedmann and Daily 2004). However, it is cautioned that such changes as witnessed here, can also likely be the result of either the inconsistent use of inferences or the incorrect implementation of assessment criteria leading to erroneous threat assessments (for example, the RRDB assessments for the giant rat (*Cricetomys gambianus*) and the cheetah's "Out of Danger") (Stattersfield, 1996; Hilton-Taylor et al., 2000; Keith et al., 2004).

Likewise variation of assessments between regional and global assessments have also been linked to changes and differences in taxonomy (Garnet et al., 2003), but in the current study, this does not seem to be the case. This large flux is most likely due to the different scales at which the assessments were undertaken, which is definitely expected (Gärdenfors et al., 1999). However, in considering the various regional criteria employed in assessing South African mammals, there were a large number of regional Data Deficient taxa, whereas for the global list the same taxa were placed in a relevant threat category. This was also the case with endemic taxa attaining different assessments between the two assessments. Hilton-Taylor et al. (2000) points to the above-mentioned discrepancy being a case of inconsistent use of the IUCN Red List by the regional assessors, even though the same information and sources should be used, especially in the case of endemic mammals. Stattersfield (1996), however, indicated that the IUCN (2001) categories and criteria rely heavily on inference when there is limited data available (Gärdenfors 2001). This could also point towards the different perceptions, availability or relevance of data used by assessors (Keith et al., 2004). Overall, it does seem that the regional vs. global changes in threat assessments in this case is most likely not actual changes in extinction likelihood, but more importantly, the information that is available or used in threat assessments that has produced the current

regional Red List categories and criteria for South African mammals. It is anticipated that more exact trend information with regard to the mammal's extinction likelihood will become more apparent after another regional Red List assessment.

Through the consideration of which criteria were used in different spatial or temporal Red List assessments, allows for an indication of the information drawn upon to make assessments, either due to the information being relevant for the specific assessment of a taxon, or that it is the only information available to make a correct assessment. The majority of the South African RRL assessments implemented criterion B which usually indicates that the taxon's restricted distribution (either extent of occurrence or area of occupancy), is showing a decline, becoming fragmented, or showing marked fluctuations in abundance (Mace and Balmford, 2000; IUCN, 2001). Criterion B's use is most likely, in the current study, not a function of the definitions used but rather the availability and reliance on existing knowledge of the historical distribution and range size, and the lack of reliable population trend data (McIntyre, 1992; Golding, 2004; Keith et al., 2004). Historical geographic distribution is often available for many taxa. Similarly, the RRL also pointed to criterion D, being implemented on numerous occasions (Table 5). Criterion D relies on information regarding small populations of range-restricted taxa. Very few assessments relied on information relating to declines of populations (Categories A and C) and support findings from an earlier study on plants by Golding (2004). In addition, Mace and Kershaw (1997) indicated that some criteria are more relevant for certain taxa and it will frequently be impossible to assess some taxa by criteria for which data are simply routinely unavailable, yet such shortfalls calls for continued research to provide pertinent information to make Red List re-assessments useful is necessary and has to continue to produce relevant new knowledge (Smithers, 1986)..

Another lapse of 18 years between Red List threat assessments (RRDB (Smithers 1986) and RRL (Friedmann and Daly, 2004)) cannot be appropriate for the future, if the state of South African mammals is to be monitored through the use of the IUCN Red List categories and criteria (Garnet et al., 2003). It is, therefore, imperative that the current RRL assessment should be the first of regular Red List threat re-assessments using the latest and most up-to-date IUCN Red List categories and criteria (Ferrar, 1991; IUCN, 2001).

Of the 251 terrestrial mammals in South Africa, 36 were classified as endemic, of which 17 (47.22%) were threatened (Friedmann and Daly, 2004). It would appear from the RRL assessment that a large

proportion of the South African mammal endemics are threatened. Endemic taxa are often considered as of national conservation priorities, while threatened endemic taxa are considered as having an even higher priority (Rebelo and Tansley, 1993), accentuating the conservation importance of these 17 taxa within a national conservation framework (Danell and Aava-Olsson, 2002). In addition, the majority of endemic mammals are mainly small (Gelderblom and Bronner 1995), predominantly Insectivores (14 of 36 endemics; Ceballos and Brown ,1995; Friedmann and Daly, 2004). The Order Insectivora was highlighted in the regional assessment as having the most threatened taxa (42.42%) within the specific Order, and yet very few of the Insectivora were assessed by either the RRDB or the GRL. This study confirms the importance of taxa belonging to the Chrysochloridae (Gelderblom et al., 1995), especially the more cryptic and newly described taxa (44% of Chrysochloridae taxa were assessed for the first time during the recent South African Mammal RRL). The taxa from the Family Chrysocloridae display high levels of speciation and unique ecological characteristics and requirements (Gelderblom et al., 1995; Danell and Aava-Olsson, 2002), making them more vulnerable to habitat-specific threats.

Threatened species lists are designed primarily to provide an easily comprehensible estimate of extinction risk (Possingham et al., 2002), and there is no doubt that threatened species lists fulfil important requirements such as a guide to conservation planning e.g. reserve planning (see Freitag et al., 1997; Possingham et al., 2002; Lamoreux et al., 2003). Possingham et al. (2002) noted that Red Lists have limitations, and the current global and regional Red List should not be regarded as either a conservation priority setting exercise, as a yardstick to influence Environmental Impact Assessments, or as a component that influences resource allocation for the conservation of certain taxa (Ferrar, 1991; Freitag et al., 1997; Possingham et al., 2002; Victor and Keith, 2004). The IUCN Red Lists are often used as a "powerful tool for estimating the current conservation status of all taxa" (Proudlove, 2004). It is ineffective for conservation planners to use Red List for this, as IUCN Red List status simply provides an assessment of extinction risk under a set of conditions (IUCN, 2001). The Red List assessments form only part of a large suit of information (e.g. costs, logistics and legal frameworks for conservation) required to establish conservation priorities (Master, 1991; Gärdenfors et al., 2001; Harcourt and Parks, 2003, Possingham et al., 2002), which are urgently required for South African mammals.

It has become clear that if regional conservation actions and priority setting should occur, that the regional Red List threat assessment should not be used in isolation, and that the global IUCN Red List

threat assessments and regional endemism should always be brought into consideration when attempting to set conservation goals and actions (Harcourt and Parks, 2003, McKee et al., 2003). With the availability of all the above mentioned information, emanating from Red List assessments such as these, the stage is set to allow for the implementation of a so called Conservation Cube. According to the IUCN (1994) and Gärdenfors (1996), any regional assessment should always be accompanied by the taxon's global threat assessment. In similar fashion, when undertaking a regional assessment, it is important to include an indication of the proportion of the international/continental population found within the country of assessment (IUCN, 1994; Gärdenfors, 1996). Failure to consider regional taxa in their larger context can often lead to short-sighted management (Hunter and Hutchinson, 1994). An indication of a species conservation requirements can be provided by combining the three measures or axes of conservation priority, with the first considering regional threat, the second a wider geographical (global) threat assessment, and the third measuring the proportion of the taxon's global distribution falling within the region of interest (as an indication of the region's importance to the global conservation of the species). One can picture this process as forming the three axes of a national conservation cube (Avery et al., 1995; Warren et al., 1997; Palmer et al., 1997). Taxa can be sorted according to their general "location" within this "conservation cube", by putting national conservation priorities into the context of international conservation priorities (Avery et al., 1995; Warren et al., 1997). The Conservation Cube allows the sorting of the taxa according to a combination of their regional and global threat listing as well as varying regional endemism (Avery et al., 1995). The Conservation Cube allows for a useful guide to assign regional assessments in an international framework, which in turn can inform regional prioritisation exercises. In using the Conservation Cube, taxa are awarded a further dimension of conservation priority. Instead of considering three separate and unique threat assessments and endemism values in isolation, which provides invaluable information all the same, the Conservation Cube provides the user a unique means of viewing priority taxa in a unique combination which can further elucidate a taxon's importance in terms of regional and global conservation. The implementation of such a Conservation Cube for South African mammals will be investigated in the near future.

5. Conclusion

The application of the IUCN Red List categories and criteria (IUCN, 1994; 2001) to the regionally extant mammal taxa found within the borders of South Africa has improved local knowledge of the

current risk of various mammals becoming extinct in the near future. Moreover, it has also provided an opportunity to evaluate South African marine mammals at a regional scale for the first time since the conception of the quantitative threat assessment criteria (e.g. IUCN Red Lists). This will allow a better reflection of objective and quantitative evaluations of threat for the purpose of incorporating threat levels into national conservation planning (Master, 1991; Mace, 1995; Possingham et al., 2002). In addition, the up-dated regional list and its resulting up-dated data will be available for up-dating the global RL. It is anticipated that the new regional IUCN Red List threat assessment (Friedmann and Daly, 2004) will be used to inform, influence, and assist regional and provincial conservation priority setting actions for South African terrestrial and marine mammals.

Acknowledgments

Financial support from the South African National Research Foundation (NRF), the University of Pretoria, and Stellenbosch University is gratefully acknowledged.

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