Zoeller, K. C., G. G. Gurney, N. Marshall, and G. S. Cumming. 2021. The role of socio-demographic characteristics in mediating relationships between people and nature. *Ecology and Society* 26(3):20. https://doi.org/10.5751/ES-12664-260320

Research

The role of socio-demographic characteristics in mediating relationships between people and nature

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ABSTRACT. Research on ecosystem services has focused primarily on questions of availability or supply and often assumes a single human community of identical beneficiaries. However, how people perceive and experience ecosystem services can differ by socio-demographic characteristics such as material wealth, gender, education, and age. Equitable environmental management depends on understanding and accommodating different perceptions of ecosystem services and benefits. We explored how socio-demographic characteristics influence people's perceptions of birds. We identified morphological and behavioral traits of birds that people care about and used these to group bird species into "cultural functional groups." Cultural functional groups of birds are defined by shared characteristics that local people perceive as contributing to cultural ecosystem services or disservices (in the same way that foraging guilds for birds can be defined by dietary information). Using perception data for 491 bird species from 401 respondents along urban-rural gradients in South Africa, we found that socio-demographic characteristics were strongly associated with human preferences for different avian cultural functional groups. Our results provide a strong quantitative demonstration that the provision of cultural ecosystem services and benefits depends on the recipient of the service and not just on the ecological community that is present.

Key Words: *birds; cultural functional groups; ecosystem services; social differentiation*

INTRODUCTION

Delivery of ecosystem goods and services is critical for human well-being and has become an important objective for environmental governance and management (MA 2005, Berbés-Blázquez et al. 2016). Although some ecosystem goods and services are unequivocally necessary for all people, e.g., breathable air and potable water, the importance of others is more subjective and hence more likely to be controversial, e.g., fish harvesting vs. tourism on coral reefs (Lau et al. 2018). Understanding heterogeneity in how people perceive and experience elements of nature requires an understanding of the complex factors that mediate human-nature interactions, and remains a key challenge for environmental management (MA 2005, Lindemann-Matthies et al. 2014, Díaz et al. 2015, Horcea-Milcu et al. 2016, Lau et al. 2018).

Although ecosystem services research has tended to take a socially aggregated approach that focuses on an average beneficiary (Daw et al. 2011), the ways in which people perceive and interact with their environment are not uniform (Scholte et al. 2015, Gurney et al. 2017). Individuals' perceptions of ecosystems are affected by a range of socio-demographic characteristics linked to key elements of identity, such as gender, ethnicity, and education, which influence how they use, value, and access ecosystems (Lau et al. 2018, 2019). For example, Lau et al. (2019) found that individuals' ratings of cultural ecosystem services were significantly influenced by gender, with men rating the service higher than women. Furthermore, perceptions of ecosystem services can be attributed to elements of identity that are specific to individual ecosystems; for instance, degree of identification as a fisher was strongly linked to how respondents rated a range of ecosystems services from coral reef fisheries (Hicks and Cinner et al. 2014). Perceptions of ecosystem services can also be influenced by where and how people live. Urban ecosystems, for example, are perceived as more limited in their capacity to produce services than rural ecosystems (Lapointe et al. 2019). As a result, the ability of people to access ecosystem services may be more restricted in urban areas. Given the rapid rates of urbanization in the Global South generally, and in Africa in particular, understanding how perceptions of ecosystem services change along an urban-rural gradient is important in ensuring the equitable management of ecosystems in developing countries (Elmqvist et al. 2013).

Taking a socially disaggregated approach to perceptions of ecosystem services can clarify who experiences costs and benefits related to ecosystem change and management, and thus help ensure equitable outcomes from decision-making processes. Aggregated assessments of ecosystem services that ignore differences between people may obscure the preferences and interests of subgroups, potentially resulting in management decisions that lead to unequal access to ecosystem services within society. Differential access to ecosystem services has been highlighted as a major gap in ecosystem service research, particularly in areas where systemic inequalities, exclusion, and segregation may result in conflict and violence (Lapointe et al. 2019). Examining heterogeneity in perceptions of ecosystem services is particularly important in post-colonial countries because colonization typically led to unequal access to ecosystem services, mirroring broader social and economic inequalities (Musavengane and Leonard 2019). Sustained unequal access to ecosystem services risks reinforcing existing social and economic inequalities (Daw et al. 2011, Sikor 2013). In South Africa, for example, formalized segregation based on "race" under apartheid has led to access to ecosystem services historically being unevenly distributed, with management decisions largely informed by white and "upper class" priorities (Musavengane and Leonard 2019). Despite progress in economic and social integration since the end of apartheid in 1994, South African society remains economically and socially divided along racial lines (Ramutsindela 2007, Kepe

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2009; F. Amodio and G. Chiovelli 2014, *unpublished manuscript*). Therefore, to foster equitable and inclusive environmental management and governance in this context, it is critical to consider the legacy of apartheid by examining how human-nature relationships are related to race (Kepe 2009, Martin et al. 2016).

Although the interactions between people and nature that produce cultural ecosystem services are mediated by identity and values, most studies of cultural ecosystem services overlook the socio-cultural factors that produce preferences (Plieninger et al. 2013, Zoderer et al. 2016). In this paper, we addressed this gap by asking how socio-demographic characteristics relate to people's perceptions of cultural ecosystem services provided by birds in South Africa. We used a functional group approach, grouping birds that shared similar behavioral and morphological traits that are relevant to cultural service provision. Functional approaches have a long history in avian ecology but are more typically applied to foraging guilds, e.g., insectivores, frugivores, raptors (Sekercioglu 2002). The functional group approach reduces irrelevant between-species heterogeneity and facilitates the identification of general patterns (Kahmen et al. 2002, de Arruda Almeida et al. 2018). It is particularly useful in establishing linkages between the functional traits of individual organisms and the production of ecosystem services (Sekercioglu 2002). Individual functional traits of organisms that underpin provisioning and regulating ecosystem services have been widely reported (Sekercioglu 2002, Cumming and Child 2009), but the functional traits that underpin cultural ecosystem services have received limited attention. Because cultural ecosystem services are inherently intangible (Chan et al. 2012), developing a functional classification for cultural ecosystem services relies on capturing human perception. Previous research (Zoeller et al. 2020) identified six cultural functional groups of birds. These were defined by species-level characteristics that people perceive as contributing to cultural ecosystem services or disservices (Zoeller et al. 2020). By comparing the demographic characteristics of respondents to their preferences for different avian functional groups, we were able to explore the influence of socio-cultural factors on cultural service provision.

MATERIALS AND METHODS

Background and study sites

From 1948 to 1994, South Africa was governed by a policy of apartheid, characterized by legislation that institutionalized segregation of "races" (Butler 2003). This legislation was partly enforced through physical separation of races, particularly through the Group Areas Act of 1950–1991 (which enforced racial segregation in cities), and the creation of homelands through the Promotion of Bantu Self-Government Act (1959–1994). This Act removed African people from urban and "white" areas into designated "Bantustans" based on racial and linguistic markers (Chisholm 2012). Racial segregation during apartheid resulted in the reinforcement of cultural identities along racial lines (Nengwekhulu 1986). The resulting economic and social impacts included disparate wealth distribution along an urban-rural gradient, as well as independent cultural development (F. Amodio and G. Chiovelli 2014, *unpublished manuscript*). Despite progress in economic and cultural integration since the end of apartheid, South African society remains economically and socially divided (Ramutsindela 2007; F. Amodio and G. Chiovelli 2014, *unpublished manuscript*). The South African census recognizes 11 official languages but still asks people to self-identify as belonging to one of four racial groups: black (80.6%), coloured (i.e., person of mixed ancestry; 8.7%), Indian/Asian (2.5%), and white (8.1%; Statistics South Africa 2011).

Respondent selection

We conducted semi-structured interviews with 401 respondents from 2016 to 2017 in five provinces in South Africa: Western Cape, Northern Cape, Eastern Cape, Mpumalanga, and Limpopo (Fig. 1). These areas contain six of the country's nine biomes: Albany thicket, forest, fynbos, grassland, savanna, and Succulent Karroo. This diversity in vegetation supports South Africa's rich birdlife, with 856 species recorded, 68 of which are endemic (Taylor and Peacock 2018). Study sites in the selected provinces were stratified to fulfil criteria of encompassing both urban and rural environments, being safe, feasible, and efficient to access, and comprising diverse socio-demographic groups (Zoeller et. al. 2020). Although time and budget constraints concentrated interviews in the Western Cape, South Africa's demographic variability was well-represented in the sample (Statistics South Africa 2011, Zoeller et al. 2020). Our dataset included individuals who occupied a range of locations along an urban-rural gradient, specifically city centers (n = 26 individuals), just outside the city (n = 16), city suburbs (n = 44), farms (n = 80), nature reserves (n = 19), rural areas (n = 92), towns (n = 101), just outside towns (n = 7), and townships (n = 16). Urban locations consisted of cities (including suburbs), towns, and townships. A town was classified as a developed area smaller than a city, with access to amenities, infrastructure, and municipal services. Townships were classified as urban because they occurred within greater city limits with limited access to natural habitats.

Fig. 1. Site map of respondent locations across South Africa.

A mixture of purposive and convenience sampling was used to select respondents and to ensure variation in socio-demographic characteristics (Etikan et al. 2016). Respondents were recruited via the Birdlife South Africa network, as well as opportunistically in public spaces, e.g., parks, libraries, and community meetings, in each location. Given the variety of people this approach

encompassed, our dataset included responses from inter alia the general public, land managers, farm managers and laborers, conservationists, students, and tour guides.

Bird traits

To determine their individual perceptions of birds, respondents were asked to rate their perceptions of a random selection of 30 bird species as positive, negative, or neutral (Zoeller et al. 2020). The perception of species was based on experiential knowledge, with each respondent being shown a photograph of the rated bird species. This was especially useful when interviewing non-birders, who might have seen the species in their local environment but not have been familiar with the species name. We randomly selected a subset of 30 bird species for each interview and cross referenced the bird species with the respondent's location. If the locations did not match, the species was discarded for that interview. This was repeated until bird and respondent location coincided for 30 species. After each of the 30 species had been rated, respondents were asked to justify the ratings of the birds based on the traits respondents perceived in that species. This part of the interview process was unstructured, and there were no limits to the justifications respondents could cite to ensure that we captured the full range of traits perceived by respondents. An example of a response is as follows: "Verreaux's Eagle-Owl receives a rating of 1 because it is associated with witchcraft. I don't like the bird's song because it reminds me of danger, and I don't like seeing the bird because it brings bad luck." This process was repeated for each of the 30 bird species per respondent, with the length of interviews ranging between one to two hours. The individual bird species' ratings were not used in this analysis.

Cultural functional group classification

Based on the explanations underlying the bird scores, we identified 45 perceived traits across the 401 interviews with respondents (see Appendix 1 for description of traits). For example, from the respondent's description of the Verreaux's Eagle-Owl above, we identified negative symbology and negative song as the dominant traits perceived by that respondent. These traits were scored as either present (1) or absent (0).

To identify cultural functional groups, we conducted a K-means cluster analysis on the 45 traits identified during the interview process. The K-means cluster analysis allocated each trait into six clusters, with the number of clusters being determined based on its silhouette coefficient. The traits enabled us to identify the dominant attributes of each cluster, which were used to develop a typology of cultural functional groups. The cultural functional groups and their derivation are described in Zoeller et al. (2020), and are identified as Visual Traits; Negative Visual and Behavioral Traits; Movement and Ecological Traits; Place Association and Abundance Indicators; Common Traits; and Behavioral Traits.

Socio-demographic characteristics

Relevant socio-demographic characteristics were obtained from each respondent during the interview process, enabling us to relate perceptions of bird traits to the socio-demographic characteristics of individual respondents. Respondents' socio-demographic characteristics are summarized in Appendix 1. From previous studies we identified the following socio-demographic characteristics as potentially important in influencing perceptions of cultural functional groups in the context of South Africa: education, gender, language, race, residential location, coarse residential location, and birding self-classification. The potential importance of these characteristics as influences on perceptions of cultural functional groups is outlined in Table 1. We included biogeographical variables to control for external factors that may influence people's perceptions of cultural functional groups. These variables included biome and province, since local vegetation influences the distribution of bird communities (Belaire et al. 2015). We additionally included frequency of bird encounters (ranging from daily to yearly) as a control variable because greater frequencies of interactions with birds may create a feedback loop in which more sightings of bird species increases the ability of individuals to perceive their cultural functions (Clergeau et al. 1998, Gaston et al. 2018).

Data analysis

Data from each respondent included (1) socio-demographic characteristics; (2) bird ratings; and (3) score justifications. Traits elicited from the score justification process were grouped using K-means cluster analysis (a distance-based measurements of similarity), producing six distinct cultural functional groups composed of different birds (see Appendices 2 and 3). Given that the traits that define the six cultural functional groups are based on perceptions, they are associated with a suite of socio-demographic characteristics, representative of individual respondents who cited that specific trait during the interview process. Thus, we examined how socio-demographic characteristics are related to cultural functional groups, i.e., perceptions of bird traits.

To determine whether socio-cultural characteristics were associated with cultural functional groups based on perceived bird traits, we first used χ^2 analyses to compare differences in the observed frequencies of socio-demographic characteristics between avian cultural functional groups. These analyses clarified the potential relevance of individual socio-demographic (explanatory) variables but were not able to provide estimates of the influence of a particular variable while controlling for the effects of the other explanatory variables.

We then used multinomial logistic regression (Upton 2017) to explore the relative influences of socio-demographic characteristics on perceptions of cultural functional group in a way that incorporated the interactions between explanatory variables. Multinomial regression can be seen as an extension of logistic regression, i.e., with a response variable of 1 or 0, to consider more than two categories. We used multinomial analysis to determine the probability of respondents perceiving each of six cultural functional groups based on socio-demographic characteristics, i.e., we treated the socio-demographic variables as explanatory or X variables and the six cultural functional groups as a single categorical response or Y variable with six categories. The traditional assumptions of regression analysis need not be met to run a multinomial logistic regression, although it is important that observations are independent (Corona et al. 2008). In our model, cultural functional groups were treated as the dependent variables and each of the socio-demographic variables was treated as independent. We also included three variables representing biome, province, and frequency of bird encounter as independent variables in order to control for key biogeographical factors thought to influence ecosystem service perceptions. We designated Movement and Ecological traits as the reference

Table 1. Socio-demographic characteristics of respondents, how they were measured, and how these characteristics might influence perception of ecosystem services, with examples.

Socio-demographic characteristic	Measurement	Category	Mechanism and examples
Age	Years	Continuous	Age has been shown to be related to perceptions of ecosystem services (Daw et al. 2011), with related priorities, responsibility, and entitlements shifting with age (Lau et al. 2019, Lapointe et al. 2020). For example, Lau et al. (2019) found that older respondents assigned higher ratings to fuelwood than younger respondents in Papua New Guinea.
Birding self-classification	Interest level	Non-birder Casual birder Enthusiastic birder Fanatical birder	Elements of identity directly related to the service at hand have been shown to influence perceptions of ecosystem services. For example, Hicks and Cinner (2014) found that the fishery benefits people perceived from coral reefs were directly related to their strength of identity as a fisher.
Race	Self-classified racial identity	Black Coloured White	In a South African context, race and language are key markers of a person's identity (Ramutsindela 2007). Because ecosystem services are co-constructed (Fischer and Eastwood 2016), knowledge, experience, and preferences for ecosystem services are likely to be influenced by race and language.
Languages	Self-identified home language	Afrikaans English Xhosa Other African languages	
Gender	Self-identified gender	Male Female	Normative gender roles have been shown to influence access to ecosystem services and the way these services are perceived (Lau et al. 2019, Yang et al. 2019). For example, Yang et al. (2019) suggested that women generally express stronger connections to cultural ecosystem services and have a greater awareness of the spiritual benefits of ecosystem services.
Years of formal education	Years of school completed	< Grade 10 Grade 10 to Grade 12 Diploma Degree Honours graduate Master's graduates PhD graduates	Perceptions of ecosystem services have been shown to be influenced by level of formal education as knowledge on ecological systems shift (Lau et al. 2019, Echeverri et al. 2020). For example, Hicks and Cinner (2014) found that years of education influenced how respondents perceived material benefits associated with ecosystem services in Madagascar and Tanzania.
Residential Location	Self-identified residential classification	City center Just outside city City suburbs Town Just outside town Township Farm Nature Reserve Rural	Bird diversity decreases with urbanization, suggesting that an individual's position along an urbanization gradient, both at the residential level and coarse level (simple urban vs. rural contrasts), is likely to affect biodiversity-based perception of ecosystem services (Clergeau et al. 1998).
Coarse Location	Broad classification based on population, infrastructure, and access to nature	Rural Urban	

category for this model because this analysis produced the lowest AIC. One category for each independent variable was used as a reference category, with the model predicting the probability of respondents perceiving each functional group against the socio-demographic reference category (Koster and McElreath 2017). All analyses were conducted in R (version 3.1.3) using stats package v7.3-14 and nnet package v7.3-14.

To reduce the dimensionality of our data, we screened for redundancy by separately coding each independent variable as a set of individual categories and removing non-significant categories from the multinomial model. We reran the analysis three times, removing non-significant variables each time, to identify the model that best fit our data based on the lowest AIC value. As summarized in Table 2, the model with the lowest AIC included variables in the broader categories of age, gender, home language, education, and race. All categories were z-score standardized.

Table 2. Regression coefficients (CF), standard error (SE), z-statistic, and p-value of the multinomial model between dimensions of socio-demographic characteristics and cultural functional groups. Socio-demographic characteristics missing p-values indicate non-significance (p > 0.05).

Characteristics	Category	Behavioral Traits				Common Traits				Negative Visual and Negative Behavioral Traits				Place Association and Abundance Indicators				Visual Traits			
		CF	SE	z statistic	P-value	CF	SE	z statistic	P-value	CF	SE	z statistic	P-value	CF	SE	z statistic	P-value	CF	SE	z statistic	P-value
	(Intercept)	-1.66	0.52	-3.19	0.01	-3.54	0.77	-4.56	0.001	-0.29	0.33	-0.88		-2.30	0.48	-4.77	0.001	-3.26	0.53	-6.14	0.001
Age	Continuous	-0.013	0.0029	-4.61	0.001	-0.0017	0.0032	-0.52		-0.0027	0.0019	-1.40		0.0054	0.0025	2.18	0.05	0.014	0.0022	6.34	0.001
Gender	Male	0.41	0.08	5.47	0.001	0.41	0.09	4.55	0.001	0.21	0.05	4.07	0.001	0.69	0.07	9.99	0.001	0.35	0.06	5.82	0.001
Home language	English	0.09	0.12	0.72		0.16	0.15	1.07		0.05	0.09	0.53		0.04	0.12	0.35		0.05	0.11	0.46	
	Other African languages	0.17	0.33	0.52		0.93	0.63	1.46		-0.20	0.21	-0.92		0.16	0.33	0.48		0.99	0.40	2.45	0.05
	Xhosa	0.08	0.33	0.23		1.32	0.62	2.11	0.05	-0.13	0.21	-0.65		0.15	0.32	0.46		1.38	0.40	3.46	0.001
Education	<Grade 10	-0.92	0.30	-3.10	0.01	-1.19	0.32	-3.67	0.001	-0.63	0.21	-2.96	0.01	-0.45	0.28	-1.65		-0.65	0.24	-2.71	0.01
	Grade 10 - Grade 12	-0.79	0.27	-2.90	0.01	-1.05	0.30	-3.55	0.001	-0.47	0.20	-2.34	0.05	-0.56	0.26	-2.13	0.05	-0.83	0.23	-3.64	0.001
	Degree	-0.57	0.30	-1.92		-1.07	0.33	-3.25	0.05	-0.27	0.22	-1.24		-0.48	0.29	-1.68		-0.70	0.25	-2.81	0.01
	Diploma	-0.69	0.29	-2.39	0.05	-0.94	0.32	-2.96	0.05	-0.22	0.21	-1.03		-0.15	0.27	-0.54		-0.69	0.24	-2.86	0.01
	Honours	-0.68	0.33	-2.05	0.05	-0.43	0.35	-1.23		-0.06	0.24	-0.27		-0.10	0.31	-0.33		-0.48	0.28	-1.70	
	Masters	-0.62	0.33	-1.91		-0.36	0.35	-1.04		-0.66	0.25	-2.67	0.01	-0.46	0.31	-1.45		-0.11	0.27	-0.42	
	PhD	0.18	0.35	0.52		-0.30	0.39	-0.77		0.09	0.27	0.35		-0.17	0.36	-0.48		-0.01	0.30	-0.02	
Race	Coloured	-0.04	0.32	-0.13		1.51	0.62	2.45	0.05	-0.34	0.20	-1.66		0.26	0.32	0.83		1.19	0.39	3.03	0.01
	White	0.60	0.30	2.02	0.05	1.84	0.60	3.06	0.01	0.07	0.18	0.40		0.51	0.30	1.73		1.19	0.38	3.14	0.01

RESULTS

Results from χ2 tests suggested that socio-demographic factors were significantly associated with people's preferences for different avian cultural functional groups. Comparisons of human preferences across avian functional groups differed significantly on all of the dimensions of socio-demographic characteristics that were measured: age (χ^2 5441.2, df = 20, p-value < 0.001), gender (χ^2 = 147.7, df = 5, p-value < 0.001), race (χ^2 = 150.3, df = 30, p-value < 0.001), language (χ^2 = 108.4, df = 15, p-value < 0.05), education (χ^2 = 230.9, df = 6, p-value < 0.001), coarse location (χ^2 = 29.6, df = 5, p-value < 0.001), residential location (χ^2 = 208.4, df = 40, p-value < 0.001), and birding self-classification (χ^2 = 88.8, df = 15, p-value < 0.001). A higher percentage of respondents across all socio-demographic characteristics reported perceiving Visual Traits than any other cultural functional group (Fig. 2). In contrast, Common Traits and Behavioral Traits consistently had the lowest number of respondents, suggesting that individual people are more likely to perceive avian visual cues than traits pertaining to behavior or observation frequency. (Fig. 2).

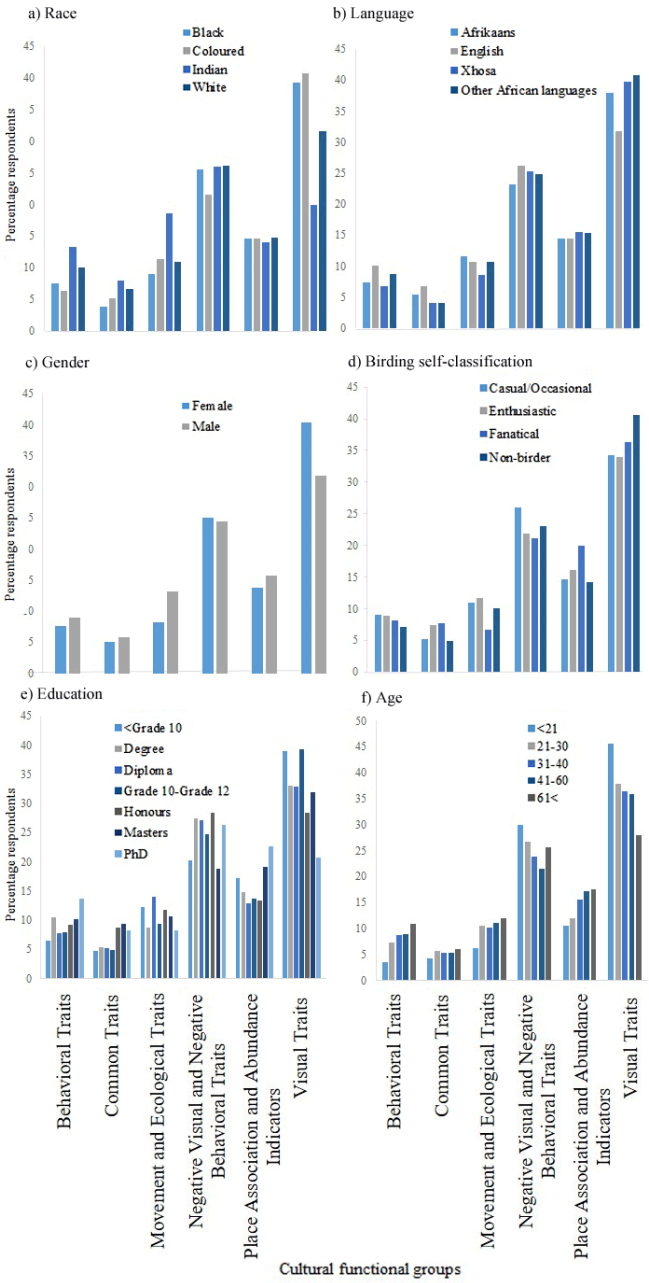
The multinomial analysis supported the argument that socio-demographic characteristics are associated with perceptions of birds from all six cultural functional groups (Figs. 2 and 3, Table 2). Age, gender, race, language, and education emerged as important socio-cultural characteristics influencing what people perceived about birds. The model explained 24% of the variance (AIC = 37118.65, residual variance = 36818.65, McFadden pseudo R^2 = 0.24, p < 0.05; Table 2). Socio-demographic characteristics differed across cultural functional groups, both in the significance of the effect and whether it was negative or positive (Figs. 2 and 3, Table 2). Gender and education were consistently significant as explanatory variables across all avian cultural functional groups, suggesting these characteristics are strongly associated with human perceptions of birds. Home language was significant for Visual Traits, and race was significant for Behavioral Traits and Visual Traits, suggesting that perceptions of birds differ significantly for people of different races and languages. Once we reduced the dimensionality of our data, only one province was significant for Behavioral Traits (Western Cape) and three biomes for Place Association and Abundance Indicators and Visual Traits (forest and fynbos, fynbos, and Succulent Karoo).

Gender was the only socio-demographic characteristic that significantly explained differences in what people perceived across all avian cultural functional groups. Men were more likely than women to perceive Behavioral Traits, Common Traits, Negative Visual and Behavioral Traits, Place Association and Abundance Indicators, and Visual Traits, compared with the Movement and Ecological Traits Group. Increasing age was significantly positively related to perceiving the Place Association and Visual Traits functional groups (compared to the Movement and Ecological Traits group), and negatively related to the Behavioral Traits, Common Traits, and Negative Visual and Behavioral Traits functional groups (although the relationship was not significant with regards the latter two). There were few significant relationships for home language, except that Xhosa speakers were significantly more likely than Afrikaans speakers to perceive bird species in the Common Traits and Visual Traits functional groups than in the Movement and Ecological Traits group. For race, there was only one significant difference between those who identified as coloured as opposed to black, whilst there were three significant differences between white and black respondents. Respondents identifying as white were significantly more likely than black respondents to perceive traits associated with the Behavioral Traits, Commons Traits, and Visual Traits functional groups as opposed to the Movement and Ecological Traits functional group.

DISCUSSION

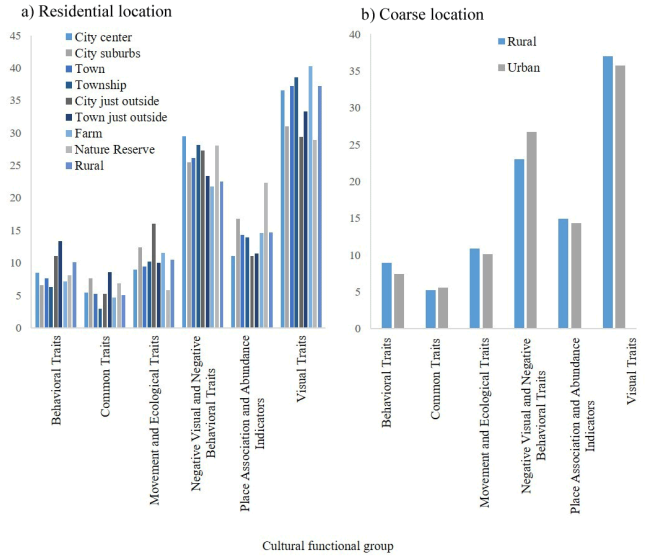
The results indicate that all socio-demographic characteristics were significantly related to perceptions of cultural functional groups, and hence with perceptions of bird traits and ultimately the receipt of cultural ecosystem services and benefits. Perceptions of avian cultural functional groups were not uniform across the range of socio-demographic characteristics that were measured,

Fig. 2. Percentage distribution of socio-demographic characteristics between dimensions of cultural functional groups: (a) race, (b) language, (c) gender, (d) birding self-classification, (e) education, and (f) age.



highlighting the importance of disaggregating the beneficiaries of ecosystem services. The association of age, gender, race, language, and education with different avian cultural functional groups emerged as particularly significant, suggesting that these characteristics can be used to predict patterns in perceptions of cultural ecosystem services.

Fig. 3. Percentage distribution of socio-demographic characteristics between dimensions of cultural functional groups: (a) residential location and (b) coarse location.



Heterogeneity in the ways people perceive birds may be indicative of individuals' differential abilities to access ecosystem services, where access is constructed through identification with particular socio-demographic characteristics (following Hicks and Cinner 2014). For example, language as an influence on perceptions of bird traits was significantly associated with Xhosa and other African language-speaking respondents. Contrasts between perceptions of birds according to racial and linguistic characteristics probably relate to forced segregation during apartheid, where black and coloured South Africans were relocated to rural areas (Butler 2003, Musavengane and Leonard 2019). In a South African context, identification with a specific race and social construction through a specific language are likely to mediate an individual's interaction with their environment and contribute to their ability to access ecosystem services (Kittinger et al. 2012, Hicks and Cinner 2014, Musavengane and Leonard 2019). Understanding the extent to which language and race inform socio-cultural values is of particular interest when cultural heritage, norms, practices, and traditions have developed in forced isolation (Butler 2003, Kittinger et al. 2012, Tengberg et al. 2012). Significant differences among respondents based on racial and linguistic characteristics can help determine how ecosystem service benefits differ according to social subgroups and is important in promoting equitable access to ecosystem services (Lau et al. 2018)

Our results suggest that urbanization did not affect perceptions of cultural functional groups. Despite there being significant differences between respondents living in different locations in the Chi-square tests, residential and coarse location were not significantly associated with particular avian cultural functional groups in the presence of other socio-demographic variables in the multinomial regression. Because research has indicated that bird diversity decreases with urbanization (Suri et al. 2017), it was

expected that an individual person's position along an urbanization gradient would affect their perception of ecosystem services (Clergeau et al. 1998), particularly because others have found that species traits may be filtered in urban environments (Croci et al. 2008). Indeed, urban dwellers more frequently report limitations to ecosystem services benefits than rural dwellers (Lapointe et al. 2019), where increased levels of land use intensity reduce the flow of ecosystem services (Balzan et al. 2018). However, the relationships between how people interact with their environment and where they live are still connected in potentially important ways in South Africa. Because of forced segregation based on race for most of South Africa's colonial history, many urban households of historically disenfranchised communities in South Africa still maintain strong links to their traditional rural homes (Smit 1998, Hamann et al. 2016). Rural-urban linkages are reinforced by circular migration and migrant labor between rural and urban households (Smit 1998). This may explain why perceptions of cultural functional groups still appear to be more strongly linked within shared social constructs that span urban and rural communities in South Africa. Understanding how perceptions of cultural functional groups are distributed across space is important in developing sustainable land management strategies and can be used to identify linkages between cultural ecosystem hotspots and local socio-cultural identities (Plieninger et al. 2013).

Establishing where differences occur between people in their perceptions of avian cultural functional groups facilitates identification of potential barriers to ecosystem service access (Mensah et al. 2017). In countries where unequal access to resources has previously been institutionalized, understanding the underlying drivers of differential perceptions of ecosystem service is important in promoting distributive justice with respect to ecosystem services across previously disenfranchised communities (Musavengane and Leonard 2019). Indeed, in other contexts, research shows that ecosystem degradation and ecosystem service loss disproportionally affect marginalized groups, such as the poor, women, and indigenous communities (Sievers-Glotzbach 2013). However, the challenges associated with capturing the complex socio-demographic factors that constrain access to ecosystem services (and subsequently result in diverse ecosystem service perceptions) have resulted in limited inclusion of diverse stakeholder preferences in ecosystem management (Kittinger et al. 2012, Iniesta-Arandia et al. 2014, Gurney et al. 2015). Incorporating diverse perceptions in ecosystem service management is particularly important in areas with social inequality, as the linkages between conservation, human well-being, and the socio-demography of ecosystem users are often not explicitly discussed in the equitable management discourse (Kepe 2009, Musavengane and Leonard 2019). Management initiatives that seek to maintain ecosystem service delivery must therefore tailor their approach to match locally specific preferences. This requires heterogeneity in ecosystem service perceptions to be incorporated into environmental management decisions (Lau et al. 2018) because we have shown here that focusing only on specific cultural functional groups risks discounting the preferences of local ecosystem users.

CONCLUSION

We have shown that exploring the drivers of perceptions of avian cultural functional groups, defined by the traits that people care about in birds, can promote an understanding of the causes of heterogeneity in people's relationships with their environment. Differences in perceptions of cultural functional groups were significant across all socio-demographic characteristics, implying that socio-demographic characteristics inform how people experience bird-related ecosystem services and their benefits. Notably, age, gender, race, language, and education were shown to significantly affect perceptions of cultural services from birds. Further research on how different societal groups perceive and experience ecosystem services will be critical for resolving inequities in the distribution of ecosystem service benefits across socially heterogeneous communities (Kepe 2009, Sievers-Glotzbach 2013) and ensuring just and equitable management of ecosystems.

Responses to this article can be read online at:
https://www.ecologyandsociety.org/issues/responses.php/12664

Acknowledgments:

We thank the numerous respondents who participated in interviews and enthusiastically volunteered their time and personal insight. We would also like to extend our gratitude to Dominic Henry and Kristine Maciejewski who provided early support and feedback on the sampling protocol. This research was funded by the National Research Foundation (NRF) through a Blue Skies grant to GSC, by the DST/NRF Centre of Excellence at the Percy FitzPatrick Institute, and by James Cook University.

Data Availability:

The data/code that support the findings of this study are available on request from the corresponding author, KCZ. None of the data/code are publicly available because research participants were ensured their anonymity in this study, and we are hesitant to include information that could compromise the privacy of research participants. Ethical approval for this research study was granted by the University of Cape Town (SFREC 48_2012)

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Appendix 1. Respondent characteristics and their percentage contribution to the sample.

Respondent characteristics	% (and number of) respondents
Birding self-classification	
Non-birder	36 (n=146)
Casual birder	45 (n=184)
Enthusiastic birder	15 (n=62)
Fanatical birder	2 (n=9)
Frequency of bird encounters	
Daily	83 (n=333)
Once a week	11 (n=46)
Once a month	5 (n=18)
Once a year	1 (n=4)
Ethnicity	
Black	32 (n=128)
Coloured	26 (n=108)
White	39 (n=160)
Languages	
Afrikaans	38 (n=153)
English	31 (n=126)
Xhosa	19 (n=76)
Other African languages	11 (n=46)
Sex	
Male	47 (n=187)
Female	53 (n=214)
Highest educational qualification	
Grade 9 or lower	14 (n=57)
Grade 10 to Grade 12	48 (n=196)
University or technical college graduates	30 (n=121)
Masters graduates	5 (n=17)
PhD graduates	3 (n=10)

Appendix 2. Description of dominant traits that characterise cultural functional groups.

Cultural functional group name	Dominant traits
Visual Traits	Colourful/handsome plumage
	Positive response to the bird's name
	Small body
	Stance
	Shape
Negative Visual and Negative Behavioural Traits	Dull/ugly plumage
	Negative song
	Negative habitat
	Difficult to identify
	Aversion for the bird at the family level
	Invasive/pest
	Negative symbology
	Boring/average behaviour
	Aggressive/territorial
Movement and Ecological Traits	Interesting flight
	Interesting foraging behaviour
	Conspicuous
	Affinity for the bird at the family level
	Camouflage/adaptability
	Clever
	Endangered
	Strong/powerful
Place Association and Abundance Indicators	Positive song
	Positive habitat
	Rare
	Migratory
	Few sightings of the species
	Breeding display
	Difficult to locate
	Indigenous/endemic
	Positive association with their sighting
	Positive symbology
	Easy to identify
Common Traits	Common
	Many sightings of the species
	Confiding
Behavioural Traits	Large body
	Interesting movement
	Parental care
	Flock size
	Source of food

Appendix 3. Frequency of species occurrence in each cultural functional group.

	Visual Traits	Negative Visual and Traits	Movement and Ecological Traits	Place Association and Abundance Indicators	Behavioural Traits	Common Traits
Acacia Pied Barbet	2	1	8			
African Barred Owlet	2	19	6		10	
African Black Crake	6	3	4	1	1	6
African Black Duck	5	8	5			9
African Black Oystercatcher	9	11	7		5	2
African Black Swift	1	13	5		1	3
African Cuckoo	2	28	17			1
African Darter	4	9	9	1	3	3
African Dusky Flycatcher		7	5	1	3	
African Firefinch	5	2	27	2		1
African Fish Eagle	9	6	7	1	15	4
African Goshawk	4	11	12	1	17	2
African Green Pigeon	2	2	11	1	2	1
African Grey Hornbill	6	5	13	1	1	1
African Harrier-hawk		3	3		7	1
African Hawk-Eagle	4	9	10		15	1
African Hoopoe	8	4	21		1	4
African Jacana	5	5	2		3	5
African Marsh Harrier	1	2	5	1	3	4
African Olive Pigeon	2	10	15	2		2
African Openbill	1	9	2		1	2
African Palm Swift	2	21	14	2	2	3
African Paradise Flycatcher	5	11	33		2	3
African Pied Wagtail	8	2	11	3		16
African Pipit		7	7	1		1
African Quailfinch		5	13		4	
African Reed Warbler	9	6	7		1	2
African Rock Pipit	4	21	13	2		3
African Sacred Ibis		1	1	1		
African Snipe	5	7	3		4	3
African Spoonbill	10	3	3	1	5	4
African Stonechat	2	8	43		2	4
African Swamphen	16	3	11	1	2	5
Agulhas Long-billed Lark	4	8	7	1	1	
Alpine Swift	2	6	5	2	4	1
Amethyst Sunbird	11	2	10	3	15	2
Amur Falcon		11	9	1	10	1
Ant-eating Chat	2	7	7		2	2
Arrow-marked Babbler		13	12	1	1	
Ashy Flycatcher	1	9	5	1	5	1

Ashy Tit	1	8	10		2	
Banded Martin		8	8		4	
Bank Cormorant	7	6	2		3	2
Barlow's Lark	1	10	18	2	1	1
Barn Owl	3	16	5	2	12	2
Barn Swallow	1	7	12	6	3	3
Barratt's Warbler	7	23	13	1	1	4
Barred Wren-Warbler	1	10	6	1		1
Bar-throated Apalis			1			1
Bateleur	3	3	13		11	1
Bearded Vulture		16	5	1	6	2
Bearded Woodpecker	5	8	13	1	1	7
Bennett's Woodpecker	6	5	3			6
Black Cuckoo		8	8	2		
Black Cuckooshrike	2	8	17			1
Black Harrier	1	4	5	2	20	2
Black Saw-wing	1	17	4			
Black-backed Puffback	1	2	18			1
Black-bellied Bustard	4	6	8			2
Black-bellied Starling	1	5	14	1	1	1
Black-chested Prinia	4	13	5	3	1	
Black-chested Snake-Eagle			3		2	1
Black-collared Barbet	4	2	10	2	1	1
Black-crowned Tchagra	3	4	18		2	
Black-eared Sparrowlark	3	16	11	2	1	
Black-faced waxbill	3	2	20		1	
Black-headed Canary		4	13	3	2	
Black-headed Heron	2	1	2	1	6	2
Black-headed Oriole	4		10	1		1
Black-necked Grebe	7	9	1		1	
Black-shouldered Kite	2	5	4	1	11	3
Blacksmith Lapwing	7	3	7	2		7
Black-throated Canary	3	12	11			
Black-winged Lapwing	2	5	5	5	2	1
Black-winged Stilt	2	2	1		4	4
Blue Crane	2	5	11	1		4
Blue Korhaan	5	6	8			6
Blue Waxbill	4	1	14	1		2
Blue-mantled Crested Flycatcher	3	3	9	1	3	1
Bokmakierie	2	2	3			
Booted Eagle		7	2		14	2
Bradfield's Swift	1	16	2			1
Brimstone Canary	4	9	18	3	3	1
Broad-billed Roller	1	3	15		1	
Bronze Mannikin	3	8	23	1		

Brown Scrub-Robin	8	8	14	2	2	5
Brown Snake Eagle		18	8		21	1
Brown-crowned Tchagra	3	4	12			3
Brown-headed Parrot		7	13			
Brown-hooded Kingfisher	5	5	3		8	1
Brown-throated Martin		17	19	2	1	1
Brubru	1	10	10		1	
Buff-spotted Flufftail	6	15	11	1		7
Buff-streaked Chat	1	3	18		1	1
Buffy Pipit		10	7	1	1	2
Burchell's Coucal	5	3	5	1		
Burchell's Sandgrouse	4	5	2		1	7
Burchell's Starling	1	4	13	1		1
Burnt-necked Eremomela	4	9	9			2
Bushveld Pipit	4	19	8			3
Cape Batis	9	4	16	2	1	1
Cape Bunting	4		7	1		
Cape Canary	4	3	14	4		
Cape Clapper Lark	2	2	15	2		
Cape Cormorant	7	5	5	5	4	5
Cape Crow	4	24	1	7	4	1
Cape Gannet	8	6	2	1	3	5
Cape Glossy Starling	8	4	10	2		
Cape Grassbird	7	11	7	1		1
Cape Long-billed Lark	4	5	5			
Cape Longclaw	2	5	15		1	2
Cape Penduline Tit	4	10	12	1		1
Cape Rock Thrush	4		6			1
Cape Shoveler	12	8	4		3	3
Cape Siskin	6	7	22			2
Cape Sparrow	3		4			1
Cape Spurfowl	8	11	15	15	2	10
Cape Sugarbird	20	7	13	4	12	3
Cape Teal	8	3	1	1	2	10
Cape Vulture	2	14	3	1	7	1
Cape Wagtail	3	7	6	3		8
Cape Weaver	3	3	4	1		1
Cape White-eye	5	2	1	4		
Capped Wheatear	1	3	9	1	2	
Cardinal Woodpecker	6	9	11		1	16
Cattle Egret	7	3	4	6	3	
Chat Flycatcher	2	3	4	2	3	
Chestnut-banded Plover	6	4	2		1	14
Chestnut-vented Tit-Babbler	4	14	25			1
Chinspot Batis	5	3	9	3	2	
Chorister Robin-Chat	2		13	1	2	2

Cinnamon-breasted Bunting	1	1	6	1		
Cloud Cisticola	4	4	14		1	2
Collared Pratincole	4	6	8	1	1	2
Collared Sunbird	7		4		6	4
Common Buzzard	2	4	2	2	8	2
Common Cuckoo	4	9	11		1	
Common Greenshank	6	2	5		5	7
Common House Martin		4	5	3	1	1
Common Moorhen	8	5	3	6	1	4
Common Myna		9	15	2		
Common Ostrich	5	4	3	5		12
Common Quail	6	18	15	7	2	13
Common Ringed Plover	3	2	6	1		8
Common Sandpiper	6	5	3	2	4	2
Common Scimitarbill	2	6	5		7	
Common Starling	1	14	11	11	2	
Common Swift	2	6	2	5	3	1
Common Tern	8	4	5	3	1	1
Common Waxbill	1	1	14	1	2	1
Coqui Francolin	7	15	8	2		8
Crested Barbet	4	5	24	2	1	1
Crested Francolin	4	3	1	5		7
Crested Guineafowl	2	5	5	8	1	7
Crimson-breasted Shrike	8	4	14		2	
Crowned Cormorant	5	8	4			3
Crowned Hornbill	2	5	7	2	3	
Crowned Lapwing	3	4	8	1		12
Curlew Sandpiper	10	3	1	1	2	2
Cut-throat Finch	3	5	21		2	1
Dark Chanting Goshawk	1	4	5	1	8	1
Dark-backed Weaver	3	3	10			1
Dark-capped Bulbul	3	5	15	7		1
Denham's Bustard	6	6	2			5
Desert Cisticola	6	3	9		2	
Dickinson's Kestrel	2	5	4		11	
Diederik Cuckoo	4	3	11		1	2
Double-banded Courser	7	4	11	1	1	7
Double-banded Sandgrouse	1	9	4			6
Drakensberg Prinia	2	10	6	1		1
Dusky Indigobird		2	14	1	2	1
Dusky Lark		4	11	1	1	3
Dusky Sunbird	6	4	3	1	7	
Eastern Clapper Lark	3	8	13			
Eastern Long-billed Lark	1	10	9	1		1
Eastern Nicator	3	13	24			
Emerald-spotted Wood Dove	8	7	24	3	2	3

Eurasian Golden Oriole	3	9	8			
European Bee-eater	2	2	13		5	1
European Honey Buzzard	1	6	11		9	1
European Roller	4	2	34		1	2
Fairy Flycatcher	3	2	10	2	4	1
Familiar Chat	2	9	11		1	8
Fawn-coloured Lark	1	14	9			3
Fiery-necked Nightjar	3	10	7		1	1
Fiscal Flycatcher		1	1		1	1
Flappet Lark	4	18	6	6		2
Forest Buzzard	1	10	7	1	12	
Forest Canary	14	2	16	6	2	1
Fork-tailed Drongo	3	10	4	2	1	
Gabar Goshawk	1	13	8		14	
Giant Kingfisher	1	6	5		15	1
Golden-breasted Bunting	5	2	29	1	2	3
Golden-tailed Woodpecker	6	7	16		3	11
Goliath Heron	7	12	4		4	9
Gorgeous Bushshrike	5	5	37	1	3	2
Great Egret	6	7	4	3	7	6
Great Reed Warbler	1	10	13	2		1
Great Sparrow	2	2	15	5	1	1
Great Spotted Cuckoo	3	4	12		1	2
Greater Blue-eared Starling	1	3	15	2	1	
Greater Double-collared Sunbird	12		6		4	
Greater Flamingo	5	3	3		2	
Greater Honeyguide	3	10	5		2	1
Greater Kestrel		3	3		10	
Greater Striped Swallow	2	2	12	3	1	
Green Wood Hoopoe	5		17		1	3
Green-backed Camaroptera	3	5	9		2	1
Green-backed Heron	6	8	4		4	3
Green-capped Eremomela	2	10	18		1	
Green-winged Pytilia	2	2	18		1	1
Grey Cuckooshrike	3	10	11			1
Grey Go-away Bird	6	5	8	3		
Grey Heron	12	6	3	1	11	6
Grey Penduline Tit	13	1	7	1	2	1
Grey Plover	6	1	4	1	1	7
Grey Sunbird	1	5	5	2	12	1
Grey Tit	5	9	23	5	6	4
Grey Tit Flycatcher	2	4	12	1	4	1
Grey-backed Camaroptera	2	7	7			
Grey-backed Cisticola	8	4	11	3	2	
Grey-backed sparrowlark	2	4	9	2	5	

Grey-headed Bushshrike	2	2	12		5	1
Grey-headed Gull	6	7	4	7	4	2
Grey-headed Kingfisher	3		7		12	
Grey-headed Parrot	1	7	14		1	
Grey-rumped Swallow	2	1	12	4	1	
Grey-winged Francolin	4	8	4	3		6
Ground Woodpecker	4	1	6			2
Groundscraper Thrush	3	2	11			3
Gurney's Sugarbird	16	1	2	1	4	2
Hadeda Ibis		14	3	8	1	1
Half-collared Kingfisher	6		3		12	
Hamerkop	6	11	6		2	1
Hartlaub's Gull	9	11	2	3	2	
Helmeted Guineafowl	1	1	1	4		5
Hooded Vulture	1	18	4		8	
Horus Swift		10	4	2	5	1
House Sparrow	4	4	1	6	1	2
Jackal Buzzard	3	12	5	1	16	3
Jacobin Cuckoo	5	10	8	1		2
Jameson's Firefinch		4	15	1		
Kalahari Scrub-Robin	6	6	8	1		2
Karoo Chat	6	2	9		1	2
Karoo Eremomela	5	7	12		1	
Karoo Korhaan	3	8	1		1	1
Karoo Lark	2		9		1	
Karoo Long-billed Lark	3	10	7	1	1	
Karoo Prinia	4	7	10			4
Karoo Scrub-Robin	3	10	16	2	1	2
Karoo Thrush	1	8	9	2	1	
Kelp Gull	6	5	8	2	1	
Kittlitz's Plover	7	5	1	1	1	10
Klaas's Cuckoo	3	4	27			1
Knob-billed Duck	2	6	8		1	3
Knysna Turaco	9		4		1	3
Knysna Warbler	5	8	10		1	
Knysna Woodpecker	6	3	3			2
Kori Bustard	5	16	9	1		6
Kurrichane Thrush	1	10	10	2	1	
Lanner Falcon	1	2	1		4	
Lappet-faced Vulture		18	3		9	2
Large-billed Lark		7	16			1
Lark-like Bunting	1	6	10	4	1	
Laughing Dove	2	1	2	5		
Layard's Tit-Babbler	2	11	10			
Lazy Cisticola	1	15	16	5		3
Lemon Dove	8	7	9	15	1	4

Lesser Flamingo	10	3	6		3	3
Lesser Grey Shrike	2	3	10		9	
Lesser Honeyguide	5	8	12		1	
Lesser Kestrel	4	6	9	1	12	3
Lesser Masked Weaver	5	3	9	8		
Lesser Spotted Eagle	1	8	9		8	2
Lesser Striped Swallow	3	3	7	3	1	
Lesser Swamp Warbler	3	15	1	4		2
Levaillant's Cisticola	2	12	9			
Levaillant's Cuckoo	1	8	11			
Lilac-breasted Roller	6		19	2		1
Little Bee-eater	6		13	1	4	2
Little Egret	7		1	3	1	
Little Grebe	8	2	2			9
Little Sparrowhawk	1	4	2		6	
Little Stint	9		4			6
Little Swift	1	7	6	1	3	1
Lizard Buzzard	1	9	16		11	2
Long-billed Crombec	1	8	11		1	2
Long-billed Pipit	1	7	22		2	
Long-crested Eagle	1	9	3		16	
Long-tailed Paradise Whydah	2	3	14			3
Long-tailed Widowbird	3	7	11			
Ludwig's Bustard	8	5	4		1	4
Magpie Shrike	1	7	13		4	3
Malachite Kingfisher	2		9	1	12	2
Malachite Sunbird	18	2	4	2	8	2
Marabou Stork	1	14	1	1	2	1
Marico Flycatcher	2	6	20	2	2	1
Marico Sunbird	5		11	2	3	1
Marsh Sandpiper	13	8	2	1	1	12
Martial Eagle		2	2		4	
Meves's Starling	4	4	14	3		
Meyer's Parrot	4	12	22		1	3
Mocking Cliff-Chat	4	3	16		1	1
Monotonous Lark	3	14	5	2		
Mosque Swallow	2	9	12		3	
Mountain Wheatear	3	6	13	1	2	
Namaqua Dove	8	5	3	2		2
Namaqua Sandgrouse	2	3	7			4
Namaqua Warbler	3	7	8	1	1	
Narina Trogon	10	2	25		1	2
Natal Spurfowl	2	3	3	3		9
Neddicky	5	11	6	7		1
Northern Black Korhaan	7	6	16		2	4
Olive Bushshrike	5	1	20	1	6	1

Olive Thrush	4		10	1		
Olive Woodpecker	4	4	3	3	1	7
Orange River White-eye	4	1	8	2	4	3
Orange-breasted Bushshrike	2	6	15	1	1	1
Orange-breasted Sunbird	9	1	7	2	8	1
Pacific Golden Plover		5	8	1	1	5
Pale Chanting Goshawk	1	5	4	3	6	1
Pale Flycatcher		8	22		2	
Pale-winged Starling	1	13	8	2		1
Pearl-breasted Swallow	4	3	19	2	4	
Pearl-spotted Owlet	3	10	1	1	10	
Peregrine Falcon		6	3		14	
Pied Crow		15	1	5	2	1
Pied Kingfisher	10	4	4		13	
Pied Starling	1	16	3	4		
Pink-billed Lark	3	6	8		2	
Pin-tailed Whydah	3	2	10	5		2
Plain-backed Pipit	2	10	8	1		1
Pririt Batis	2		7		3	1
Purple Heron	4	3	1		4	2
Purple Roller	2	1	13		4	
Purple-crested Turaco	3	1	17			1
Pygmy Falcon		2	8	1	13	
Pygmy Kingfisher	6	4	10		12	1
Rattling Cisticola	2	5	9	3	1	
Red-backed Shrike	2	2	8		8	
Red-billed Buffalo-weaver	2	13	6	1		1
Red-billed Firefinch		1	22	1	1	
Red-billed Oxpecker	3	5	4		7	1
Red-billed Quelea		10	11	2	1	
Red-billed Teal	7	3	3			8
Red-breasted Swallow	1	5	8	1	3	2
Red-capped Lark	2	8	4		1	1
Red-capped Robin-Chat	2	2	11	1	1	5
Red-chested Cuckoo	3	4	11	1	1	
Red-collared Widowbird	3	3	10	1	5	
Red-crested Korhaan	9	5	2		1	3
Red-eyed Dove	4	3	10	13		
Red-faced Cisticola	3	5	11	1		
Red-faced Mousebird	1	2	4	2	1	5
Red-fronted Tinkerbird	3	4	32			1
Red-headed Finch	3	1	7	1	1	1
Red-headed Weaver	2	7	12			
Red-knobbed Coot	3	4	1	3	1	1
Red-necked Spurfowl	1	6	4	4		4
Red-throated Wryneck	3	5	10		1	1

Red-winged Starling	1	4	9	8		1
Reed Cormorant	4	8		1	1	3
Reitz's Helmetshrike		3	18		4	
Rock Dove	4	5	2	7		2
Rock Kestrel	2	4	2		4	2
Rock Martin	3	9	8	2		1
Ruddy Turnstone	7	3	7		2	1
Ruff	7	6	4	1		3
Rufous-cheeked Nightjar	4	9	6		1	
Rufous-eared Warbler	6	1	7	1	3	
Rufous-naped Lark	1	13	8		1	
Rufous-winged Cisticola	2	4	12	2		
Sabota Lark	6	15	15	3	1	
Saddle-billed Stork	12	3	3		3	3
Sandwich Tern	14	9	7		2	
Scaly-feathered Finch	2	3	6		2	2
Scaly-throated Honeyguide	8	9	6	1	1	1
Scarlet-chested Sunbird	4	3	5		7	2
Secretarybird	4	4	5		5	4
Senegal Lapwing		6	11			10
Sentinel Rock Thrush		1	15	2		4
Shaft-tailed Whydah	1	3	14			1
Shelley's Francolin	2	7	3	1		8
Shelley's Sunbird	6		6		12	1
Shikra	3	5	6		8	2
Short-toed Rock-Thrush	2	3	9		2	1
Sickle-winged Chat	2	4	7			
Sociable Weaver	3	10	16	1		1
Sombre Greenbul	2	14	11	3		
South African Cliff Swallow	11	5	9	1		1
South African Shelduck	3	4	3		1	9
Southern Black Flycatcher	1	9	5	1	4	1
Southern Black Korhaan	3	1	5		1	7
Southern Black Tit	2	7	10	1		
Southern Boubou	5	4	3	1	2	2
Southern Carmine Bee-Eater	1		17		4	
Southern Double-collared Sunbird	9	1	5	1	11	3
Southern Fiscal		3	3	2		
Southern Grey-headed Sparrow	4	9	13	12	2	
Southern Ground Hornbill	7	7	3		1	2
Southern Masked Weaver	2	1	4	3		2
Southern Pied Babbler	7	2	9	2	1	1
Southern Red Bishop	2	1	6	3		1
Southern Red-billed Hornbill	7	6	10	1		1
Southern Tchagra	1	6	12	1		

Southern White-crowned Shrike	1	3	14		6	
Southern Yellow-billed Hornbill	4	10	17		4	1
Speckled Mousebird	4	3	11	1		1
Speckled Pigeon	9	5	7	6	1	4
Spectacled Weaver	5	3	8	1	2	
Spike-heeled Lark	2	9	10			
Spotted Eagle-Owl	5	4	5	2	4	6
Spotted Flycatcher	1	4	3	1		1
Spotted Thick-knee		8	4	1		9
Spur-winged Goose	7	5	6	2	1	2
Squacco Heron	4	11	8		6	1
Stark's Lark	2	11	7	1		1
Stierling's Wren-Warbler	2	10	10			
Streaky-headed Seedeater	2	3	5		5	1
Striped Kingfisher	6		3	1	7	3
Striped Pipit	2	9	7	2		
Swainson's Spurfowl	2	7	3	2		6
Swallow-tailed Bee-eater	3		13		3	1
Swee Waxbill	4	3	16			4
Swift Tern	19	2	5		1	1
Tambourine Dove	4	5	6	1		
Tawny Eagle		6	3		15	
Tawny-flanked Prinia	4	5	6		1	3
Temminck's Courser	2	3	10		3	3
Terrestrial Brownbul	1	18	7			1
Thick-billed Weaver	2	10	10			
Three-banded Plover	5	1	1	2		11
Tractrac Chat	1	9	10	1	1	1
Tropical Boubou	2		13		2	3
Trumpeter Hornbill	5	28	9		1	1
Verreaux's Eagle	1	6	3		5	
Verreaux's Eagle-Owl	2	22	11	1	12	3
Victorin's Warbler		11	9			
Village Indigobird	1	6	12		1	
Violet-backed Starling		1	19	1		
Violet-eared Waxbill	6	1	16			
Wahlberg's Eagle	1	5	4		15	
Wailing Cisticola	3	8	9	1	1	
Water Thick-knee	4	4		4		8
Wattled Starling		4	4	1		
Whiskered Tern	2		4	1	3	1
White Stork	6	14	12		9	2
White-backed Duck	9	3	3		1	4
White-backed Mousebird	3	2	13	1		1
White-backed Vulture	1	10	2		4	2

White-bellied Sunbird	3	2	3		11	1
White-breasted Cormorant	3	6	2		3	1
White-browed Robin-Chat	4	3	7	4	1	1
White-browed Scrub-robin	2	10	6	1	1	2
White-browed Sparrow Weaver	1	5	11	3		1
White-crested Helmetshrike	2	4	12		2	
White-faced Whistling Duck	7	5	7			7
White-fronted Bee-eater	3		15		3	1
White-fronted Plover	2	5	2		1	14
White-necked Raven		8	3		5	1
White-rumped Swift	1	10	8	2	2	2
White-throated Canary	1	5	7	6		
White-throated Robin-Chat	2	2	16		2	2
White-throated Swallow	2	2	7	5	3	4
White-winged Tern		14	2		2	2
White-winged Widowbird		6	11	1		
Willow Warbler		8	3	1	1	1
Wing-snapping Cisticola		23	6	1		2
Wire-tailed Swallow	3	5	5	2	4	1
Wood Sandpiper	7	3	2		3	7
Woodland Kingfisher	7	1	16	2	13	
Yellow Bishop	12	4	25	5		3
Yellow Canary	5	1	13	3	1	1
Yellow-bellied Eremomela	1	5	11	1	1	1
Yellow-bellied Greenbul	1	5	15	1		1
Yellow-billed Duck	3	1		4		3
Yellow-billed Kite		5	2		7	1
Yellow-billed Oxpecker	1	2	9		10	
Yellow-billed Stork	5	9	6		4	2
Yellow-breasted Apalis	4	4	32	1		5
Yellow-crowned Bishop	4	4	6	5		1
Yellow-fronted Canary	5	4	24	4	2	1
Yellow-fronted Tinkerbird	3	3	15			1
Yellow-throated Longclaw	3		10	1	2	3
Yellow-throated Petronia	3	4	7	1	2	
Yellow-throated Woodland Warbler	2	5	10	1	1	1
Zitting Cisticola	8	6	17	1		2