Chapter 4: Discussion

Major findings

The results of the cluster analyses provide ambivalent support for the functional uniqueness of snakes as a group within the Koeberg Private Nature reserve's tetrapod community. The identification of both dietary and functional guilds saw some snake species grouped within speciose guilds while others were grouped within guilds containing few or single species. In terms of dietary guilds *Dasypeltis scabra* formed the only single species reptile guild and only exclusively egg eating species in the entire community. The identified functional guilds placed four snake species (*Pseudaspis cana*, *Dasypeltis scabra*, *Homoroselaps lacteus* and *Lamprophis guttatus*) within single species guilds that seem to occupy unique functional positions within the community. The remaining snake species were placed into guilds of low to medium richness levels. These guilds tended to contain predator species from other taxonomic groups displaying similar traits as the snake species, indicating their low to moderate levels of functional redundancy with their guild mates.

The relationship between species richness and functional diversity within and between taxonomic groups indicated that losing snakes, as a group, would result in disproportionate losses of dietary and functional diversity. However, the likelihood of losing entire taxonomic groups when the different species within those groups display different functional traits is unlikely. This prompted the investigation of individual species effects on functional diversity. This analysis found that single species, rather than the group as a whole, were responsible for the seemingly significant contribution to functional diversity made by snakes within the community. This was true for both dietary and functional diversity. In descending order, the loss of *Dasypeltis scabra, Homoroselaps lacteus, Lamprophis guttatus* and *Pseudaspis cana* resulted in the highest functional diversity loss values for any individual species of snake.

Considering that these four species also fell into single species guilds, it is clear that they occupy unique functional positions within the community and cannot be replaced if extirpated. The relationship between functional diversity and species richness for most of the guilds including snakes indicates that losing snakes would result in a slightly disproportionate loss of functional diversity. It is likely that within less speciose guilds, including those containing snakes, extirpation of one or more species could drastically change the level of functional redundancy and thereby the functional importance of those guilds.

The findings of the single species analyses also highlight the impact species identity has on the functional importance of the guild they are grouped within. Although functional guilds are based on the idea that species within them exhibit similar traits, it does not necessarily mean that those species perform the same roles as their guild mates. The formation of guilds is based on the traits used to characterise species. Due to the colossal challenge of characterising the myriad of traits exhibited by species, despite being the same functional type, the functional importance of the finer more explicit differences between species are underestimated. Tackling this challenge would require an increased focus on the identity and life history of faunal species in general in order to better characterise their functioning within ecosystems.

Overall, the results of this study suggest that snakes within the Koeberg Nature reserve exhibit low to moderate levels of functional redundancy. Certain species occupy clearly unique positions within the terrestrial tetrapod community and losing those species would likely result in significant losses of ecosystem functionality. In contrast, the effects of losing other functionally redundant species would in all likelihood be buffered by the shared traits of their guild-mates.

Limitations

Trait selection is of utmost importance in studies making use of traits to represent species involvement or contribution towards ecosystem processes (Naeem and Wright 2003). The need to identify 'common currency' traits while still ensuring that those traits accurately represent the effects all study species play on ecosystem processes poses a considerable challenge. Confidence in selected traits would require further research into the actual effects of species traits on ecosystem functionality (Petchey et al. 2009). As a result, the number of traits used in this study was limited to five due to difficulties in establishing appropriate traits with readily available data for each species. When assessing functional redundancy of species, the fewer the number of traits considered, the greater the likelihood of misleadingly classifying species as functionally redundant (Rosenfeld 2002a). A limited number of traits is an unfortunate limitation in a study attempting to characterize as many facets of terrestrial vertebrate functionality as possible.

The ability of analyses, such as those used within this study, to accurately identify functional guilds within ecosystems and measure functional diversity is entirely dependent on available trait data for species within the community under study. The associated challenges of obtaining such data limits predictive power due to each drawn conclusion being essentially a temporal snapshot of the state of a community at that time (Jaksic 1981, Hooper et al. 2005). The lack of long-term data on the study community's species composition and resource availability changes over time is problematic. The general dearth of such data results in investigators being limited to making conservation decisions prioritizing non-redundant species on short term assessments. This has the potential to be troublesome since sudden changes in the state of the community may alter the state of previously identified guilds and species redundancy.

Despite understanding that the degree to which species influence ecological processes is strongly tied to its abundance within a community (Grime 1998), the effect species abundance has on the ecological influence of presented functional traits is not well understood. Time limitations during the sampling period of this project prevented the acquisition of abundance data for all species within the community. This lack of data prevented us from using functional diversity measures that took into account the abundance of each species. Analyses taking into account species abundance tend to provide more complex and detailed insight into the influence of functional traits on species functional importance (Stuart-Smith et al. 2013). Abundance data would have been a valuable addition to the functional diversity component of this project's analysis and would have contributed to our understanding of the effects of species abundances on ecosystems.

Comparison to other studies

Most studies of ecological and functional guilds tend to deal with either floral taxa or narrowly defined taxonomic groupings of faunal taxa (Jaksic 1981, Parker et al. 2001, Blaum et al. 2011, Sundstrom et al. 2012), so finding comparative studies is challenging. While there are studies, like this one, that characterise and compare ecological guilds based on trait similarities between groups of species such as birds, mammals, reptiles, and invertebrates (Brown et al. 1979, Jaksic et al. 1996, Bremner et al. 2003, González-Salazar et al. 2014) they tend to focus on less speciose communities or specific species assemblages. These assemblages tend to be determined *a priori* for a community under study resulting in studies with narrow taxonomic scope.

In terms of taxonomic scope, the identification of trophic guilds across all four vertebrate classes in Sierra Nevada by Parker et al (2001) was most similar to this study. Similar dietary guilds to those identified within this study were characterized and comparisons were made of each guild's relative contribution to total species richness. Their use of ecological groupings focused on a comparison between communities in order to highlight the importance of scaling in characterising vertebrate communities. Despite the major differences between their study and this one, it nonetheless remains one of few across all vertebrate classes, guild comparisons. Another study measured levels of functional redundancy within bird assemblages in Great Britain over a period of approximately 20 years (Petchey et al. 2007). This was done using a previous iteration of the same measure of functional redundancy used in our study (Petchey and Gaston 2002), albeit with fewer quantified functional traits. No functional redundancy was discovered within the investigated assemblages with fluctuations in functional diversity almost exactly matching the proportions of changes in species richness. Despite using fewer functional traits when conducting the analysis, it provides an example of an ideal long-term dataset. Research using long-term data sets has the potential to contribute towards formulating general laws for communities rather than purely revealing conclusions relevant for that moment in time only. The limited taxonomic scope however, in terms of vertebrate classes investigated, limits the comparability of their findings to ours. These limitations present within these studies could likely be attributed to the intensive time and financial costs associated with data collection and analysis at various spatial scales. These costs, along with a lack of standard methodology for faunal studies of this nature (Blondel 2003), create challenges for functional ecology investigators.

Those existing studies that have focussed on empirical application and comparisons of functional diversity measures have focussed on a variety of organisms including mixed plant species (Walker and Langridge 2002, Petchey et al. 2004), detrivorous arthropods (Heemsbergen 2004), mammalian predators (Blackburn et al. 2005) amphibians (Ernst et al. 2006) as well as a wealth of research on birds (Tscharntke 2008, Sundstrom et al. 2012, Edwards et al. 2013). Although these findings provide valuable insight into the specific relationships between functional diversity, disturbance, species invasions and traits, their limited scope may be problematic. Looking at assemblages rather than entire communities presents a challenge when attempting to formulate standardized methods and empirically supported generalizations about ecosystem functionality and processes.

Importance and implications of findings

This study presents one of the rare investigations into the functional redundancy of snakes relative to taxa belonging to the other terrestrial vertebrate classes. Additionally, this study also incorporates various emphasized aspects of previous functional ecology research. Criteria such as careful trait selection, community level rather than assemblage investigation, statistically supported functional guild identification, as well as functional diversity analysis to aid in identifying redundancy. Based on the above I believe that this study constitutes a preliminary framework for empirical functional redundancy analyses of not just snake communities but multi-taxa vertebrate communities as well.

As mentioned previously, the suggestion that certain species are very functionally similar to their guild mates also brings up questions of competitive interactions and possible resource partitioning within the environment. Certain snake species such as the Psammophines, for example, were almost exclusively grouped into the same guild suggesting similar use of resources within the environment. If these closely related species display similar functional roles within the ecosystem, the fact that they have not yet excluded each other suggests partitioning on a finer scale than the traits investigated in this study (e.g. fine-scale differential space use, variable foraging times, etc.). On the other hand, there are guilds containing species belonging to very different lineages such as the grouping of a functionally important snake species *Dispholidus typus*, and two raptor species, *Haliaeetus vocifer* and *Accipiter tachiro*.

Findings such as these indicate the importance of studies into the finer functional traits exhibited by species in general.

The prospect that certain species within a given community could be fulfilling unique functional roles has the potential to lend focus to ecological research and conservation efforts involving those species. Ecological research highlighting the functional roles species fulfil combined with statistical support for their proposed importance strengthens propositions and arguments in favour of maintaining their presence in ecosystems. This study highlights the possible functional importance certain snake species play within the community under study. Of these the most obviously important, *Dasypeltis scabra*, seemingly provides traits (particularly diet-wise) that other species do not. It is likely that the rate of predation on bird eggs by *Dasypeltis* species is greatly underestimated with multiple studies providing evidence suggesting that *D. scabra* is an important predator on eggs of various bird species (Bates and Little 2013). Prior knowledge of their activities in Koeberg Nature Reserve highlights their role as one of the dominant bird nest predators within this particular community (Naiwanga et al. 2004). The separation of *D. scabra* into its own specific feeding and functional guild seems appropriate then considering the existing literature highlighting its status as an important, specialist predator of bird eggs in various communities. The functional importance highlighted within this study along with existing records of predation suggest that *D. scabra* is likely to be consuming eggs at a higher rate than their fellow, more generalist, vertebrate species that include eggs in their diets. This and possible future ecological research, spurred on by the functional uniqueness highlighted in this study, may lead to bigger conclusions regarding their role in controlling bird populations within the reserve. A similar scenario could also be true for species such as *Naja nivea*. The ecology and dietary habits of this species has received more attention than that of *Dasypeltis scabra* (Shine et al. 2007, Layloo et al. 2017). While this knowledge is invaluable when focusing on the role of snakes in ecosystems, our results suggest their functional importance is less significant compared to other, less studied, snake species within this ecosystem. By developing analyses such as those used within this study, it improves our ability to identify those species deserving of an increase in focus on their ecology due to their greater contribution to ecosystem functioning.

Conclusion and suggestions for future research

The true value of this project lies in its potential applications in conservation management. Quantifying the level of functional redundancy within biological communities provides us with the ability to better allocate limited resources to those species most significantly contributing to the maintenance of ecosystem functionality. Functional redundancy analyses should not be used in isolation when conducting Biodiversity-Ecosystem Functioning investigations. The ongoing debate regarding the applicability, optimisation and invention of various functional diversity measures, while important, has created issues in functional diversity research. Previously, it had us running the risk of placing too much focus on the measures themselves rather than the slightly more important matter of trait selection (Petchey et al. 2009). Fortunately, the rise in faunal functional diversity studies over the past few decades has drawn attention to the various functional traits of species as well as the specific links between those traits and ecosystem processes. Additionally, the study also highlights lack of focus that research into the functional traits of animals has received relative to plant taxa. Readily available data on various functional traits for many animal species is scarce and of the available trait data, even less can be compared across vertebrate taxonomic groups due to the major differences in physiology and life histories between those groups. Something akin to the "TRY Plant Trait Database" (https://www.try-db.org/) for animals would be crucial for increasing the amount of studies making use of animal functional traits. A tool of this nature would greatly improve ease of access to fine scale functional trait data beyond the accuracy of data used within this study however further research would definitely be needed to establish additional traits for comparing across groups. Once a deeper understanding of the effect various traits have on ecosystem functioning has been achieved, our ability to compare across groups would improve. Less obviously comparable physical traits for species from different groups may become comparable as further research sheds light on the similarities of their functional effects. This is crucial for gaining a more holistic understanding of the functional importance of animals within ecosystems.

The need for research focussing on diversity changes over time within small scale ecosystems as well as the characterisation of the functional relationships within will always be a necessity for correctly measuring functional diversity. By acknowledging the importance of functional diversity in driving ecosystem processes (Petchey and Gaston 2002) we hope to place value on snakes as important contributors to ecosystem functional diversity. This is done with the hope that it will generate further interest in research investigating the potentially significant impact these cryptic creatures have on ecosystem functionality.

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Supplementary Material

Table 6 - Per species card appearance (pre marine bird removal) breakdown for all relevant bird species reported in South African Bird Atlas Projects 1 and 2

Common name	Number of cards species appeared on: SABAP 1 (3318CB QDGC)	SABAP 2 (pendat 3335_1820)	SABAP 2 (pendat 3335_1825)	Total Cards
Acacia Pied Barbet	100	0	2	102
African Black Duck	2	0	2	4
African Black Oystercatcher	126	10	15	151
African Black Swift	60	1	5	66
African Darter	31	9	5	45
African Dusky Flycatcher	1	0	0	1
African Fish-Eagle	13	1	9	23
African Goshawk	0	0	2	2
African Harrier-Hawk	2	0	0	2
African Hoopoe	46	0	3	49
African Jacana	1	0	0	1
African Marsh-Harrier	9	1	7	17
African Penguin	16	0	0	16
African Pipit	45	0	10	55
African Purple Swamphen	26	0	3	29
African Rail	10	0	0	10
African Reed-Warbler	11	0	2	13
African Sacred Ibis	55	6	16	77
African Snipe	30	0	0	30
African Spoonbill	35	1	4	40
African Stonechat	31	0	2	33
Alpine Swift	46	1	6	53
Antarctic Tern	5	0	0	5
Ant-eating Chat	7	0	0	7
Arctic Tern	17	0	0	17
Banded Martin	16	6	8	30
Bank Cormorant	19	0	1	20
Barn Owl	5	0	0	5
Barn Swallow	77	3	10	90
Bar-tailed Godwit	2	0	0	2
Bar-throated Apalis	41	13	23	77
Black Crake	27	2	0	29
Black Harrier	11	3	11	25
Black Korhaan	53	0	0	53
Black Sparrowhawk	0	0	1	1
Black Stork	4	0	0	4
Black-crowned Night-Heron	30	0	4	34
Black-headed Canary	0	0	1	1
Black-headed Heron	93	4	14	111
Black-necked Grebe	5	0	1	6
Black-rumped Buttonquail	1	0	0	1
Black-shouldered Kite	218	5	18	241
Blacksmith Lapwing	171	2	32	205
Black-winged Stilt	38	1	7	46
Blue Crane	8	0	1	9

Bokmakierie	173	10	26	209
Booted Eagle	0	0	2	2
Brimstone Canary	12	0	11	23
Brown-throated Martin	115	10	18	143
Burchell's Coucal	9	0	0	9
Cape Batis	2	1	6	9
Cape Bulbul	208	13	32	253
Cape Bunting	116	12	17	145
Cape Canary	54	0	14	68
Cape Cormorant	129	11	11	151
Cape Crow	2	0	0	2
Cape Gannet	45	2	2	49
Cape Grassbird	13	9	15	37
Cape Longclaw	30	0	2	32
Cape Penduline-Tit	16	1	1	18
Cape Robin-Chat	157	13	33	203
Cape Shoveler	80	0	9	89
Cape Sparrow	198	7	27	232
Cape Spurfowl	178	9	29	216
Cape Sugarbird	23	0	1	24
Cape Teal	19	0	0	19
Cape Turtle Dove	221	9	28	258
Cape Wagtail	215	9	28	252
Cape Weaver	168	10	27	205
Cape White-eye	93	11	28	132
Cape Long-billed Lark	0	1	1	2
Capped Wheatear	79	0	18	97
Cardinal Woodpecker	2	0	0	2
Caspian Tern	1	2	2	5
Cattle Egret	157	0	7	164
Chestnut-vented Tit-Babbler	45	8	23	76
Clapper Lark	19	0	1	20
Cloud Cisticola	12	0	1	13
Common Fiscal	206	6	24	236
Common Greenshank	22	0	2	24
Common Moorhen	80	4	8	92
Common Ostrich	86	0	1	87
Common Quail	8	0	0	8
Common Ringed Plover	31	0	0	31
Common Sandpiper	10	0	0	10
Common Starling	209	6	32	247
Common Swift	3	0	0	3
Common Tern	74	1	0	75
Common Waxbill	58	8	15	81
Crowned Cormorant	111	3	2	116
Crowned Lapwing	166	0	13	179
Curlew Sandpiper	56	0	0	56
Dideric Cuckoo	3	0	1	4
Dusky Sunbird	1	0	0	1
Egyptian Goose	91	6	26	123
European Bee-eater	33	1	6	40
Fairy Flycatcher	1	0	0	1
Familiar Chat	3	0	1	4
Fiery-necked Nightjar	6	0	1	7

Fiscal Flycatcher	73	1	11	85
Giant Kingfisher	21	0	1	22
Glossy Ibis	22	0	6	28
Great Crested Grebe	7	0	4	11
Great White Pelican	23	6	14	43
Greater Flamingo	3	1	0	4
Greater Honeyguide	0	0	1	1
Greater Sheathbill	3	0	0	3
Greater Striped-Swallow	10	2	15	27
Green-backed Heron	0	0	1	1
Grey Heron	62	6	13	81
Grey Plover	4	0	0	4
Grey Tit	3	1	0	4
Grey-backed Cisticola	92	12	26	130
Grey-backed Sparrowlark	1	0	0	1
Grey-headed Gull	21	0	3	24
Grey-winged Francolin	60	0	1	61
Hadeda Ibis	37	2	15	54
Hamerkop	14	0	0	14
Hartlaub's Gull	215	9	25	249
Helmeted Guineafowl	128	0	21	149
Horus Swift	1	0	0	1
House Sparrow	105	1	8	114
Jackal Buzzard	7	3	11	21
Karoo Lark	18	0	0	18
Karoo Prinia	0	13	34	47
Karoo Scrub-Robin	151	12	25	188
Kelp Gull	219	13	27	259
Kentish Plover	1	0	0	1
Kittlitz's Plover	105	0	0	105
Klaas's Cuckoo	15	1	4	20
Lanner Falcon	5	0	0	5
Large-billed Lark	38	0	2	40
Laughing Dove	218	1	16	235
Layard's Tit-Babbler	25	0	0	25
Le Vaillant's Cisticola	71	1	12	84
Lesser Honeyguide	0	0	1	1
Lesser Kestrel	1	0	0	1
Lesser Swamp- Warbler	68	8	8	84
Little Bittern	3	0	0	3
Little Egret	79	0	3	82
Little Grebe	78	4	10	92
Little Rush-Warbler	19	2	4	25
Little Stint	32	0	0	32
Little Swift	104	3	18	125
Long-billed Crombec	45	7	15	67
Longbilled Lark	2	0	0	2
Maccoa Duck	42	0	0	42
Malachite Kingfisher	35	0	5	40
Malachite Sunbird	125	9	16	150
Marsh Sandpiper	6	0	0	6
Martial Eagle	1	0	0	1
Mountain Chat	1	0	0	1
Namaqua Dove	80	1	6	87
Namaqua Sandgrouse	2	0	0	2

Olive Thrush	5	0	2	7
Orange-breasted Sunbird	0	0	1	1
Parasitic Jaeger	3	0	0	3
Pearl-breasted Swallow	51	6	10	67
Peregrine Falcon	0	1	2	3
Pied Avocet	15	0	0	15
Pied Crow	200	12	31	243
Pied Kingfisher	43	1	2	46
Pied Starling	158	10	27	195
Pin-tailed Whydah	40	1	6	47
Purple Heron	4	2	3	9
Red Knot	5	0	0	5
Red-billed Teal	73	0	8	81
Red-capped Lark	58	0	10	68
Red-chested Cuckoo	2	0	0	2
Red-eyed Dove	98	2	25	125
Red-faced Mousebird	43	4	13	60
Red-knobbed Coot	107	2	9	118
Red-winged Starling	14	0	17	31
Reed Cormorant	80	8	16	104
Rock Dove	33	1	3	37
Rock Kestrel	31	4	23	58
Rock Martin	51	4	12	67
Ruddy Turnstone	76	0	0	76
Ruff	15	0	0	15
Sabine's Gull	1	0	0	1
Sand Martin	1	0	0	1
Sanderling	60	0	0	60
Sandwich Tern	80	0	0	80
Secretarybird	1	0	0	1
Shy Albatross	1	0	0	1
Sombre Greenbul	1	0	0	1
Sooty Shearwater	6	0	0	6
South African Shelduck	52	3	3	58
Southern Boubou	8	5	12	25
Southern Double-collared Sunbird	140	11	30	181
Southern Fulmar	1	0	0	1
Southern Giant-Petrel	1	0	0	1
Southern Masked-Weaver	36	1	11	48
Southern Pochard	15	0	2	17
Southern Red Bishop	78	1	11	90
SouthernBlack Korhaan	0	1	1	2
Speckled Mousebird	22	2	6	30
Speckled Pigeon	143	3	29	175
Spotted Eagle-Owl	42	0	0	42
Spotted Flycatcher	5	0	0	5
Spotted Prinia	146	0	0	146
Spotted Thick-knee	34	1	16	51
Spur-winged Goose	69	1	12	82
Steppe Buzzard	83	1	10	94
Streaky-headed Seedeater	7	0	0	7
Subantarctic Skua	1	0	0	1
Swift Tern	53	4	4	61
Three-banded Plover	90	0	8	98

Verreaux's Eagle	2	0	0	2
Water Thick-knee	1	1	1	3
Wattled Starling	37	0	0	37
Whiskered Tern	1	0	0	1
White-backed Duck	6	0	2	8
White-backed Mousebird	97	8	26	131
White-breasted Cormorant	113	8	11	132
Whitechinned Petrel	7	0	0	7
White-fronted Plover	142	2	0	144
White-necked Raven	0	2	1	3
White-rumped Swift	25	2	9	36
White-throated Canary	93	1	9	103
White-throated Swallow	54	2	11	67
White-winged Tern	12	0	0	12
Wood Sandpiper	36	0	3	39
Yellow Bishop	125	1	15	141
Yellow Canary	182	5	23	210
Yellow-billed Duck	90	3	13	106
Yellow-billed Egret	12	0	7	19
Yellow-billed Kite	45	2	9	56
Zitting Cisticola	10	0	0	10

Table 10 - Species composition for 54 guild hierarchical clustering solution using UPGMA agglomeration

Species	Guild	Species	Guild	Species	Guild	Species	Guild
Acacia pied barbet		African clawless otter		African hoopoe		African marsh-harrier	
Cape bulbul		Bat-eared fox		African pipit		Black harrier	
Cardinal woodpecker		Black-backed jackal	4	African reed-warbler		Black-shouldered kite	
Chestnut-vented tit-babbler		Black-headed heron		Ant-eating chat		Black sparrowhawk	
Klaas's cuckoo	1	Caracal		Cape girdled lizard		Booted eagle	
Long-billed crombec		Lesser kestrel		Cape longclaw		Jackal buzzard	
Red-faced mousebird		African darter	5	Cape skink		Lanner falcon	10
Sombre greenbul		African fish-eagle		Cape sugarbird		Martial eagle	
Speckled mousebird		African goshawk	6	Cloud cisticola		Rock kestrel	
White-backed mousebird		Boomslang		Crowned lapwing		Rufous-chested sparrowhawk	
African black duck		African harrier-hawk		Grey-backed cisticola		Steppe buzzard	
Cape shoveler		African sacred ibis		Karoo scrub-robin	8	White-necked raven	
Cape teal	2	Blue crane		Knox's desert lizard		Yellow-billed kite	
Maccoa duck		Bokmakierie		Levaillant's cisticola		African paradise-flycatcher	
Red-knobbed coot		Burchell's coucal		Little rush-warbler		Bar-throated apalis	
African black swift		Cape cobra		Malachite sunbird		Cape batis	
African dusky flycatcher		Cape crow		Namaqua dwarf chameleon		Cape penduline-tit	
Alpine swift		Cape whip snake		Orange-breasted sunbird		Cape white-eye	
Banded martin		Common (Southern) fiscal	7	Red-sided skink		Diderick cuckoo	
Barn swallow		Karoo whip snake		Short-legged seps		Dusky sunbird	11
Brown-throated martin		Large grey mongoose		Variegated skink		European bee-eater	
Common swift	3	Pied crow		Zitting cisticola		Fairy flycatcher	
Horus swift		Secretarybird		African jacana	9	Greater honeyguide	
Little swift		Small grey mongoose				Grey tit	
Sand martin		Spotted skaapsteker				Lesser honeyguide	
White-rumped swift		Yellow mongoose				Southern double-collared sunbird	
White-throated swallow							

Species	Guild
African purple swamphen	
African rail	
African spoonbill	
Black stork	
Glossy ibis	
Great crested grebe	
Greater flamingo	
Grey-headed gull	12
Little grebe	
Little stint	
Reed cormorant	
Ruff	
White-breasted cormorant	
Wood sandpiper	
Yellow-billed egret	
African pygmy mouse	
Cape gerbil	
Cape porcupine	13
Hairy-footed gerbil	
Scrub hare	
African stonechat	
Cape robin-chat	
Cape wagtail	
Cattle egret	
Common sandpiper	
Common starling	
Familiar chat	14
Fiscal flycatcher	
Grey-winged francolin	
Hadeda ibis	
Lesser swamp-warbler	
Olive thrush	
Red-winged starling	
African wild cat	
Herald snake	
Olive house snake	15
Small-spotted genet	
Spotted thick-knee	
Angulate tortoise	
Black-headed canary	
Blackrumped buttonquail	
Brimstone canary	
Cape bunting	
Cape canary	
Cape clapper lark	
Cape grassbird	
Cape long-billed lark	
Cape sparrow	
Cape spurfowl	
Cape weaver	
Capped wheatear	16
Common quail	
Common waxbill	
Grey-backed sparrowlark	
Helmeted guineafowl	
House sparrow	
Karoo lark	
Large-billed lark	
Laughing dove	
Layard's tit-babbler	
Mountain chat	
Namaqua dove	
Namaqua sandgrouse	
Pearl-breasted swallow	
Pied starling	
Pin-tailed whydah	
Red-capped lark	
Red-eyed dove	
Rock dove	
Southern grey-headed sparrow	
Southern masked-weaver	
Southern red bishop	16
Speckled pigeon	
Streaky-headed seedeater	
Vlei rat	
Wattled starling	
White-throated canary	
Yellow bishop	
Yellow canary	
Austen's thick-toed gecko	
Cape sand frog	
Cape sand toad	17
Egyptian free-tailed bat	
Ocelated thick-toed gecko	
Barn owl	18
Spotted eagle-owl	
Black (Southernrace) saw-wing	19
Black crake	
Black-winged stilt	
Common greenshank	
Common moorhen	
Green-backed heron	20
Hartlaub's gull	
Little bittern	
Mallard duck	
Pied avocet	
Black-crowned night-Heron	21
Blacksmith lapwing	22
Blouberg dwarf burrowing skink	
Cape golden mole	
Delalande's beaked blind snake	23
Rose's rain frog	
Silvery dwarf burrowing skink	
Blue wildebeest	24
Bontebok	
Cape dune mole-rat	25
Cape grysbok	
Common duiker	
Common eland	
Four-striped grass mouse	26
Springbok	
Spur-winged goose	
Steenbok	
Cape horseshoe bat	
Cape serotine	
Egyptian slit-faced bat	
Geoffroy’s horseshoe bat	27
Longtailed serotine bat	
Natal long-fingered bat	
Robert’s flat-headed bat	
Temminck’s myotis	
Cape turtle-dove	28
Egyptian goose	
Clicking stream frog	29
Common ostrich	
Gemsbok	30
Plains zebra	
Red hartebeest	

Species	Guild	Species	Guild
Common platanna	31	Hamerkop Kelp gull Little egret	41
Crossed whip snake Karoo prinia Southern black korhaan	32	Mole snake	42
Egyptian rousette bat	33	Peregrine falcon Verreaux's eagle	43
Fiery-necked nightjar	34		
Forest shrew	35	Purple heron	44
Fork-tailed drongo	36	Red-billed teal	45
Giant kingfisher Malachite kingfisher Pied kingfisher Red-chested cuckoo Southern boubou	37	Rhombic egg-eater	46
		Rock martin	47
		South african shelduck Southern pochard	48
		Spotted flycatcher	49
Greater striped swallow White-winged tern	38	Spotted harlequin snake	50
		Spotted house snake	51
Great white pelican	39	Water thick-knee	52
Grey heron	40	White-backed duck	53
		Yellow-billed duck	54