Ecotourism potential of frogs in South Africa

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ABSTRACT

Ecotourism is the fastest growing sector of the international travel industry, which in turn is one of the worlds' largest and fastest growing industries. Ecotourism, defined as a visit to a fragile, unspoiled, and protected area, has become very popular over the last decade, particularly in South Africa. These experiences helps to educate tourists (travellers), provides funds for nature and cultural conservation, raises respect for the environment and cultures, and lastly directly benefits economic development of the local communities. Ecotourism in South Africa can be a powerful conservation tool, one that encourages people to maintain and protect the natural environment.

Traditionally amphibians have not generated much attention among eco-tourists, partly because they are easily overshadowed by other more charismatic taxa or habitat attractions, and partly because the possibility of frog-related ecotourism has been poorly investigated. This unique and underappreciated animal group has been under severe pressure since the industrial revolution, with almost a third of the nearly 7,000 known amphibian species listed as threatened by the IUCN. In amphibians, an entire class of vertebrates are facing a mass extinction spasm and conservation actions are needed in order to save them. Both environmental and human threats such as climate change, emerging diseases, pollution, exotic species, and habitat loss are major causes of amphibian loss worldwide. To minimize the existing threats in the amphibian extinction crisis, the global community must respond in an innovative and multidisciplinary approach to protect amphibians at an unprecedented scale. It is crucial to protect frogs because they form part of South Africa's natural heritage and ecotourism is a means by which amphibians can be protected.

Innovative methods to attract tourists to take part in amphibian ecotourism activities is needed, due to amphibians traditionally not being a species that people find interesting. Statistics shows that people do not have much interest in viewing amphibian, reptile, insects, or fish species. This project investigated the possibility of using ecotourism as a conservation tool for amphibian conservation, especially in South Africa. Species distribution maps were created to indicate the overlap of current ecotourism destinations with frog habitat hotspots to determine if these destinations can be a starting point for the conservation of amphibians.

Frogging is a well-known term within the frog conservation society where it describes the activity of searching for frogs in the wild. Frogging can be combined with other ecotourism activities to attract tourists and create an interest in the conservation of frogs, while having fun. The aim was to determine the ecotourism potential of frogs in South Africa, primarily by

distributing questionnaires to tourists to retrieve information on whether they would be interetd in partaking in frog-related ecotourism activities.

This project identified 22 South African parks that can be used as a marketing tool for the start of frog-related ecotourism activities. The 22 parks coincide with frog hotspots and are distributed all over South Africa. Furthermore, the outcome of the questionnaire was also very positive as the tourists indicated that they would like to participate in frog related activities.

The project will introduce the wonders and excitement of frogging to the South African community and thereby promote it as a new tourism activity in South Africa. In return the data tourists will gather from their frogging expedition can be used by scientists and conservationists for research and management of species. Ultimately, tourism activities can contribute towards the conservation of frogs in South Africa.

Keywords: frogs/amphibians, ecotourism, conservation, hotspots, frogging, South Africa.

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DECLARATION

I, Zoëgné du Preez, declare that this dissertation is my own, unaided work, except where otherwise acknowledged. It is being submitted for the degree of M.Sc. to the North-West University, Potchefstroom. It has not been submitted for any degree or examination in any other university.

Z du Preez

ACRONYMS USED IN THE STUDY

ACAP	Amphibian Conservation Action Plan
ADU	Avian Demography Unit
ANOVA	Analysis of Variance
ArcGIS	Aeronautical Reconnaissance Coverage Geographic Information System
CAMP	Conservation Assessment and Management Plan
DAPTF	Declining Amphibian Populations Task Force
DEAT	Department of Environmental Affairs and Tourism
EC	Eastern Cape
EDGE	Evolutionarily Distinct and Globally Endangered
EWT	Endangered Wildlife Trust
FS	Free State
GAA	Global Amphibian Assessment
GP	Gauteng
INT	International
IRG	International Resources Group
IUCN	International Union for Conservation of Nature
KMO	Kaiser-Meyer-Olkin test
KRCA	Kenilworth Racecourse Conservation Area
KZN	KwaZulu-Natal
L	Limpopo
MP	Mpumalanga
NC	Northern Cape
NGO	Non-Governmental Organization
NW	North West
SAFAP	Southern African Frog Atlas Project
SANBI	South African National Biodiversity Institute

SANParks	South African National Parks
SAT	South African Tourism
SPSS	Statistical Package for the Social Sciences
SSC	Species Survival Commission
TREES	Tourism Research in Economics, Environs and Society
UNESCO	United Nations Educational, Scientific and Cultural Organization
WC	Western Cape
ZSL	Zoological Society of London

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CHAPTER 1: INTRODUCTION AND BACKGROUND TO FROGS AND ECOTOURISM

1.1 Introduction and Background

1.1.1 The state of amphibians worldwide

Humans rely on nature and need natural resources for their own survival. Unfortunately, over the years, these natural resources have been used in an unsustainable manner, due to population growth, advances in industries and technology, intensification of agriculture, amongst others (Wymann von Dach *et al.*, 2005). Consequently, different kinds of nature conservation actions have been developed worldwide. A good example for the impetus of conservation action is that there is increasing alarm among global scientists that many frog and other amphibian populations are rapidly declining due to anthropogenic threats (Mokhatla *et al.*, 2012). This unique animal group has been under severe pressure since the industrial revolution, with almost a third of the more than 7,000 known amphibian species listed as threatened by the IUCN (Amphibiaweb, 2017; Bishop *et al.*, 2012 & IUCN, 2017). An entire class of vertebrates are facing a mass extinction spasm and conservation actions are needed to save them.

Amphibians are of crucial importance with regards to the role they play in ecosystems and with regard to their evolutionary significance. Both environmental and human threats are major causes of amphibian losses worldwide (Collins *et al.*, 2007 & Angulo *et al.*, 2011). The Amphibian Conservation Action Plan (ACAP) (Gascon *et al.,* 2007) and a document published by SANBI (Angulo *et al*., 2011), *Ensuring a Future for South Africa's frogs: a strategy for conservation research*; state that the greatest global threat to most amphibian species is agricultural and aqua-cultural activities which lead to habitat destruction (Harrison *et al*., 2000). This affects nearly half of all species, which is then followed closely by biological resource use (logging and wood harvesting) and residential and commercial development, which affects nearly one third of all amphibians (Angulo *et al*., 2011). Other factors include pollution, invasive species, genes and natural system modification, but it has been evaluated that a lower percentage of amphibians are impacted by these threats (Angulo *et al*., 2011). To address these needs, a global strategy is required that provides guidelines for survival assurance of amphibian colonies, research on diseases, and habitat protection, which form the focus of saving amphibians. Actions to combat these threats need to be drafted and carefully assessed due to visible interactions amongst these factors, which are difficult to measure and mitigate (Moore *et al.,* 2008:16). By planning and researching the eminent threats and their interactions with amphibians, early warning alarms to environmental problems can be identified (Gascon

et al., 2007). Threats affecting amphibians need to be addressed at the local, national and international levels to be effective depending on differences in regions and habitats.

The purpose of Chapter 1 is to structure the problem statement, determine the aims and objectives of the study, to discuss the methods of research and give the chapter orderings of the study.

1.1.2 The state of amphibians in South Africa

Almost 50% of all amphibian species in South Africa are affected by agriculture and aqua-culture, which result in habitat loss (Angulo *et al.*, 2011). Threats like invasive species, problematic species, and genes affect 37% of all South African frogs. This approximation is noticeably higher than the global average of 15.7% (Angulo *et al.*, 2011). The second major threat towards South African species is biological resource usage (46%), pollution comes third affecting 14% of amphibians, together with residential and commercial development affecting almost a third of South African amphibian species (Harrison *et al.*, 2000 & Angulo *et al.*, 2011). The fourth factor affecting nearly 26% of all South African amphibian species is comprised of several natural system modifications processes (fire, water quality and weather). Studying literature, very few examples of scientific studies have actually quantified the relative impact of each threat and how these threats should be dealt with (Angulo *et al.*, 2011). However, in 2014 a document was published called, *Amphibian conservation: Global evidence for the effects of interventions*, which discusses scientific evidence on studies done to help mitigate environmental threats, together with lists of approaches that can be applied now and, in the future, to help with the mitigation of threats (Smith & Sutherland, 2014).

The amphibian conservation timeline starts with evidence of early amphibian conservation practices from a 30-year-old map (in 1964) of frog distributions (Poynton, 1964) and the first assessment of threatened frogs occurring in South Africa, Swaziland and Lesotho was presented in the South African Red Data Book – Reptiles and Amphibians and listed nine species as threatened (McLachlan, 1978). This assessment was updated 10 years later by Branch (1988) and a total of 17 frog species, comprising four endangered, one vulnerable, two rare, eight restricted, one peripheral and one indeterminate species, were included. In 1994 the South African herpetological community took decisive action to conserve local amphibians in an attempt to contribute towards the global effort to mitigate amphibian extinction (Angulo *et al.*, 2011) with the initiation of the South African Frog Atlas Project (SAFAP) which was officially launched in November 1995 (Harrison *et al.*, 2000). A few years into the Atlas project, the threatened status of frogs in South Africa and its surrounding regions were assessed through a Conservation Assessment and Management Plan (CAMP) process that served as a precursor to the Atlas document (Harrison *et al.*, 2000). The Frog Atlas project

ultimately resulted in the publication of the first inclusive Atlas and Red Data book for the frogs of South Africa, Lesotho and Swaziland (Minter *et al.,* 2004). This volume provided an up to date species by species summary of the geographical distribution and conservation status of Southern African frogs.

In 2000 a Conservation Assessment and Management Plan for South African frogs was published, in which key strategies were proposed to help conserve amphibians (Harrison *et al.*, 2000). These strategies included the prevention of habitat loss, intensifying legislation and regulation of the animal trade in South Africa, further field research to understand the ecological roles of key species, as well as developing biological monitoring techniques to manage captive amphibian populations for potential augmentation of wild populations (Harrison *et al.*, 2000). One of the most important strategies was to identify and highlight the species that fall into the most threatened categories and which are thus in greatest need of conservation action. Apart from targeted species research, other unconventional methods are needed to retrieve information about the status of amphibians in South Africa, such as ecotourism.

Since 2004, numerous new species have been added to the South African species list and a lot of name changes and taxonomic revisions have taken place. Table 1.1 gives an outline of the IUCN Red Data List of frog species of South Africa on how the numbers have changed in 2004 (Angulo *et al*., 2011), 2009 (Tolley *et al*., 2011) and 2015 (IUCN, 2017). This temporal perspective demonstrates that the threatened amphibian species numbers keep on growing and something different must be done if this trend is to be reversed.

Table 1.1: Amphibian red list totals for South Africa in three different years.

Year	Critically Endangered	Endangered	Vulnerable	Near Threatened
2004		20		5
2009	5	7	5	
2015	7	12	5	7

1.1.3 Amphibian conservation strategies

Amphibian declines were first reported in the 1950's, but according to Bishop *et al*. (2012) the phenomenon of global amphibian species declines only started to receive extensive scientific and public attention in the 1980's at the first World Congress of Herpetology in England in 1989 (Bishop *et al.,* 2012). This was due to discussions about the rapid rates that amphibian

extinctions were taking place at the time, including in relatively pristine areas. During the 1990's researchers started to demonstrate that amphibian population declines were truthfully happening and they documented the occurrences and searched for participants to help in amphibianconservation (Moore et al., 2008).

In 1991, the IUCN/SSC activated the Declining Amphibian Populations Task Force (DAPTF) due to the awareness of how immense the global amphibian extinction crisis truly was (Moore *et al.,* 2008 & Bishop *et al.*, 2012). For more than a decade after the activation of DAPTF, the Task Force were very successful in disseminating the knowledge and advancing the understanding of the extent and potential causes of amphibian declines globally. However, creating awareness on its own is not enough to mitigate the risks towards amphibian's extinction. It was realised that more resources and, for example, individual community projects were needed to conserve amphibian species.

One of the main reasons behind the drive for amphibian conservation was because the Global Amphibian Assessment (GAA) realized that almost a third of amphibians are threatened with extinction. This percentage exceeds the proportion of threatened birds and mammals (12% and 23% respectively) known to date (Moore *et al*., 2008 & Measey, 2011). The GAA was published in 2004 by the IUCN as an assessment tool for every known amphibian species (Moore *et al*., 2008 & Stuart *et al*., 2004).

During the 2005 Amphibian Conservation Summit organised by the IUCN/SSC and Conservation International in Washington, DC the Amphibian Conservation Action Plan (ACAP) was developed (Mittermeier *et al*., 2008 & Moore *et al*., 2008). This 5-year plan that was published in 2007 by the IUCN (Bishop *et al*., 2012) offers practical, large-scale, creative, innovative and realistic actions that were deemed vital to minimize the rate of amphibian extinctions at that time (Gascon *et al*., 2007). Within this declaration and plan, four focus points were recommended as crucial priorities to be practised for global amphibian conservation (Moore *et al*., 2008):

1) create better understanding and awareness of the causes of declines and extinctions;
2) constant documentation of amphibian diversity, and population changes;
3) development and application of long-term conservation programs or projects;
4) emergency responses to immediate or near-potential crises.

Several devoted amphibian specialist groups like; DAPFT, the Global Amphibian Specialist Group (GASG) and the GAA, were combined into a single body in an effort to pool all of their resources that were needed to implement the ACAP for amphibian conservation. Together they formed the Amphibian Specialist Group (ASG) of the IUCN/SSC (Gascon *et al*., 2007).

The ASG network was composed of global conservation and research professionals to ensure the implementation of the ACAP. In 2006, the Amphibian Survival Alliance (ASA) was launched and acts as a global partnership for amphibian conservation. Its primary function is to implement ACAP in all their programmes acting as promoters for organisations to work together and help fight amphibian losses (Bishop *et al*., 2012). The role of the Alliance is to restore all threatened indigenous amphibian species and population levels in ecosystems worldwide.

Concomitantly in 2007, the Zoological Society of London (ZSL) proposed the Evolutionarily Distinct and Globally Endangered (EDGE) index. The goal was to prioritise species (focusing on the top 100 ranked mammals and top 100 ranked amphibians) and raise funds for conservation efforts (Washington, 2012) which lead to the start of the EDGE of Existence programme. Animals that made it to these lists were selected according to their phylogenetic position (evolutionary distinctiveness) and degree of threat (globally endangered) with regards to other global species.

The ACAP is the most ambitious programme ever developed to combat the extinction of species, but although there have been significant efforts in recent years the reaction to the catastrophe has not developed across all areas to minimize the crisis (Bishop *et al.* 2012). The ACAP needs international communities to take part in this plan and to take great risks and calls on all global governments, corporations, civil society and scientific communities to respond (Gascon *et al.,* 2007).

1.1.4 Ecotourism as an alternative conservation strategy

Traditionally tourism was described as an activity where people traveled to destinations usually away from their usual residence or work place to enjoy facilities and activities that were created to fulfill the requirements of the travelers (Mathieson & Wall, 1982 & The European Commission, 2002). Nowadays tourism can be seen as a set of activities completed by people who travel and stay in places outside their usual environment, for longer than one day, but less than one year, for leisure, bussiness and other purposes (The European Commission, 2002). Tourism is globally a major growing industry and by some classified as the world's largest industry (Tisdell & Wilson, 2012:3). National and international tourism activities tend to rise with per capita income which in turn increases education and job opportunities. Reasons why people want to travel varies and can usually be ascribed to their life style (Collins & Tisdell, 2002). One of the reasons for traveling is to view the natural wonders of the world and to experience and make use of different features of nature for enjoyment. This is known as nature-based tourism, which is a type of tourism that provides opportunities to tourists to learn

and appreciate the natural environment (Weaver, 2001). Sometimes recreational human engagement takes place within a nature-based destination, but the focal organism is not purposefully removed or permanently affected by the engagement (such as zoos) (Wagar, 1964). There are different forms of nature-based tourism and it may be based on the utilisation of natural living (biotic) things, visits to natural non-living (abiotic) objects or a combination of both. Nature-based started due to the development of the tourism industry and the desire for tourists to see wildlife. In the mid-1970's, Dr. Gerardo Budowski, IUCN's first Director General (IUCN, 2017) commented: "In recent years there has been virtually an explosion of tourism concerned with wildlife, wildlife areas and scenic beauty based on natural areas." (Tisdell & Wilson, 2012).

One of the branches of sustainable nature-based tourism is ecotourism, which is an alternative form of tourism that involves the conservation of resources (biological diversity), maintenance of sustainable use of resources, bringing an ecological experience to tourists, conserving the ecological environment and gaining economic benefit (Tisdell & Wilson, 2012). Hector Ceballos-Lacertian defined ecotourism as a visit to a fragile, unspoiled, and protected area (Fennell, 2003). The whole experience helps to educate tourists (travellers) (Orams, 1995), provide funds for nature and cultural conservation and raise respect for the environment and cultures found in the area (Hetzer, 1970) existing in almost any ecosystem. It is important to note that travellers "believe" that ecotourism is mainly there to promote nature conservation and sustain biodiversity, but this is not always true in every situation. Although the development of ecotourism can have a positive effect on the conservation of nature, e.g. help to protect endangered species or contribute generally to biodiversity conservation, there are limitations (Tisdell & Wilson, 2012). In order for ecotourism to conserve nature, a willingness from different stakeholders to give input is required. This includes the paying of conservation fees by individuals, as well as help from local communities to ensure the success of projects. It is important to note that ecotourism is not a substitute for the role of public support in nature conservation, but rather a way to help promote nature conservation.

Since 1990 it has been emphasised that ecotourism should be sustainable. According to the World Tourism Organisation (Cernat & Gourdon, 2007), sustainable tourism is where the needs of the tourists, tourism destination and local community is met while the environment is still protected and opportunities for the future is improved. In 1994 the National Ecotourism strategy of Australia stated that apart from educating tourists, ecotourism should be managed in such a way that it is ecologically sustainable (Tisdell & Wilson, 2012:9). It was then emphasised by Wight (1996) that ecotourism should not degrade environmental resources, but should rather provide long-term benefits. These benefits should be shared by the local

communities, educate all participants and stakeholders about the nature being used for the specific ecotourism activity and lastly stimulate ethical behaviour towards nature and the related cultural attractions (Tisdell & Wilson, 2012:9). Since 1970 the use of nature-based wildlife resources has attracted large numbers of tourists (Budowski, 1976). This has generated benefits for both local and regional communities like economic value, skills, educational and job opportunities. Even though the goal of ecotourism is to improve nature conservation, there are a few negative effects that can arise if proper precautionary measures are not upheld. These negative side-effects include the increasing number of visitors to a natural site and trampling that can destroy vegetation or the disturbance of wildlife in their natural habitat (Tisdell & Wilson, 2012:11). It is thus important to always make sure that ecotourism has more positive effects towards nature conservation than negative effects and that the negative effects can be eliminated or minimalized so that the overexploitation of wildlife doesn't occur (Tisdell & Wilson, 2012:53).

1.2 Problem Statement

It is very important to protect frogs because of the ecological function they perform. Frogs help to control insect populations, keep waterways clear and they serve as a food source in ecosystems (Wilson, 2011). To minimize the existing amphibian extinction crisis, the global community must respond in an innovative and multidisciplinary approach to protect amphibians at an unprecedented scale (Angulo *et al.*, 2011 & Mittermeier *et al.*, 2008). This should also include identifying common components of success that will allow prediction of future successes and prioritisation of limited funds (Washington, 2012). One way in which amphibians can both be protected and involve communities is through the ecotourism industry. Ecotourism is the fastest growing sector of the international travel industry, which is in turn one of the world's largest and fastest growing enterprises (Saayman, 2009). The experience helps to educate tourists (travellers), it provides funds for nature and cultural conservation, it raises respect for the environment and cultures and lastly it directly benefits economic development of the local communities. Ecotourism in South Africa can be a powerful conservation tool, one that encourages people to maintain and protect the natural environment (Pinsof & Sanhaji, 2009).

South Africa's wildlife, both fauna and flora, is very rich and diverse and has led to a continuous increase in visitors to South Africa (Department of Environmental Affairs and Tourism, 2008). According to SANBI (South African National Biodiversity Institute) in 2016 South Africa hosted over 10 million foreign tourists, of which 2.5 million were overseas visitors and 7.5 million were visitors from African countries. Statistics from 2015 demonstrate that over 1.3 million of the

visitors that come to South Africa visited nature-based destinations during their trips (Department of Environmental Affairs and Tourism, 2008). However, it was noted that only 33% of the trips made by domestic tourists (South African citizens) were to visit nature-based destinations. South Africa has a network of parks (national and provincial) that represent the diversity of fauna and flora, including in many cases an incredible diversity of frog species. In South Africa national parks were created to primarily conserve natural resources (Thomas & Middleton, 2003:4) and secondly to introduce tourism into these areas to create an opportunity for tourists to learn about the natural resources in the park and engage in some form of activity. One of the strongest motivations for people travelling to and within South Africa is that of a nature experience. In return, the income generated by tourism is used to manage and conserve the natural areas. Over the year's government funding for national parks in South Africa has been reduced thus, making the funds generated by tourism services a vital supplementary income (Phillips, 2009). Creating more ways to attract tourists to national parks will in turn increase the income of the parks.

Frogging tourism is an example of a relatively novel approach that can result in the park generating more income while conserving amphibians and expanding public knowledge about the amphibians and the threats that they are facing. Ideally, the finances received by tourists should contribute to the conservation of amphibians in South Africa and worldwide. However, when this project was started no empirical data could be found on this topic and that there is a lack of research on the tourism potential of frogs in South Africa. It was noted that innovative methods to attract tourists to take part in amphibian ecotourism activities will be needed, due to amphibians not being as popular as other species such as rhinos, large carnivores or even birds that tourists mainly want to see. Fennell and Weaver (1997) did a survey study on the success of vacation farms and the different species interests that tourists have. Their findings were that birds are the most popular category of wildlife viewed, followed by mammals and plants. Their statistics showed that people do not have much interest in viewing amphibian, reptile, insect or fish species (Fennell & Weaver, 1997). The biggest challenge for amphibian-based ecotourism is that the public is not particularly educated about frogs and are unaware of the major role that frogs play in the ecosystem (Tolley *et al.* 2011). However, this provides an opportunity to create new and exciting ways of introducing this diverse and interesting group of creatures, to tourists and the public. South Africa, with its thriving ecotourism industry and diverse environment, provides the ideal opportunity to study the potential of frogs within ecotourism. The project is one of its kind and can be seen as a novel initiative to determine if the combination of frogs and ecotourism can benefit their conservation.

International action plans with a blueprint on how to conserve amphibians are needed and the Amphibian Conservation Action Plan (ACAP) is an example of one of the leading amphibian conservation action plans, currently being implemented (Moore *et al*., 2008). Plans mentioned in ACAP include strategies for habitat protection, research on current and potential threats, enforcement of legislation (especially for the regulation of the movement of amphibians in and out of a country) and providing enough resources in a country for the establishment and maintenance of captive assurance colonies (Moore *et al*., 2008). There is no mention however of the potential role that ecotourism can play. After the completion of this study, we aim to have enough information from a South African perspective that can be used to give recommendations on how to implement the usage of ecotourism as a conservation tool for a supplement to the ACAP plan.

1.3 Aims and Objectives

The aim of this project is to determine the ecotourism potential of frogs in South Africa. By doing so, the project will promote frogging as a new tourism activity in South Africa and introduce the wonders and excitement it holds to the South African community. In return, the data tourists will gather from their frogging expedition can be used by scientists and conservationists for research and management of species.

The main objectives were as follows:

- **Objective 1:** To undertake a literature analysis regarding history of frog conservation in South Africa and the combination of frogging with ecotourism (Chapter 1). Such an analysis has not been done before and will therefore act as the foundation upon which the other objectives can be based.
- **Objective 2:** Identify the biodiversity and conservation hotspots in South Africa that will benefit ecotourism of frogs (Chapter 2). If we assume that ecotourism can indeed benefit amphibian conservation, an in-depth review of the taxonomic and spatial diversity of frogs in South Africa needs to be undertaken. Feasability of the ecotourism approach will depend on how the current protected regions can act as tourist destinations for amphibians, based on the species distributions.
- **Objective 3:** Assess the success of current frog-related ecotourism activities and whether they contribute towards the conservation of frogs (Chapter 3). The past and current experiences of the private sector in dealing with amphibian ecotourism can be applied as one of the first sources of information when it comes to planning an ecotourism strategy for amphibians.

- **Objective 4:** Assess the knowledge and opinion of tourists on frogs in conservation and if they would be interested in participating in frog-related ecotourism activities (Chapter 3). Before developing an ecotourism strategy any further, it is imperative to have a solid understanding of the preferences and demographic trends of the tourist.
- **Objective 5:** To make recommendations with regard to development aspects of frog-related ecotourism activities in South Africa and especially for the national parks (SANParks) in South Africa. Data generated by the previous four objectives will be used to advise such an ecotourism strategy (Chapter 4).

CHAPTER 2: ASSESSING THE ROLE THAT AMPHIBIANS PLAY IN ECOTOURISM

2.1 Introduction

The first scientific research on frogs of Southern Africa was published by Dr Andrew Smith in 1849. The document contained information of 26 frog species known by then and 14 that Dr Smith discovered himself (du Preez & Carruthers, 2017). Since this first account, the known number of species in Southern Africa has grown to approximately 170 (du Preez & Carruthers, 2017). South Africa has a wide variety of landscapes, climate and habitats that contribute to its rich frog diversity (du Preez & Carruthers, 2017). Frogs are unevenly distributed throughout South Africa but have adapted to every biome in the country. Even though South Africa is an arid country with rainfall below the global average of 860mm (Cowan, 1995) many species have adapted in such a way that they can survive in these arid conditions at particular localities. Most amphibian species are dependent on moisture for their survival, and that is why the highest frog species richness is found in KwaZulu-Natal, which has high rainfall and diverse habitats, and the Western Cape boasts the highest number of endemic species (Measey *et al*., 2011). South Africa has nine major biomes (figure 2.1) and these biomes can be a useful indicator to identify hotspot areas for frogging in South Africa (du Preez & Carruthers, 2017; Mucina *et al*., 2014). Within each biome, there are also different freshwater habitat types (pans, pools, ponds, rivers, floodplains, mountain torrents, dams, lakes, wetlands etc.) that can be identified where various frog species occur (du Preez & Carruthers, 2017). These micro-habitats will be the main frogging attractions within a hotspot. Creating frogging hotspot destinations in many of the biomes in South Africa could help put amphibians and their conservation plight into the public eye (Davide, 2011 & South African Tourism, 2017).

The objective of this chapter was to establish a systematic reference for tourism hotspots in South Africa that could serve as frogging destinations. Identify the overlap between tourism and amphibian diversity hotspots in order to establish an ecotourism strategy that will ultimately contribute towards the conservation of amphibians.

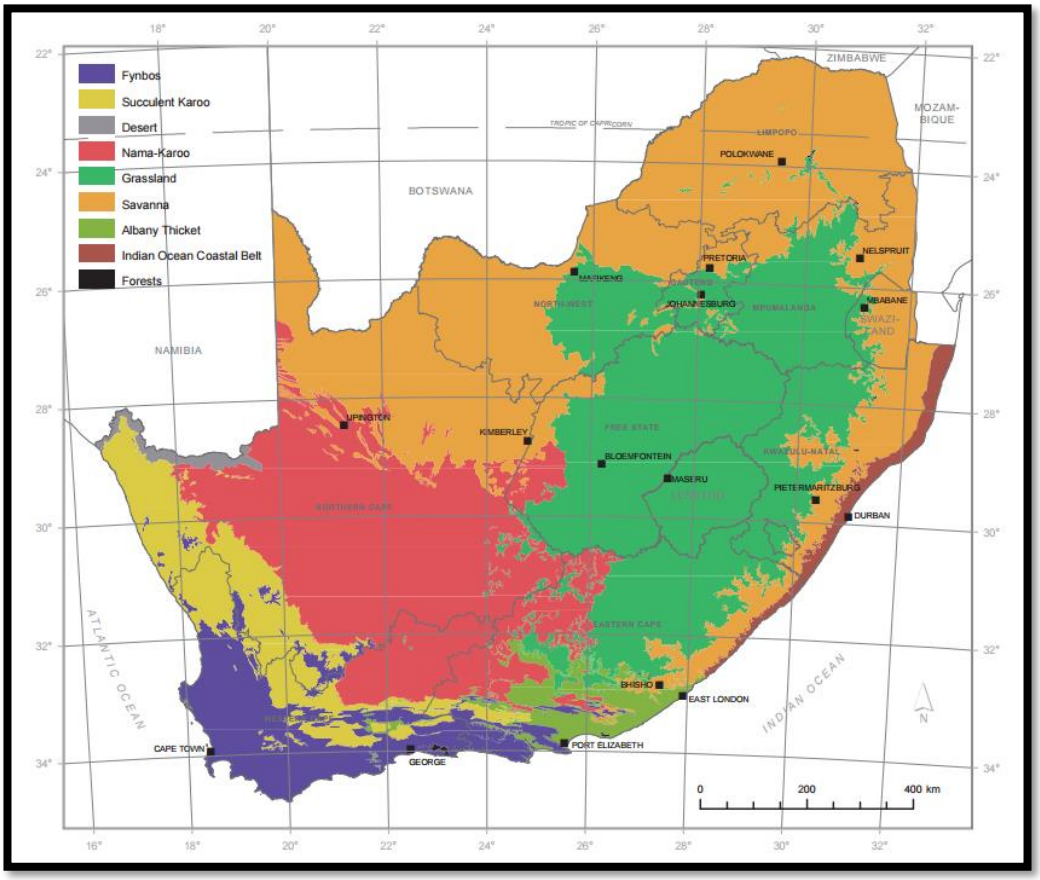


Figure 2.1: Biomes of South Africa biomes can be a helpful indicator to identify hotspot areas for frogging in South Africa (Mucina *et al*., 2014).

2.2 Materials and methods

2.2.1 Create species lists

Lists of frog species that occur in each province, as well as the conservation status of each species were compiled. This information was needed for further analyses that will be discussed in section 2.3. The *Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland* (Minter *et.al,* 2004) together with *A complete guide to the frogs of Southern Africa* (du Preez & Carruthers, 2017) were used to compile this list. The publication of the Atlas and Red Data Book of South Africa, Lesotho and Swaziland were made possible by the Southern African Frog Atlas Project (SAFAP), which in collaboration with the Avian Demography Unit (ADU) was officially launched on 15 November 1995. At the time, frog distribution maps of the region were 30 years old and distribution data that were used to compile these maps was spread over a long period of time, and coverage of the region was patchy. The primary objective of SAFAP was therefore, to systematically gather up-to-date distribution data for all the frog species of South Africa, Lesotho and Swaziland, and to achieve relatively even coverage of the region. These data could then be used to re-evaluate the

conservation status of each species (Minter *et.al,* 2004). Species data prior to 1996 (see figure 2.2) were therefore excluded from the list as it can be seen as historical and outdated, and lists were compiled up to species level. A red data list of species found in du Preez and Carruthers (2017) and the IUCN Red List (IUCN, 2017) were used to determine the conservation status of the frog species within each province.

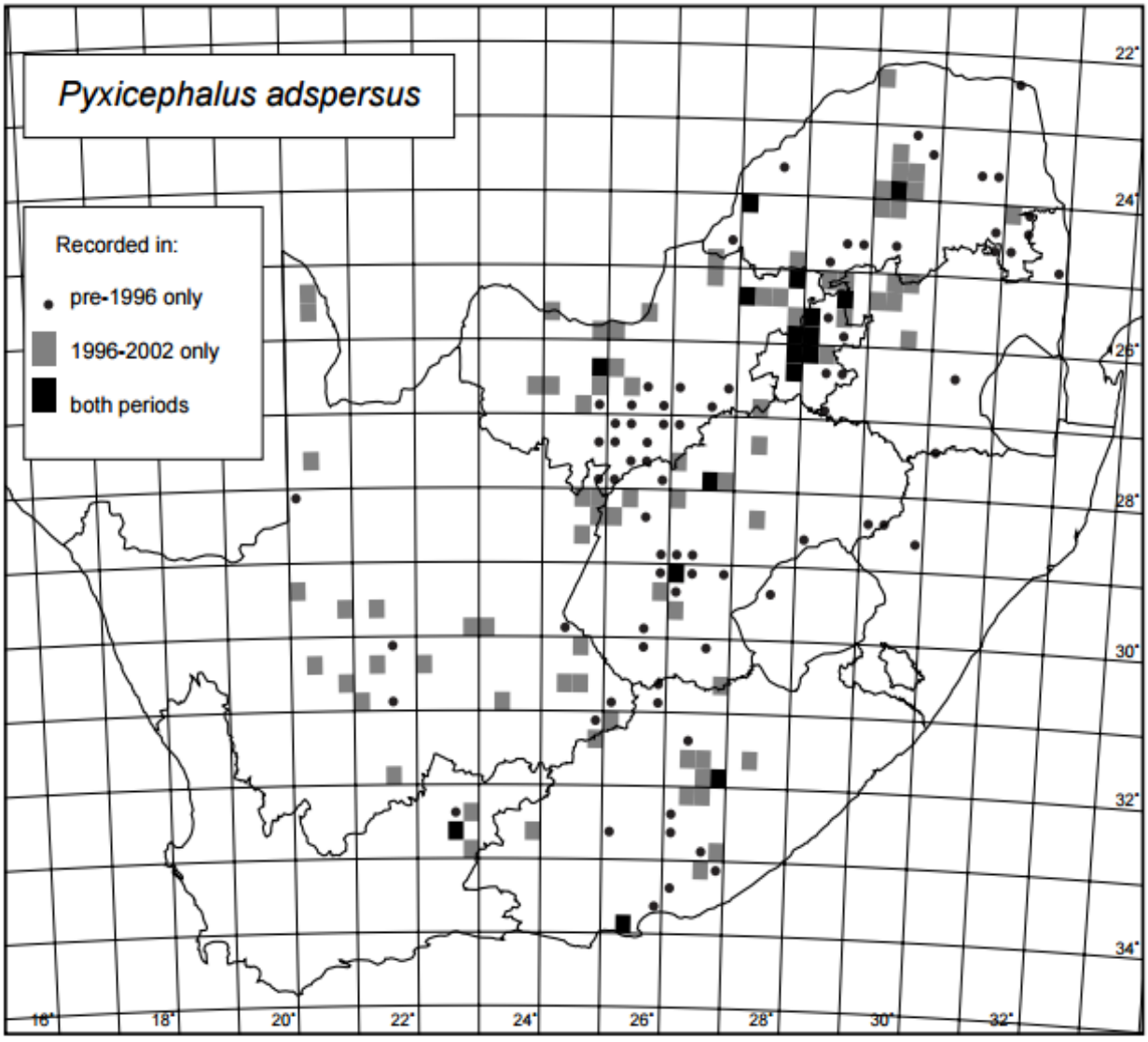


Figure 2.2: Species distribution map of the Giant Bullfrog, *Pyxicephalus adspersus* (Minter *et.al*, 2004) showing how this species was allocated to different provinces. In this map, the Giant Bullfrog was not included into the final list of species for KwaZulu-Natal due to the species only found there prior to 1996.

2.2.2 Criteria used to identify suitable parks

Biomes: Amphibian species composition will differ between biomes across South Africa and the variety of biomes will ensure that a greater total of species can be included into the identified parks. A map of biomes of South Africa from Mucina *et al.* (2014) (see figure 2.1) was used and overlapped with the location of suitable parks (see figure 2.4). Parks were then

selected to be representative of the different biomes and provinces. At least one park per biome and province was selected, which functioned as mandatory criteria to ensure that parks will be available to visit for tourists from all 9 provinces and to include as many as possible frog species into the parks.

Finding the right parks: The following criteria were evaluated and compared to select parks that met the mandatory criteria.

- **Species richness:** The number of frog species per quarter-degree cell is illustrated in Figure 2.3. The suitable parks identified by the above-mentioned criteria were then used and overlapped with a map of Minter *et al.* (2004) showing coverage of South Africa's species richness at quarter degree scale. Where multiple parks met the criteria for biomes the species richness of each park in a certain biome were compared to find a further suitable park.

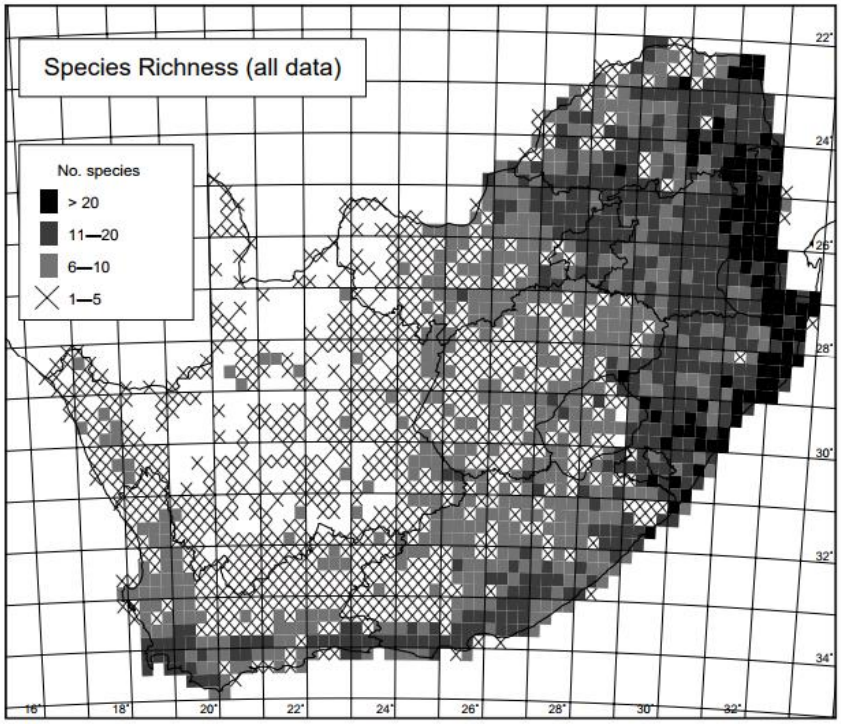


Figure 2.3: Species richness map of frogs, and coverage at the quarter-degree scale (Minter *et al*., 2004). KwaZulu-Natal has a higher species richness than for example Northern Cape and therefor KwaZulu-Natal will be a more suitable province to have a few frogging destinations.

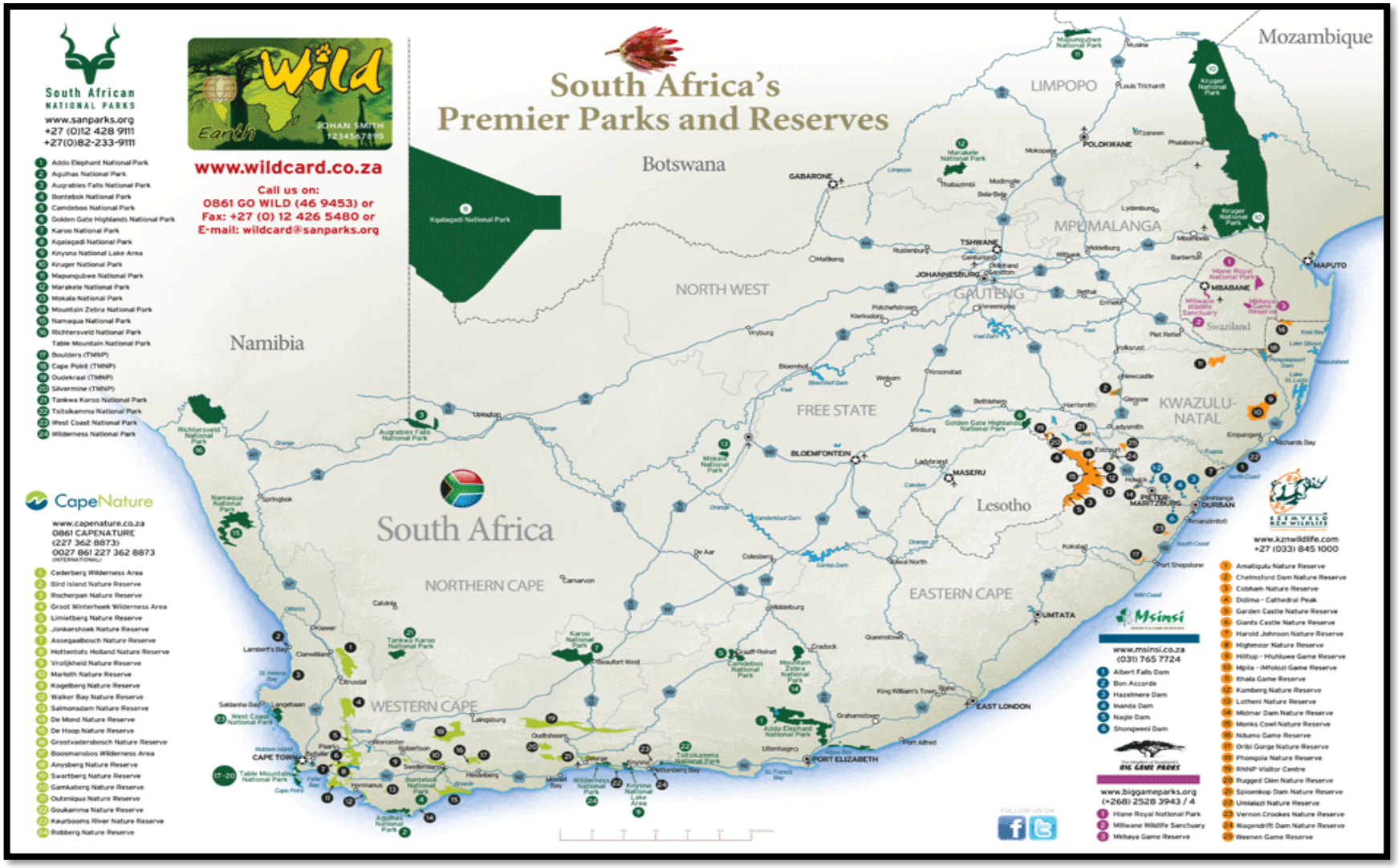


Figure 2.4: Various Nature Reserves in South Africa used to help identify possible parks per province with potential frogging hotspots (SANParks, 2017).

- **Endemicity:**

Endemic species are defined as only to be found in a specific area and are also often threatened as a result of their habitat preferences and limited range (Ducarme *et.al*, 2012). These species can be used to identify potential hotspot areas. Species that are widespread, but endemic to South Africa (excluding Swaziland and Lesotho) as seen in Figure 2.5 were divided from species that are localised endemic to South Africa (Figure 2.6). Where multiple parks met the criteria for biomes and species richness, the endemic species of each park were compared to find a further suitable park, with localised endemic species carrying a higher weight than widespread endemics in selected parks.

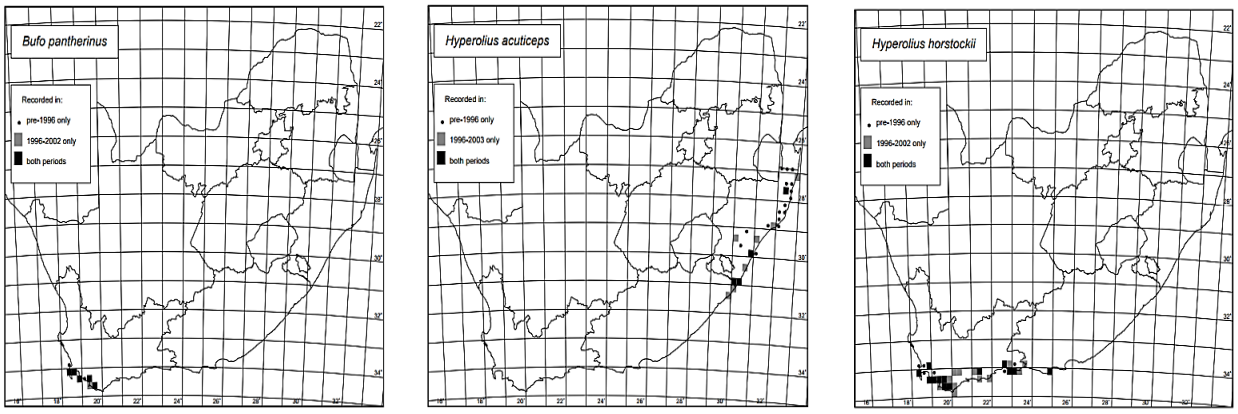


Figure 2.5: Species widespread endemic to South Africa (Minter *et al*., 2004). These species are endemic to only South Africa but can be found in more than one area.

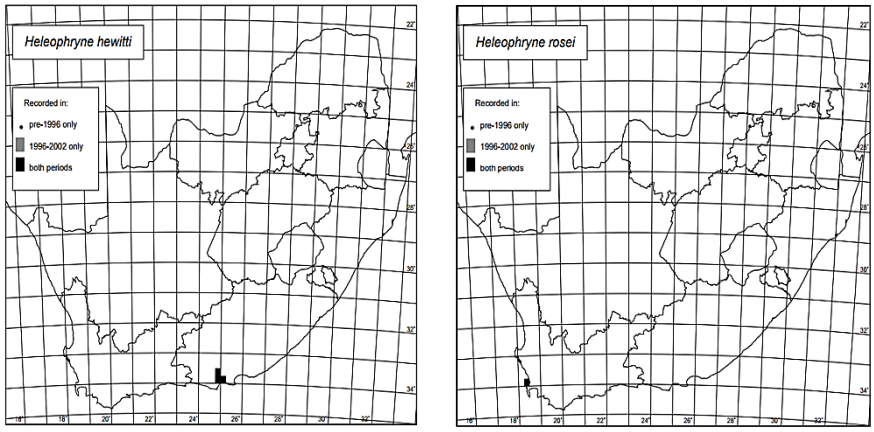


Figure 2.6: Species localised endemic to South Africa (Minter *et al*., 2004). These species are endemic to South Africa and can only be found in one specific area.

- **Conservation status:**

  The higher the species are on the IUCN red data list (critically endangered) the higher the need for conservation, to protect the population of the species and prevent extinction. Therefore, if endangered species are present within the park, the park was more likely to be selected as a suitable park.

- **Charismatic value:**

  The presence of charismatic frog species in the parks was evaluated as they would make the park more attractive for frogging-relating tourism activities. Charismatic species were chosen based on the following features (Ducarme *et.al*, 2012); endemicity, threat status, aesthetic features, unique representatives of a specific area and already existing conservation projects.

- **Park attributes:**

  In cases where parks in the same vicinity met similar criteria, parks that were more popular as tourist attractions were given preference. This was done to ensure that only one or two parks were selected from the same biome and to promote parks all over South Africa equally. Parks with multiple species were also preferred.

After identifying the parks that would be used for the study, species lists were compiled of all the frogs that occurred within those sites. For each species, the scientific name, as well as a common name was included, information about the conservation status of the species, an indication of whether they are common in the area, whether they are endemic to South Africa and whether they are charismatic. Figure 2.7 serves as an example of how a species was included into the various parks. If a species has been recorded inside or in the vicinity of the park the species was listed under the park.

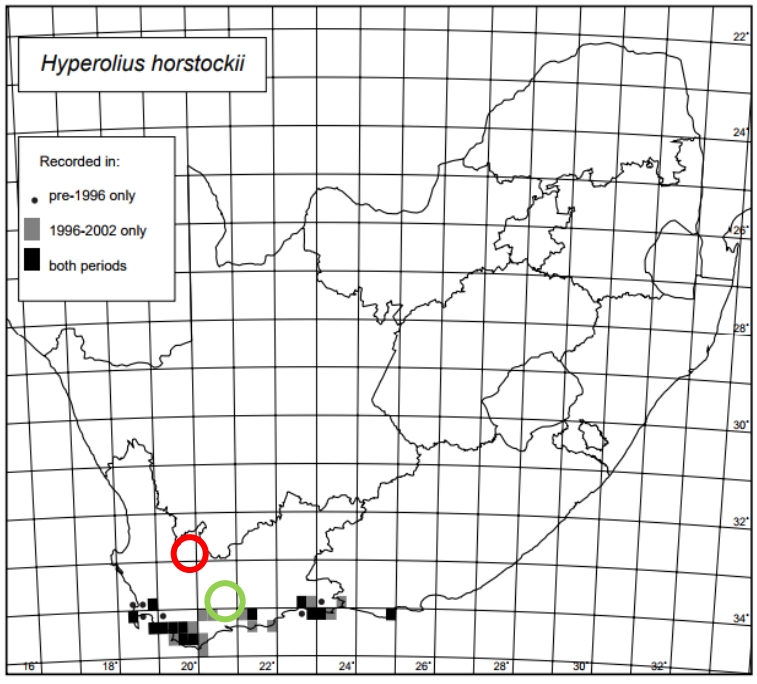


Figure 2.7: Figure showing how species were included into parks. The red and green circles represent the relative location of two parks. When evaluating a species' distribution, a park situated within the red circle will not include the species in its species list, as it does not occur in the immediate vicinity of the park (there are no grey/black blocks surrounding it). However, for a park situated in the green circle the species would be included in the park list as the species does occur in the vicinity according to the SAFAP data (Minter *et al*., 2004).

2.2.3 Frogging hotspot maps

The final product of this chapter is maps that were created using ArcGIS programming. The map represents each province and the location of the chosen parks within that province. Photos of the charismatic species found in the province were requested from various frog enthusiasts to be added to the map for tourists to have a better idea of which charismatic species can be found in each of the frogging hotspots.

2.3 Results and Discussion

2.3.1 Create species lists

Appendix A can be viewed for full species lists that were created. Each province was assigned a colour code that was used throughout the chapter. This was done to help with easy identification of each province. The study focussed on tourists and therefore species were listed alphabetically only up to genus level and higher taxonomic classification was excluded. The common names were also included to familiarise tourists with species and to aid in identification.

2.3.2 Criteria used to identify suitable parks for frogging hotspot maps

Table 2.1: List of selected parks based on predetermined criteria and additional information.

Province	Parks	Park Type	Biome	Total species per park
Northern Cape	Richtersveld National Park	SANParks & UNESCO	Desert & Succulent	8
	Namaqua National Park	SANParks	Succulent Karoo & Fynbos	10
	Mokala National Park	SANParks	Savanna & Nama-Karoo	11
Western Cape	Bontebok National Park	SANParks	Fynbos & Succulent Karoo	14
	Garden Route National Park	SANParks	Forest & Fynbos	19
	Cape Point National Park	SANParks	Fynbos	22
	Agulhas National Park	SANParks	Fynbos	14

Eastern Cape	Tsitsikamma National Park	SANParks	Forest & Fynbos	15
	Addo Elephant National Park	SANParks	Albany Thicket, Fynbos, Savanna, Nama-Karoo	17
KwaZulu-Natal	Royal Natal National Park	Ezemvelo KZN Wildlife	Grassland	21
	Ndumo Game Reserve	Ezemvelo KZN Wildlife	Savanna	32
	Isimangaliso/St. Lucia Wetland Park	Ezemvelo KZN Wildlife & UNESCO	Indian Ocean coastal belt	45
	Ukhalamba Drakensberge World Heritage Site	Ezemvelo KZN Wildlife & UNESCO	Grassland	25
Free State	Golden Gate Highlands National Park	SANParks	Grassland	19
Mpumalanga	Kruger National Park	SANParks	Savanna	28
	Chrissiesmeer	Regional Park	Grassland	18
Gauteng	Suikerbosrand Nature Reserve	Provincial Park	Grassland & Savanna	16
Limpopo	Kruger National Park	SANParks	Savanna	29
	Mapungubwe National Park	SANParks & UNESCO	Savanna	22
	Marekele National Park	SANParks	Savanna	24
North West	Pilansberg National Park	Provincial Park	Savanna	21
	Madikwe Game Reserve	Provincial Park	Savanna	19

Based on the aforementioned criteria, 22 parks were selected for this study (see figure 2.8). A minimum of one park per province was selected and we aimed to select parks that represent

different biomes within a province where possible. All the biomes are represented within the different parks, with the Fynbos and Savanna biome being covered in seven or more of the parks. Due to the Forest, Desert and Indian Ocean belt biomes having a limited distribution in South Africa they are only represented by one to three of the selected parks. Some of the parks are situated across provincial borders, such as the Kruger National Park occurring in both Mpumalanga and Limpopo. In this instance, the Kruger National Park was split into a southern Mpumalanga region and a northern Limpopo region.

It is important to know which organisation manages each park, because this influences the type of marketing that can be done for the park and the popularity amongst tourists. SANParks (South African National Parks) is the organisation responsible for managing South Africa's national parks. SANParks was formed in 1926 and is currently managing 19 of South Africa's parks of which 13 were identified for the purpose of this thesis (SANParks, 2017). These parks are well marketed within the travel industry and are better known in the international travel industry due to being a wildlife icon of South Africa (Van der Merwe & Saayman, 2008). Ezemvelo KZN Wildlife is the authority within KwaZulu-Natal (KZN) that manages 33 biodiversity conservation areas which also includes two UNESCO sites. In KZN, four parks were identified for purpose of the study. Ezemvelo KZN Wildlife is one of the largest ecotourism operations in South Africa (KZNWildlife, 2017). UNESCO (United Nations Educational, Scientific and Cultural Organization) parks are world heritage sites that are areas of extraordinary beauty or importance to humanity. South Africa has eight of these parks and these parks are also well known within the international tourism industry (UNESCO, 2017). Out of the eight UNESCO sites that South Africa has to offer, five were identified for inclusion in this study.

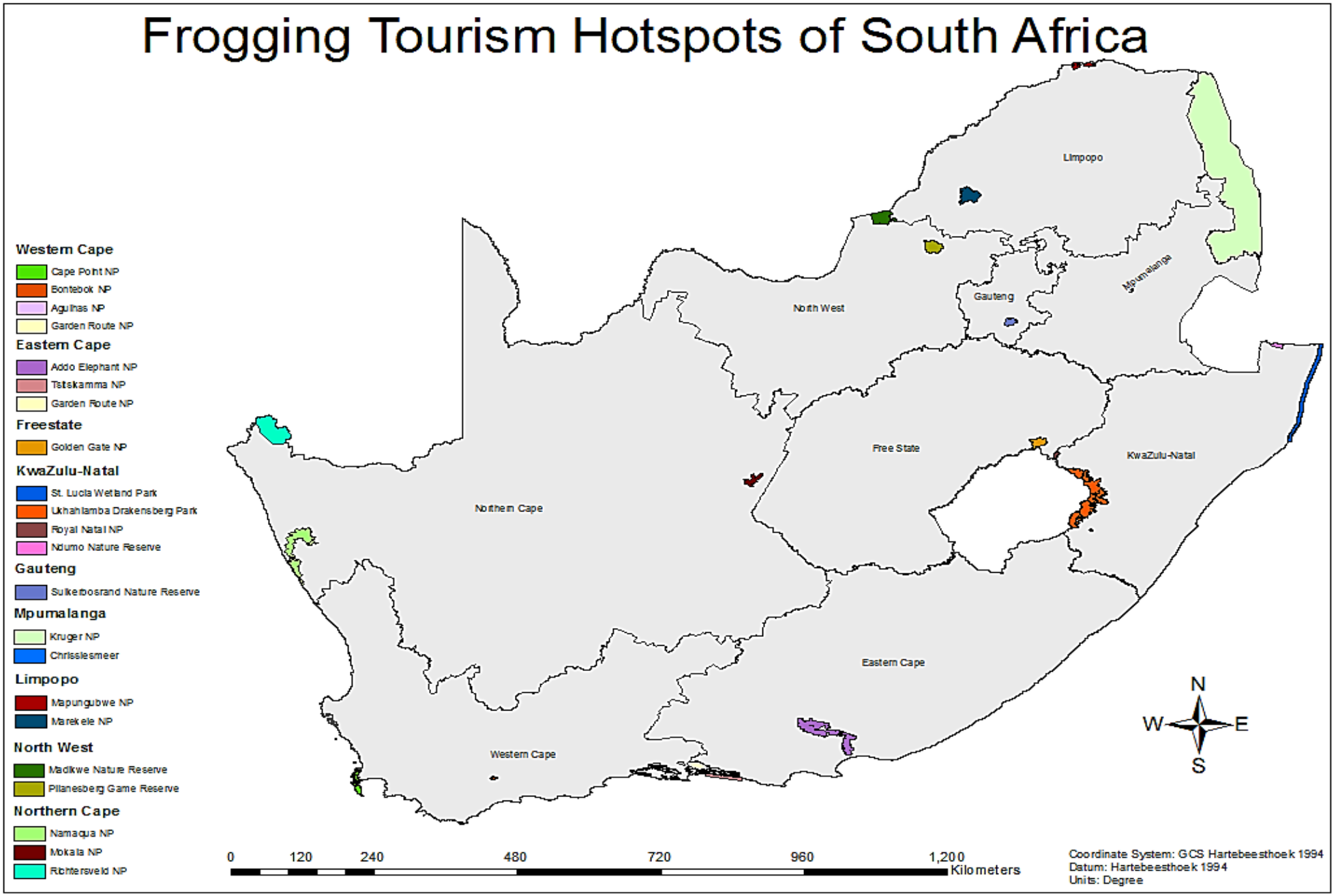


Figure 2.8: ArcGIS map indicating the location of the 22 parks selected for this study.

Tables were created for each province with the list of species that occur within each of the 22 selected parks. Some of the identified frog species can be found in more than one park and province, while others are restricted to only one park. Additional information is given for each species that occurs in a certain park. This includes the conservation status according to the IUCN Red Data List, whether the species is abundant in the area in which the park is situated, whether the species is endemic to South Africa, and whether the species is regarded as a charismatic species. The reason for selecting charismatic features to represent the frogs of the parks is so to highlight those species that may prove popular with tourists and thereby serve as symbols to encourage conservation awareness and action (Heywood, 1995 & Ducarme *et.al,* 2012). Charismatic species are also more likely to draw financial support (Meffe & Carrol, 1997 & Ducarme *et.al,* 2012.). The reason for being charismatic is listed in an additional table. The concept behind this is to make frogs more interesting to tourists and to help them to remember the name more easily.

2.3.3 Frogging hotspot maps

The final product is a visual representation of the location of all parks per province, including photos of the charismatic species (selected based on the above-mentioned criteria) that occur in the province (see figure 2.9 – 2.17). A list of photographers that shared their photos for the purpose of the project can be viewed in the acknowledgement section of the thesis.

A number of South African species were not included in the selected parks, due to them being isolated in terms of their distribution and not occurring in the vicinity of the selected parks. A list of these species was compiled (table 2.20), which includes their location, conservation status, endemic status, whether they are abundant in the area, as well as their charismatic value (see table 2.21). The purpose of these lists are that parks can use them as guidelines of frogs that occurs in the park and to hand out to tourists to make them aware of the species that can be seen in the park.

Northern Cape

Table 2.2: Species found in the Northern Cape parks with their criteria

NORTHERN CAPE				
Richtersveld NP	**Conservation Status**	**Common in Area**	**Endemic To SA**	**Charismatic**
Amietia delalandii (Common River Frog)				
Cacosternum namaquense (Namaqua Caco)			*	
Phrynomantis annectens (Marbled Rubber Frog)				
Sclerophrys capensis (Rauccos Toad)				
Strongylopus springbokensis (Namaqua Stream Frog)			*	*
Vandijkophrynus gariepensis (Karoo Skurwepadda)		*		
Vandijkophrynus robinsoni (Paradise Toad)		*		*
Xenopus laevis (Common Platanna)		*		
Mokala NP	**Conservation Status**	**Common in Area**	**Endemic To SA**	**Charismatic**
Amietia delalandii (Common River Frog)				*
Amietia poyntoni (Poynton's River Frog)				
Breviceps adspersus (Bushveld Rain Frog)		*		
Cacosternum boettgeri (Boettger's Caco)				*
Kassina senegalensis (Bubbling Kassina)			*	
Poyntonophrynus vertebralis (Southern Pygmy Toad)				*
Sclerophrys gutturalis (Guttaral Toad)		*		
Sclerophrys poweri (Western Olive Toad)		*		
Sclerophrys capensis (Rauccos Toad)				
Tomopterna cryptotis (Tremolo Sand Frog)				*
Xenopus laevis (Common Platanna)		*		

Namaqua NP	Conservation Status	Common in Area	Endemic To SA	Charismatic
Amietia poyntoni (Poynton's River Frog)				
Breviceps branchi (Branch's Rain Frog)			*	
Breviceps macrops (Desert Rain Frog)	VU		*	*
Breviceps namaquensis (Namaqua Rain Frog)			*	*
Cacosternum namaquense (Namaqua Caco)			*	*
Strongylopus springbokensis (Namaqua Stream Frog)			*	
Tomopterna delalandii (Cape Sand Frog)			*	*
Vandijkophrynus gariepensis (Karoo Skurwepadda)		*		
Vandijkophrynus robinsoni (Paradise Toad)				
Xenopus laevis (Common Platanna)				

Table 2.3: Charismatic species of Northern Cape

NORTHERN CAPE			
Species Name	**Common Name**	**Park Location**	**Charismatic Value**
Amietia delalandii	Common River Frog	Mokala NP Richtersveld NP	A very recognisable call due to the species wide distribution
Breviceps macrops	Desert Rain Frog	Namaqua NP	Spectacular skin colouration - pale white/yellow with a brown pattern Can only be found on the coastal edge (red dunes) of Namaqualand It's ability to survive in extremely arid conditions
Breviceps namaquensis	Namaqua Rain Frog	Namaqua NP	Confined to the Namaqua coast (white dunes) and the mountains of the succulent Karoo Tracks visible in the sand early mornings
Cacosternum boettgeri	Boettger's Caco	Mokala NP	Call in mass choruses in road side pools after summer rains

Cacosternum namaquense	Namaqua Caco	Namaqua NP Richtersveld NP	Distinct call resembles cork being removed from a wine bottle
Poyntonophrynus vertebralis	Southern Pygmy Toad	Mokala NP	Appear seemingly out of now where in masses after heavy rain
Strongylopus springbokensis	Namaqua Stream Frog	Namaqua NP Richtersveld NP	Named after the town Springbok where the species can be found
Tomopterna cryptotis	Tremolo Sand Frog	Mokala NP	When species senses danger it buries itself by wriggling backwards into the sand
Vandijkophrynus robinsoni	Paradise Toad	Namaqua NP Richtersveld NP	They have a subdued mewing sound unique to all other toad calls Remarkable colouration and beautiful eyes

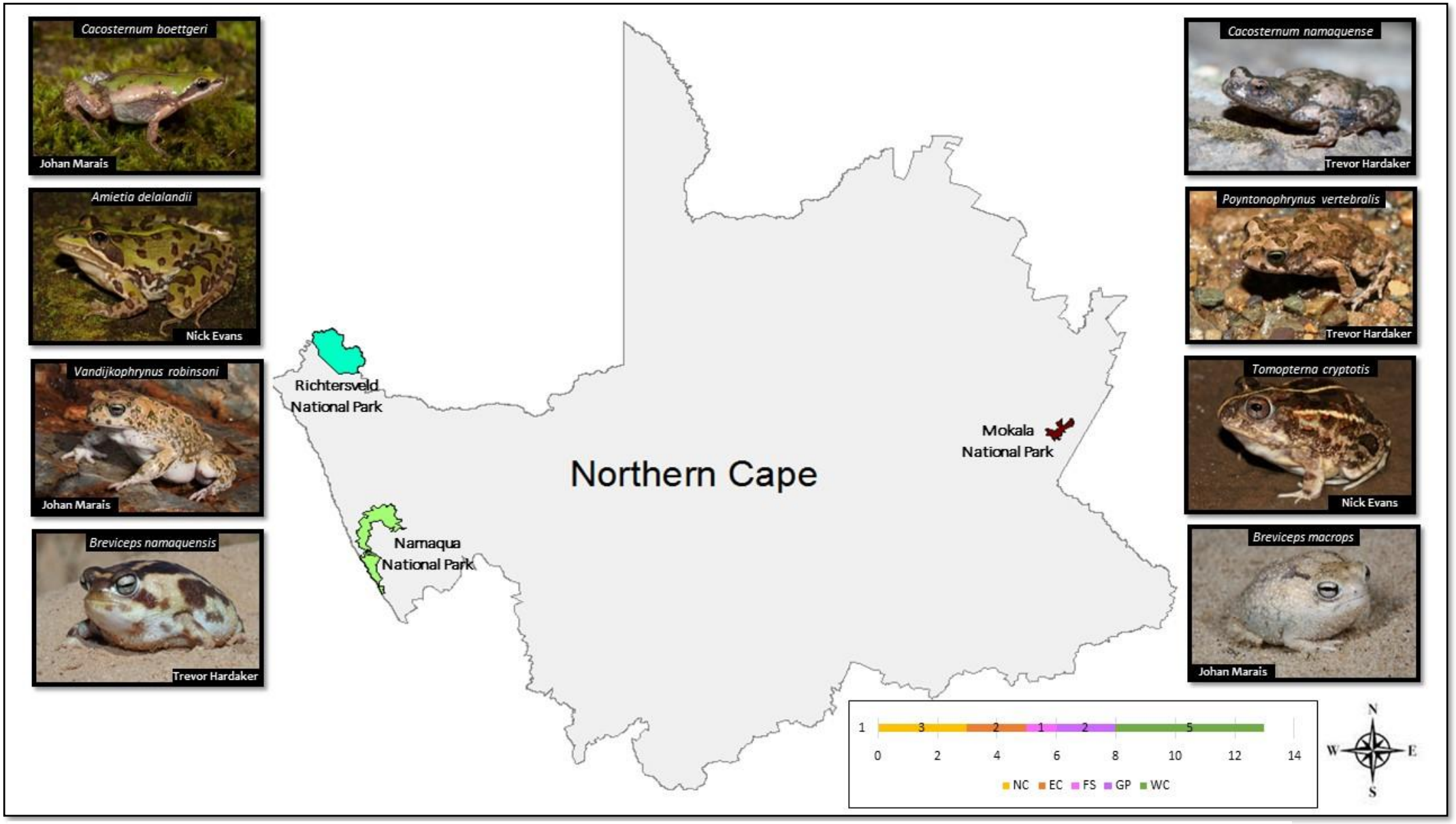


Figure 2.9: Map of Northern Cape with the selected parks and charismatic species that can be found in the parks.

Western Cape

Table 2.4: Species found in the Western Cape parks with their criteria

WESTERN CAPE				
Bontebok NP	**Conservation Status**	**Common in Area**	**Endemic To SA**	**Charismatic**
Amietia fuscigula (Cape River Frog)		*		
Breviceps acutirostris (Strawberry Rain Frog)			*	*
Breviceps fuscus (Plain Rain Frog)			*	
Breviceps montanus (Cape Mountain Rain Frog)			*	*
Cacosternum boettgeri (Boettger's Caco)				
Capensibufo tradouwi (Tradouw Mountain Toad)			*	*
Heleophryne orientalis (Eastern Ghost Frog)			*	*
Sclerophrys capensis (Rauccos Toad)		*		
Semnodactylus wealii (Rattling Frog)				
Strongylopus bonaespei (Banded Stream Frog)			*	
Strongylopus fasciatus (Striped Stream Frog)		*		
Strongylopus grayii (Clicking Stream Frog)		*		
Vandijkophrynus gariepensis (Karoo Skurwepadda)		*		
Xenopus laevis (Common Platanna)		*		
Garden Route NP	**Conservation Status**	**Common in Area**	**Endemic To SA**	**Charismatic**
Afrixalus knysnae (Knysna Leaf-folding Frog)	EN		*	*
Amietia delalandii (Common River Frog)				
Amietia fuscigula (Cape River Frog)		*		
Breviceps fuscus (Plain Rain Frog)		*	*	*

Breviceps montanus (Cape Mountain Rain Frog)			*	
Cacosternum boettgeri (Boettger's Caco)		*		
Cacosternum nanum (Bronze Caco)		*		
Heleophryne regis (Southern Ghost frog)			*	*
Hyperolius horstockii (Arum Lily Frog)			*	
Hyperolius marmoratus (Painted Reed Frog)		*		
Sclerophrys pardalis (Eastern leopard Toad)			*	
Sclerophrys capensis (Rauccos Toad)		*		
Semnodactylus wealii (Rattling Frog)		*		
Strongylopus bonaespei (Banded Stream Frog)			*	*
Strongylopus fasciatus (Striped Stream Frog)		*		
Strongylopus grayii (Clicking Stream Frog)		*		
Tomopterna delalandii (Cape Sand Frog)		*	*	
Vandijkophrynus gariepensis (Karoo Skurwepadda)				
Xenopus laevis (Common Platanna)		*		
Agulhas NP	**Conservation Status**	**Common in Area**	**Endemic To SA**	**Charismatic**
Amietia fuscigula (Cape River Frog)				
Arthroleptella lightfooti (Cape Peninsula Moss Frog)	NT		*	*
Breviceps montanus (Cape Mountain Rain Frog)			*	
Breviceps rosei (Rose's Rain Frog)			*	
Cacosternum australis (Southern Caco)			*	
Cacosternum boettgeri (Boettger's Caco)		*		
Hyperolius horstockii (Arum Lily Frog)		*	*	*
Sclerophrys capensis (Rauccos Toad)				
Semnodactylus wealii (Rattling Frog)				

Strongylopus bonaespei (Banded Stream Frog)			*	
Strongylopus grayii (Clicking Stream Frog)		*		
Tomopterna delalandii (Cape Sand Frog)		*	*	*
Vandijkophrynus angusticeps (Cape Sand Toad)			*	
Xenopus laevis (Common Platanna)				
Cape Point NP	**Conservation Status**	**Common in Area**	**Endemic To SA**	**Charismatic**
Amietia fuscigula (Cape River Frog)		*		
Arthroleptella lightfooti (Cape Peninsula Moss Frog)	NT	*	*	
Breviceps gibbosus (Cape Rain Frog)	NT		*	
Breviceps montanus (Cape Mountain Rain Frog)			*	
Breviceps rosei (Rose's Rain Frog)		*	*	*
Cacosternum aggestum (Klipheuwel Caco)			*	
Cacosternum boettgeri (Boettger's Caco)		*		
Cacosternum capense (Cape Caco)	NT		*	*
Cacosternum platys (Flat Caco)			*	
Capensibufo rosei (Rose's Mountain Toad)	CR	*	*	*
Heleophryne rosei (Table Mountain Ghost Frog)	CR		*	*
Hyperolius horstockii (Arum Lily Frog)		*	*	
Hyperolius marmoratus (Painted Reed Frog)				
Microbatrachella capensis (Micro Frog)	CR		*	*
Sclerophrys pantherinus (Western Leopard Toad)	EN		*	*
Semnodactylus wealii (Rattling Frog)				
Strongylopus bonaespei (Banded Stream Frog)		*	*	
Strongylopus grayii (Clicking Stream Frog)		*		
Tomopterna delalandii (Cape Sand Frog)		*	*	

Vandijkophrynus angusticeps (Cape Sand Toad)			*	
Xenopus gilli (Cape Platanna)	EN	*	*	*
Xenopus laevis (Common Platanna)				

Table 2.5: Charismatic species of Western Cape

WESTERN CAPE			
Species Name	**Common Name**	**Park Location**	**Charismatic Value**
Afrixalus knysnae	Knysna Leaf-folding Frog	Garden Route NP	Named after the town of Knysna Only found in the Garden Route region of S.A
Breviceps fuscus	Plain Rain Frog	Bontebok NP Garden Route NP	The Latin word *fuscus* refers to the dark colour of the frog Males glue themselves to the back of the female so that the pair can create a burrow for eggs to be laid in
Breviceps gibbosus	Cape Rain Frog	Cape Point NP	The first frog description in S.A by Linnaeus (1758) Has a grumpy-looking face Can be found in botanical gardens of Cape Town
Breviceps montanus	Cape Mountain Rain Frog	Agulhas NP Bontebok NP Cape Point NP Garden Route NP	During the terrestrial development stage, the tadpoles remain in the nest until they metamorphose into frogs
Cacosternum capense	Cape Caco	Cape Point NP	Has unique blister-like glands on its back
Capensibufo rosei	Rose's Mountain Toad	Cape Point NP	Spectacular skin colouration - Has scattered patches of red/oranges markings on an olive-green body Only voiceless species known in South Africa
Capensibufo tradouwi	Tradouw Mountain Toad	Bontebok NP	Named after the Tradouw Pass where the species was first found

Heleophryne orientalis	Eastern Ghost Frog	Bontebok NP	Only found in the Bontebok NP region of the whole South Africa
Heleophryne regis	Southern Ghost frog	Garden Route NP	Endemic to the Garden Route
Heleophryne rosei	Table Mountain Ghost Frog	Cape Point NP	One of the most threatened species in S.A First found in the Skeleton Gorge of Table Mountain and that is where the name Ghost frog came from Occurs only on Table Mountain
Hyperolius horstockii	Arum Lily Frog	Agulhas NP Cape Point NP Garden Route NP	Synonymous with Arum Lily flowers where they hide inside the flower cup
Microbatrachella capensis	Micro Frog	Cape Point NP	One of the most threatened species in S.A Only occur in a total area of 10km² in the whole South Africa
Sclerophrys pantherinus	Western Leopard Toad	Cape Point NP	Name derived from a panther due to the similarity in colour pattern One of the few species that has an existing conservation project
Strongylopus bonaespei	Banded Stream Frog	Agulhas NP Bontebok NP Cape Point NP Garden Route NP	The specific epithet *bonaespei* means good hope, which refers to the Cape of Good Hope where the species occurs
Xenopus gilli	Cape Platanna	Cape Point NP	Common platanna can hybridize with this threatened species Should not be mistaken with *Xenopus leavis* (gilli has 3 black stripes on the dorsal side of the frog)

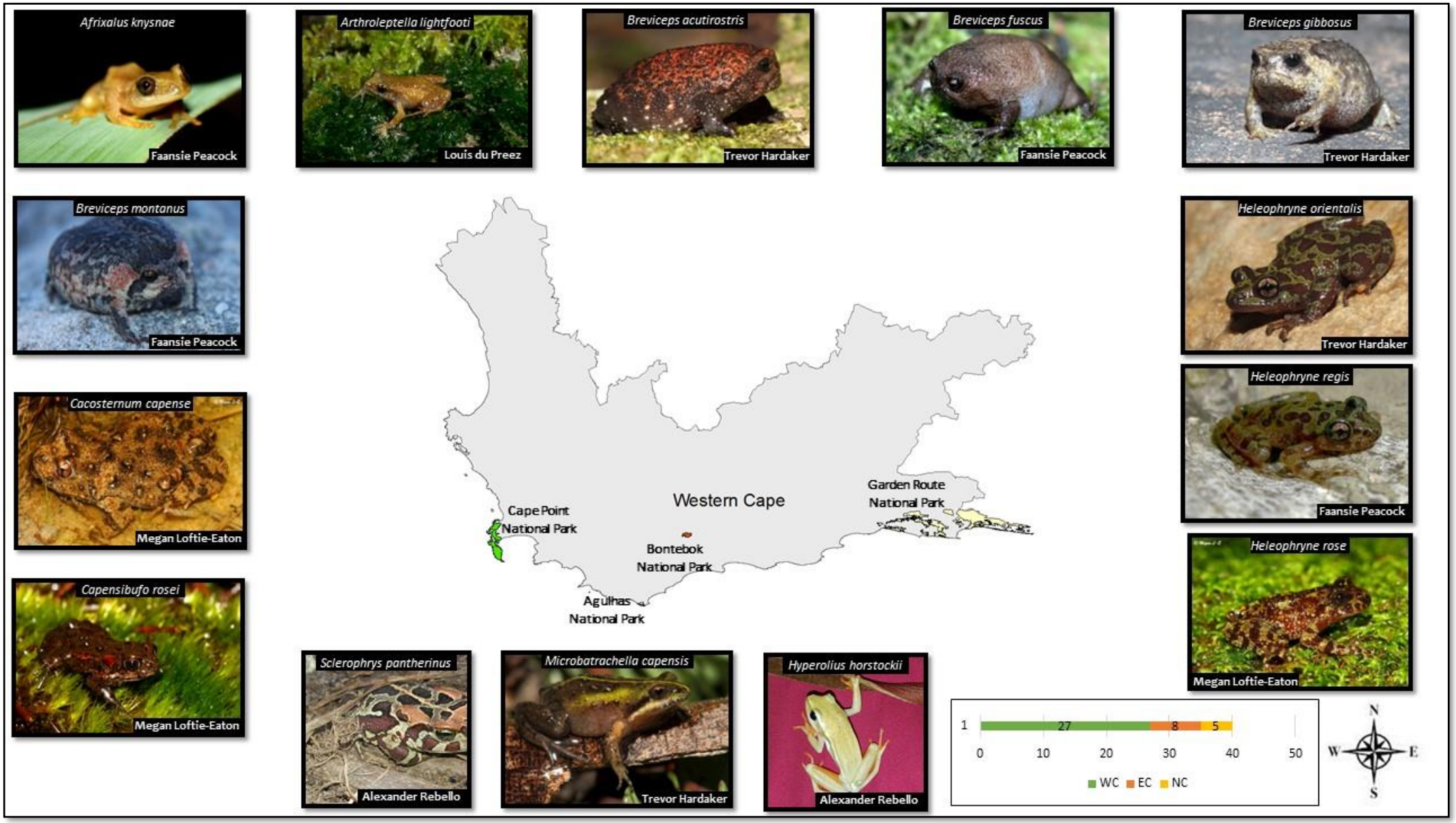


Figure 2.10: Map of Western Cape with the selected parks and charismatic species that can be found in the parks.

Eastern Cape

Table 2.6: Species found in the Eastern Cape parks with their criteria

EASTERN CAPE				
Tsitsikamma NP	**Conservation Status**	**Common in Area**	**Endemic To SA**	**Charismatic**
Afrixalus knysnae (Knysna Leaf-folding Frog)	EN	*	*	*
Amietia fuscigula (Cape River Frog)		*		
Breviceps adspersus (Bushveld Rain Frog)			*	
Breviceps fuscus (Plain Rain Frog)		*	*	*
Cacosternum boettgeri (Boettger's Caco)				
Cacosternum nanum (Bronze Caco)		*		
Heleophryne regis (Southern Ghost frog)			*	*
Hyperolius horstockii (Arum Lily Frog)			*	*
Hyperolius marmoratus (Painted Reed Frog)		*		
Sclerophrys capensis (Rauccos Toad)		*		
Semnodactylus wealii (Rattling Frog)				
Strongylopus fasciatus (Striped Stream Frog)		*		
Strongylopus grayii (Clicking Stream Frog)		*		
Vandijkophrynus *angusticeps* (Cape Sand Toad)			*	*
Xenopus laevis (Common Platanna)		*		
Addo Elephant NP	**Conservation Status**	**Common in Area**	**Endemic To SA**	**Charismatic**
Amietia delalandii (Common River Frog)		*		
Amietia poyntoni (Poynton's River Frog)				
*Breviceps adspersus (*Bushveld Rain Frog)			*	

Cacosternum boettgeri (Boettger's Caco)		*		
Cacosternum nanum (Bronze Caco)		*		
Hyperolius marmoratus (Painted Reed Frog)		*		*
Hyperolius semidiscus (Yellow-striped Reed Frog)				*
Kassina senegalensis (Bubbling Kassina)		*		
Sclerophrys pardalis (Eastern leopard Toad)			*	*
Sclerophrys capensis (Rauccos Toad)		*		
Semnodactylus wealii (Rattling Frog)				
Strongylopus fasciatus (Striped Stream Frog)				
Strongylopus grayii (Clicking Stream Frog)				
Tomopterna delalandii (Cape Sand Frog)			*	*
Tomopterna tandyi (Tandy's Sand Frog)				
Vandijkophrynus gariepensis (Karoo Skurwepadda)				
Xenopus laevis (Common Platanna)		*		

Table 2.7: Charismatic species of Eastern Cape

EASTERN CAPE			
Species Name	**Common Name**	**Park Location**	**Charismatic Value**
Afrixalus knysnae	Knysna Leaf-folding Frog	Tsitsikamma NP Garden Route NP	Named after the town of Knysna Only found in the Garden Route region of S.A
Breviceps fuscus	Plain Rain Frog	Tsitsikamma NP Garden Route NP	The Latin word *fuscus* refers to the dark colour of the frog Males glue themselves to the back of the female so that the pair can create a burrow for eggs to be laid in

Heleophryne regis	Southern Ghost frog	Tsitsikamma NP Garden Route NP	Endemic to the Garden Route
Hyperolius horstockii	Arum Lily Frog	Tsitsikamma NP Garden Route NP	Synonymous with Arum Lily flowers where they hide inside the flower cup
Hyperolius marmoratus	Painted Reed Frog	Addo Elephant NP Tsitsikamma NP	Common, yet beautifully coloured Call in massive choruses
Hyperolius semidiscus	Yellow-striped Reed Frog	Addo Elephant NP	Spectacular skin colouration - Green/olive colour with a yellow side band Breeding males usually found on floating water-lilies
Sclerophrys pardalis	Eastern leopard Toad	Addo Elephant NP	Name derived from a female leopard (*pardalis*) due to the similarity in colour pattern Difficult to distinguish from the Western leopard Toad, but they have different ranges
Vandijkophrynus angusticeps	Cape Sand Toad	Tsitsikamma NP	This species has distinct yellow feet

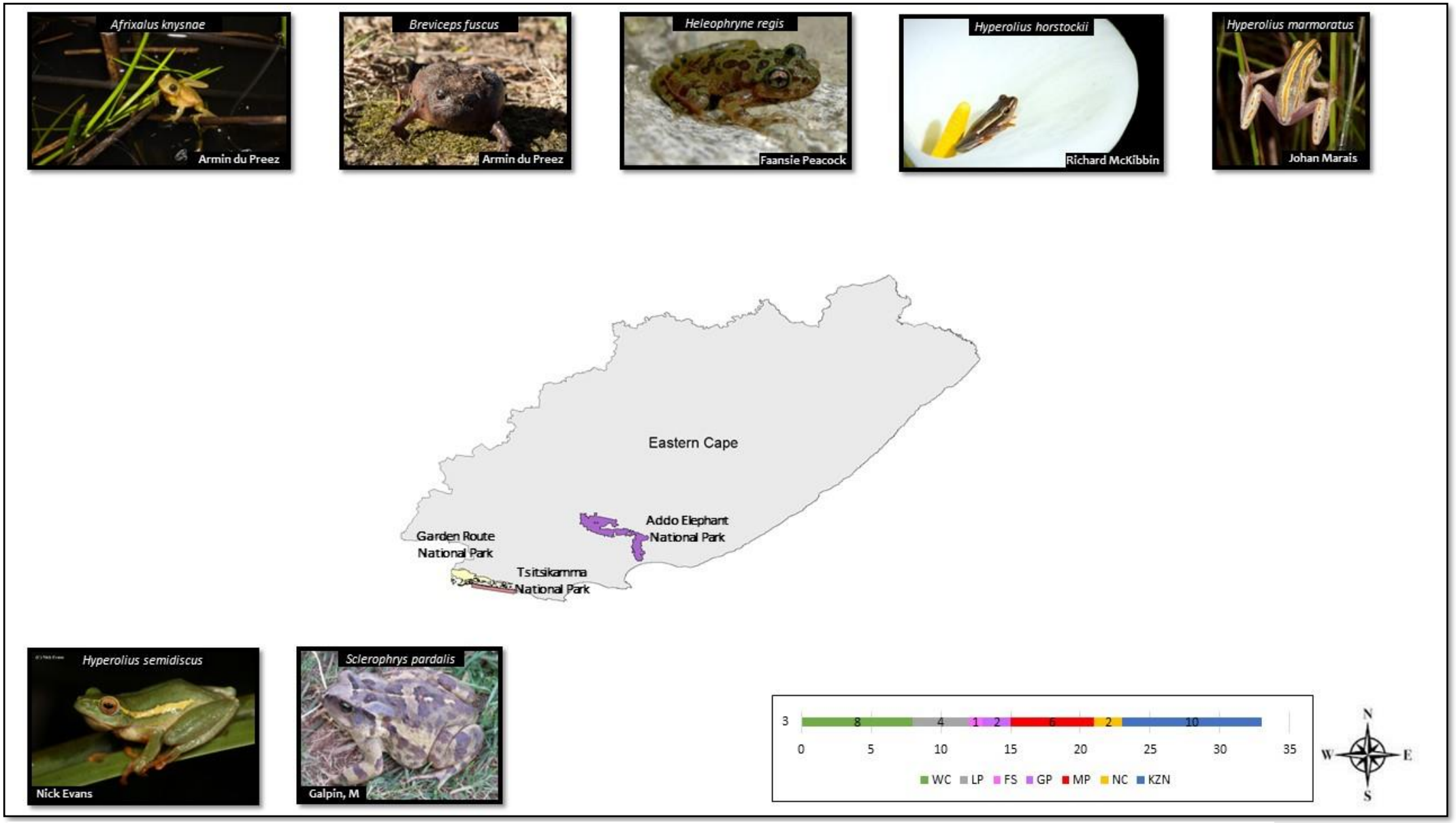


Figure 2.11: Map of Eastern Cape with the selected parks and charismatic species that can be found in the parks.

KwaZulu-Natal

Table 2.8: Species found in the KwaZulu-Natal parks with their criteria

KWAZULU-NATAL				
Royal Natal NP	**Conservation Status**	**Common in Area**	**Endemic To SA**	**Charismatic**
Afrixalus spinifrons (Natal Leaf-Folding Frog)			*	*
Amietia delalandii (Common River Frog)		*		
Amietia poyntoni (Poynton's River Frog)				
Amietia vertebralis (Maluti River Frog)				*
Amietia hymenopus (Phofung River Frog)	NT	*		
Anhydrophryne hewitti (Natal Chirping Frog)			*	
Breviceps adspersus (Bushveld Rain Frog)		*		
Breviceps mossambicus (Mozambique Rain Frog)				
Breviceps verrucosus (Plaintive Rain Frog)				
Cacosternum boettgeri (Boettger's Caco)				
Cacosternum nanum (Bronze Caco)		*		
Hadromophryne natalensis (Natal Cascade Frog)		*		*
Kassina senegalensis (Bubbling Kassina)		*		
Ptychadena porosissima (Striped Grass Frog)				
Sclerophrys gutturalis (Guttaral Toad)		*		
Sclerophrys capensis (Rauccos Toad)		*		
Strongylopus grayii (Clicking Stream Frog)				
Strongylopus wageri (Plain stream Frog)			*	*
Tomopterna natalensis (Natal Sand Frog)				

Vandijkophrynus gariepensis (Karoo Skurwepadda)		*		
Xenopus laevis (Common Platanna)		*		
Ukhalamba Drakensberge	**Conservation Status**	**Common in Area**	**Endemic To SA**	**Charismatic**
Amietia delalandii (Common River Frog)		*		
Amietia hymenopus (Phofung River Frog)	NT	*		
Amietia poyntoni (Poynton's River Frog)				
Amietia vertebralis (Maluti River Frog)		*		
Anhydrophryne hewitti (Natal Chirping Frog)			*	*
Breviceps adspersus (Bushveld Rain Frog)				
Breviceps verrucosus (Plaintive Rain Frog)		*		*
Cacosternum boettgeri (Boettger's Caco)				
Cacosternum nanum (Bronze Caco)		*		
Cacosternum parvum (Mountain Caco)				*
Cacosternum rhythmum (Rhythmic Caco)				
Cacosternum striatum (Striped Caco)			*	
Hadromophryne natalensis (Natal Cascade Frog)		*		
Kassina senegalensis (Bubbling Kassina)				
Leptopelis xenodactylus (Long-toed Tree Frog)	EN		*	*
Ptychadena porosissima (Striped Grass Frog)		*		
Sclerophrys capensis (Rauccos Toad)				
Sclerophrys gutturalis (Guttaral Toad)		*		
Semnodactylus wealii (Rattling Frog)				
Strongylopus fasciatus (Striped Stream Frog)				
Strongylopus grayii (Clicking Stream Frog)		*		
Strongylopus wageri (Plain stream Frog)			*	

Tomopterna natalensis (Natal Sand Frog)				
Vandijkophrynus gariepensis (Karoo Skurwepadda)				
Xenopus laevis (Common Platanna)		*		
Isimangaliso/St. Lucia	**Conservation Status**	**Common in Area**	**Endemic To SA**	**Charismatic**
Afrixalus aureus (Golden Leaf-folding Frog)				
Afrixalus delicatus (Delicate Leaf-folding Frog)		*		
Afrixalus fornasinii (Greater Leaf-folding Frog)		*		*
Afrixalus spinifrons (Natal Leaf-Folding Frog)			*	
Amietia delalandii (Common River Frog)		*		
Arthroleptis stenodactylus (Shovel-footed Squeaker)				
Arthroleptis wahlbergi (Bush Squeaker)		*	*	
Breviceps adspersus (Bushveld Rain Frog)		*		
Breviceps mossambicus (Mozambique Rain Frog)		*		*
Breviceps sopranus (Whistling Rain Frog)			*	
Cacosternum boettgeri (Boettger's Caco)				
Cacosternum nanogularum (KwaZulu Caco)			*	
Cacosternum nanum (Bronze Caco)				
Cacosternum striatum (Striped Caco)			*	
Chiromantis xerampelina (Southern Foam Nest Frog)		*		
Hemisus guttatus (Spotted Shovel-nosed Frog)	VU		*	*
Hemisus marmoratus (Mottled Shovel-nosed Frog)		*		
Hyperolius poweri (Power's Reed Frog)				*
Hyperolius argus (Argus Reed Frog)		*		
Hyperolius marmoratus (Painted Reed Frog)		*		
Hyperolius pickersgilli (Pickersgill's Reed Frog)	EN		*	*

Hyperolius pusillus (Water Lily Frog)		*		
Hyperolius tuberilinguis (Tinker Reed Frog)		*		
Kassina maculata (Red-legged Kassina)		*		
Kassina senegalensis (Bubbling Kassina)		*		
Leptopelis mossambicus (Brown-backed Tree Frog)		*		*
Leptopelis natalensis (Natal Tree Frog)			*	*
Phrynobatrachus mababiensis (Dwarf Puddle Frog)		*		
Phrynobatrachus natalensis (Snoring Puddle Frog)		*		*
Phrynomantis bifasciatus (Banded Rubber Frog)				
Ptychadena anchietae (Plain Grass Frog)		*		
Ptychadena nilotica (Mascarene Grass Frog)				*
Ptychadena mossambica(Broad-banded Grass Frog)		*		
Ptychadena oxyrhynchus (Sharp-nosed Grass Frog)		*		
Ptychadena porosissima (Striped Grass Frog)				
Ptychadena taenioscelis (Dwarf Grass Frog)				
Pyxicephalus edulis (Edible Bullfrog)				
Schismaderma carens (Schismadera carens)				
Sclerophrys garmani (Eastern Olive Toad)		*		
Sclerophrys gutturalis (Guttaral Toad)		*		
Strongylopus fasciatus (Striped Stream Frog)				
Strongylopus grayii (Clicking Stream Frog)				
Tomopterna natalensis (Natal Sand Frog)		*		
Xenopus laevis (Common Platanna)				
*Xenopus muelleri (*Müller's Platanna)				

Ndumo Game Reserve	Conservation Status	Common in Area	Endemic To SA	Charismatic
Afrixalus aureus (Golden Leaf-folding Frog)		*		*
Afrixalus delicatus (Delicate Leaf-folding Frog)				*
Afrixalus fornasinii (Greater Leaf-folding Frog)		*		
Amietia delalandii (Common River Frog)				
Arthroleptis stenodactylus (Shovel-footed Squeaker)		*		
Breviceps adspersus (Bushveld Rain Frog)				
Breviceps mossambicus (Mozambique Rain Frog)		*		
Cacosternum boettgeri (Boettger's Caco)				
Cacosternum nanum (Bronze Caco)				
Chiromantis xerampelina (Southern Foam Nest Frog)		*		
Hemisus marmoratus (Mottled Shovel-nosed Frog)		*		
Hildebrandtia ornata (Southern Ornata Frog)				
Hyperolius argus (Argus Reed Frog)		*		*
Hyperolius marmoratus (Painted Reed Frog)		*		
Hyperolius pusillus (Water Lily Frog)		*		
Hyperolius tuberilinguis (Tinker Reed Frog)		*		
Kassina maculata (Red-legged Kassina)		*		
Kassina senegalensis (Bubbling Kassina)		*		
Leptopelis mossambicus (Brown-backed Tree Frog)		*		
Phrynobatrachus mababiensis (Dwarf Puddle Frog)				*
Phrynomantis bifasciatus (Banded Rubber Frog)				
Ptychadena anchietae (Plain Grass Frog)		*		
Ptychadena mossambica(Broad-banded Grass Frog)				
Ptychadena oxyrhynchus (Sharp-nosed Grass Frog)				

Ptychadena taenioscelis (Dwarf Grass Frog)				*
Pyxicephalus edulis (Edible Bullfrog)				
Sclerophrys garmani (Eastern Olive Toad)		*		
Sclerophrys gutturalis (Guttaral Toad)		*		
Sclerophrys pusilla (Flat-backed Toad)				
Sclerophrys capensis (Rauccos Toad)				
Tomopterna krugerensis (Knocking Sand Frog)				
*Xenopus muelleri (*Müller's Platanna)				

Table 2.9: Charismatic species of KwaZulu-Natal

KWAZULU-NATAL			
Species Name	**Common Name**	**Park Location**	**Charismatic Value**
Afrixalus aureus	Golden Leaf-folding Frog	Ndumo Game Reserve St. Lucia Wetlands	The specific epithet *aureus* refers to the golden colour of the frog
Afrixalus delicatus	Delicate Leaf-folding Frog	Ndumo Game Reserve St. Lucia Wetlands	The specific epithet *delicatus* refers to the delicate build of this frog species
Afrixalus fornasinii	Greater Leaf-folding Frog	Ndumo Game Reserve St. Lucia Wetlands	Largest of the *Afrixalus species*
Afrixalus spinifrons	Natal Leaf-Folding Frog	Royal Natal NP St. Lucia Wetlands	Short zip call followed by a longer trill Males call in choruses of up to 20 frogs Bright yellow colouration
Amietia vertebralis	Maluti River Frog	Royal Natal NP Ukhalamba Drakensberge	Can only be found in this part of South Africa and mainly in Lesotho Can tolerate extreme conditions

			Very large species and has teeth
Anhydrophryne hewitti	Natal Chirping Frog	Royal Natal NP Ukhalamba Drakensberge	Tiny frog can be found at altitudes up to 2700m
Breviceps mossambicus	Mozambique Rain Frog	Ndumo Game Reserve Royal Natal NP St. Lucia Wetlands	Species colour varies, depending on the habitat found in (mainland vs island)
Breviceps verrucosus	Plaintive Rain Frog	Royal Natal NP Ukhalamba Drakensberge	**Eerie** call audible during rain or misty conditions
Cacosternum parvum	Mountain Caco	Ukhalamba Drakensberge	This is a very small frog species (16mm)
Hadromophryne natalensis	Natal Cascade Frog	Royal Natal NP Ukhalamba Drakensberge	Iconic of the Tugela and other rivers in the Drakensberg foothills
Hemisus guttatus	Spotted Shovel-nosed Frog	St. Lucia Wetlands	Spectacular skin colouration - Olive/brown skin with bright yellow spots The specific epithet g*uttatus* refers to the spotted body of the frog
Hyperolius poweri	Power's Long Reed Frog	St. Lucia Wetlands	Species engages in amusing territorial disputes in breeding season
Hyperolius argus	Argus Reed Frog	Ndumo Game Reserve St. Lucia Wetlands	Spectacular skin colouration - Green/brown/purple body with yellow bands or dots They have prominent yellow markings on their snout
Hyperolius pickersgilli	Pickersgill's Reed Frog	St. Lucia Wetlands	This is an endangered frog species Endemic to the coast of KwaZulu-Natal South African mascot – green and gold in colour

Leptopelis mossambicus	Brown-backed Tree Frog	Ndumo Game Reserve St. Lucia Wetlands	Can call from high up in trees During dry periods they burrow to a depth of 250mm Horseshoe marking on back
Leptopelis natalensis	Natal Tree Frog	St. Lucia Wetlands	Spectacular skin colouration - Lime green/brown colour with emerald green blotches Often found in houses and is easy to handle
Leptopelis xenodactylus	Long-toed Tree Frog	Ukhalamba Drakensberge	Spectacular skin colouration - Lime green colour Only tree frog that lives exclusively among grassy wetland vegetation Sounds like a baby crocodile
Phrynobatrachus natalensis	Snoring Puddle Frog	St. Lucia Wetlands	Can be found in muddy tracks left by cattle and game
Phrynomantis bifasciatus	Banded Rubber Frog	Ndumo Game Reserve St. Lucia Wetlands	Spectacular skin colouration - Black body with two reddish bands and reddish spots (indicative of toxicity) SA's most toxic frog
Ptychadena nilotica	Mascarene Grass Frog	St. Lucia Wetlands	Able to jump a significant distance through moist grassy vegetation
Ptychadena taenioscelis	Dwarf Grass Frog	Ndumo Game Reserve St. Lucia Wetlands	Rare in South Africa; distinct black and yellow bands on inner thighs
Strongylopus wageri	Plain stream Frog	Royal Natal NP Ukhalamba Drakensberge	Amazing altitudinal range throughout the Drakensberg mountains

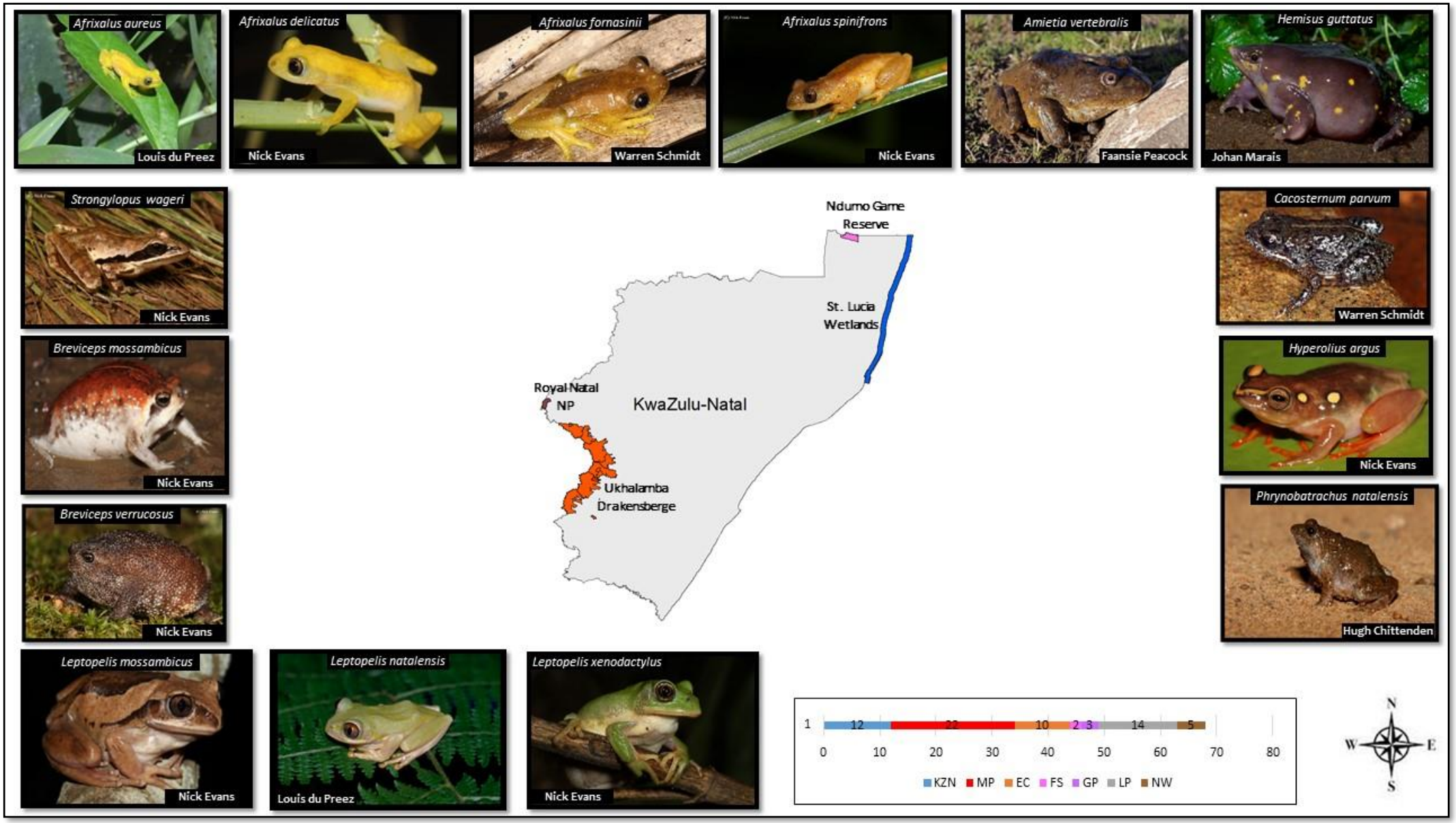


Figure 2.12: Map of KwaZulu-Natal with the selected parks and charismatic species that can be found in the parks.

Mpumalanga

Table 2.10: Species found in the Mpumalanga parks with their criteria

MPUMALANGA				
Kruger National Park (Mpumalanga region)	**Conservation Status**	**Common in Area**	**Endemic To SA**	**Charismatic**
Afrixalus aureus (Golden Leaf-folding Frog)		*		*
Afrixalus fornasinii (Greater Leaf-folding Frog)				
Amietia delalandii (Common River Frog)				
Breviceps adspersus (Bushveld Rain Frog)		*		*
Cacosternum boettgeri (Boettger's Caco)		*		
Chiromantis xerampelina (Southern Foam Nest Frog)		*		
Hemisus marmoratus (Mottled Shovel-nosed Frog)		*		
Hildebrandtia ornata (Southern Ornata Frog)				*
Hyperolius marmoratus (Painted Reed Frog)		*		
Hyperolius pusillus (Water Lily Frog)				*
Kassina senegalensis (Bubbling Kassina)		*		
Leptopelis mossambicus (Brown-backed Tree Frog)		*		*
Phrynobatrachus mababiensis (Dwarf Puddle Frog)		*		
Phrynobatrachus natalensis (Snoring Puddle Frog)		*		
Phrynomantis bifasciatus (Banded Rubber Frog)		*		*
Poyntonophrynus fenoulheti (Northern Pygmy Toad)		*		*
Ptychadena anchietae (Plain Grass Frog)		*		
Ptychadena nilotica (Mascarene Grass Frog)				
Ptychadena mossambica (Broad-banded Grass Frog)		*		

Pyxicephalus edulis (Edible Bullfrog)		*		*
Schismaderma carens (Schismadera carens)		*		
Sclerophrys garmani (Eastern Olive Toad)		*		
Sclerophrys gutturalis (Guttaral Toad)		*		
Sclerophrys pusilla (Flat-backed Toad)		*		
Tomopterna cryptotis (Tremolo Sand Frog)		*		
Tomopterna natalensis (Natal Sand Frog)				
Xenopus laevis (Common Platanna)				
*Xenopus muelleri (*Müller's Platanna)				
Chrissiesmeer	**Conservation Status**	**Common in Area**	**Endemic To SA**	**Charismatic**
Amietia delalandii (Common River Frog)		*		
Amietia poyntoni (Poynton's River Frog)		*		
Breviceps mossambicus (Mozambique Rain Frog)				*
Cacosternum boettgeri (Boettger's Caco)		*		
Hyperolius marmoratus (Painted Reed Frog)		*		*
Hyperolius semidiscus (Yellow-striped Reed Frog)				*
Kassina senegalensis (Bubbling Kassina)		*		
Phrynobatrachus natalensis (Snoring Puddle Frog)				
Ptychadena porosissima (Striped Grass Frog)		*		*
Sclerophrys gutturalis (Guttaral Toad)				
Sclerophrys capensis (Rauccos Toad)				
Semnodactylus wealii (Rattling Frog)		*		*
Strongylopus fasciatus (Striped Stream Frog)		*		
Strongylopus grayii (Clicking Stream Frog)		*		*
Tomopterna cryptotis (Tremolo Sand Frog)				

Tomopterna natalensis (Natal Sand Frog)		*		
Tomopterna tandyi (Tandy's Sand Frog)				
Xenopus laevis (Common Platanna)		*		

Table 2.11: Charismatic species of Mpumalanga

MPUMALANGA			
Species Name	**Common Name**	**Park Location**	**Charismatic Value**
Afrixalus aureus	Golden Leaf-folding Frog	Kruger NP	The specific epithet *aureus* refers to the golden colour of the frog
Breviceps adspersus	Bushveld Rain Frog	Kruger NP	Terrestrial nests are constructed in a labyrinth of tunnels underground in the soil in which 45 large eggs are laid Females stay with the eggs till the froglets leave the nest
Breviceps mossambicus	Mozambique Rain Frog	Chrissiesmeer	Species colour varies, depending on the habitat found in (mainland vs island)
Hildebrandtia ornata	Southern Ornata Frog	Kruger NP	Spectacular skin colouration - white throughout with black stripes
Hyperolius marmoratus	Painted Reed Frog	Kruger NP Chrissiesmeer	Common, yet beautifully coloured Call in massive choruses
Hyperolius semidiscus	Yellow-striped Reed Frog	Chrissiesmeer	Spectacular skin colouration - Green/olive colour with a yellow side band Breeding males usually found on floating water-lilies
Leptopelis mossambicus	Brown-backed Tree Frog	Kruger NP	Can call from high up in trees During dry periods they burrow to a depth of 250mm
Phrynomantis bifasciatus	Banded Rubber Frog	Kruger NP	Spectacular skin colouration - Black body with two reddish bands and reddish spots

Poyntonophrynus fenoulheti	Northern Pygmy Toad	Kruger NP	One of only two pygmy toad species in South Africa
Ptychadena porosissima	Striped Grass Frog	Chrissiesmeer	These are some of the best "jumping" species, known for leaping a couple of meters
Pyxicephalus edulis	Edible Bullfrog	Kruger NP	The specific epithet *edulis* refers to the fact that some communities eat this species Adults can bury themselves for almost a year and only emerge during breeding season
Semnodactylus wealii	Rattling Frog	Chrissiesmeer	When they feel threatened they pretend to be dead by curling up and remaining motionless
Strongylopus grayii	Clicking Stream Frog	Chrissiesmeer	Soft clicking sound of choruses can often be heard calling from wetland

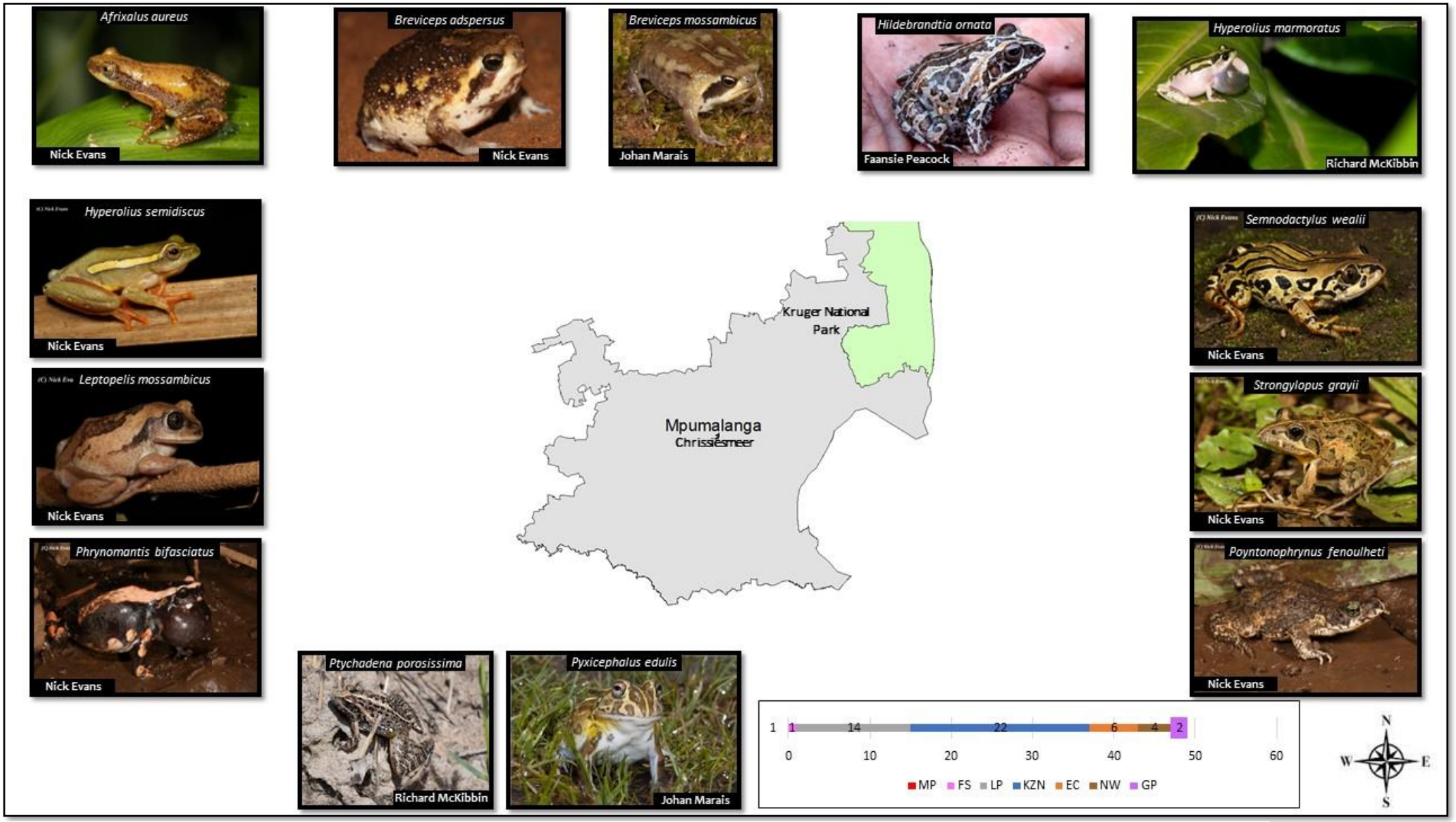


Figure 2.13: Map of Mpumalanga with the selected parks and charismatic species that can be found in the parks.

Limpopo

Table 2.12: Species found in the Limpopo parks with their criteria

LIMPOPO				
Kruger National Park (Limpopo region)	**Conservation Status**	**Common in Area**	**Endemic To SA**	**Charismatic**
Afrixalus aureus (Golden Leaf-folding Frog)		*		*
Amietia delalandii (Common River Frog)				
Arthroleptis stenodactylus (Shovel-footed Squeaker)				
Breviceps adspersus (Bushveld Rain Frog)		*		
Cacosternum boettgeri (Boettger's Caco)		*		
Chiromantis xerampelina (Southern Foam Nest Frog)		*		
Hemisus marmoratus (Mottled Shovel-nosed Frog)		*		
Hildebrandtia ornata (Southern Ornata Frog)				
Hyperolius marmoratus (Painted Reed Frog)		*		*
Hyperolius pusillus (Water Lily Frog)				*
Kassina maculata (Red-legged Kassina)				*
Kassina senegalensis (Bubbling Kassina)		*		
Leptopelis mossambicus (Brown-backed Tree Frog)				
Phrynobatrachus mababiensis (Dwarf Puddle Frog)		*		
Phrynobatrachus natalensis (Snoring Puddle Frog)		*		
Phrynomantis bifasciatus (Banded Rubber Frog)		*		
Poyntonophrynus fenoulheti (Northern Pygmy Toad)		*		*
Ptychadena anchietae (Plain Grass Frog)		*		
Ptychadena mossambica(Broad-banded Grass Frog)				

Ptychadena oxyrhynchus (Sharp-nosed Grass Frog)				*
Pyxicephalus edulis (Edible Bullfrog)		*		
Schismaderma carens (Red Toad)				
Sclerophrys garmani (Eastern Olive Toad)		*		
Sclerophrys gutturalis (Guttaral Toad)				
Sclerophrys pusilla (Flat-backed Toad)		*		
Sclerophrys capensis (Rauccos Toad)				
Tomopterna cryptotis (Tremolo Sand Frog)				
Tomopterna marmorata (Russer-backed Sand frog)				
*Xenopus muelleri (*Müller's Platanna)				
Mapungubwe	**Conservation Status**	**Common in Area**	**Endemic To SA**	**Charismatic**
Breviceps adspersus (Bushveld Rain Frog)		*		*
Cacosternum boettgeri (Boettger's Caco)				
Chiromantis xerampelina (Southern Foam Nest Frog)		*		
Hemisus guineesis (Guinea Shovel-nosed Frog)				*
Hemisus marmoratus (Mottled Shovel-nosed Frog)		*		
Kassina senegalensis (Bubbling Kassina)		*		
Phrynobatrachus mababiensis (Dwarf Puddle Frog)				*
Phrynobatrachus natalensis (Snoring Puddle Frog)				*
Phrynomantis bifasciatus (Banded Rubber Frog)				
Poyntonophrynus fenoulheti (Northern Pygmy Toad)				
Ptychadena anchietae (Plain Grass Frog)		*		*
Ptychadena mossambica (Broad-banded Grass Frog)				
Pyxicephalus adspersus (Giant Bullfrog)				*
Pyxicephalus edulis (Edible Bullfrog)				

Sclerophrys garmani (Eastern Olive Toad)				
Sclerophrys gutturalis (Guttaral Toad)				
Sclerophrys pusilla (Flat-backed Toad)				
Tomopterna cryptotis (Tremolo Sand Frog)				
Tomopterna krugerensis (Knocking Sand Frog)				*
Tomopterna marmorata (Russer-backed Sand frog)				
Tomopterna natalensis (Natal Sand Frog)				
*Xenopus muelleri (*Müller's Platanna)				*
Marekele	**Conservation Status**	**Common in Area**	**Endemic To SA**	**Charismatic**
Amietia delalandii (Common River Frog)				
Breviceps adspersus (Bushveld Rain Frog)		*		
Cacosternum boettgeri (Boettger's Caco)				
Chiromantis xerampelina (Southern Foam Nest Frog)		*		
Hemisus marmoratus (Mottled Shovel-nosed Frog)				
Hildebrandtia ornata (Southern Ornata Frog)				*
Hyperolius marmoratus (Painted Reed Frog)		*		
Kassina senegalensis (Bubbling Kassina)		*		*
Phrynobatrachus natalensis (Snoring Puddle Frog)		*		
Phrynomantis bifasciatus (Banded Rubber Frog)		*		*
Ptychadena anchietae (Plain Grass Frog)				
Ptychadena mossambica (Broad-banded Grass Frog)				
Pyxicephalus edulis (Edible Bullfrog)				*
Schismaderma carens (Red Toad)				*
Sclerophrys garmani (Eastern Olive Toad)				
Sclerophrys gutturalis (Guttaral Toad)				

Sclerophrys pusilla (Flat-backed Toad)		*		
Sclerophrys poweri (Western Olive Toad)		*		
Sclerophrys capensis (Rauccos Toad)				
Tomopterna cryptotis (Tremolo Sand Frog)		*		
Tomopterna krugerensis (Knocking Sand Frog)				
Tomopterna marmorata (Russer-backed Sand frog)				
Tomopterna natalensis (Natal Sand Frog)				
Xenopus laevis (Common Platanna)				

Table 2.13: Charismatic species of Limpopo

LIMPOPO			
Species Name	**Common Name**	**Park Location**	**Charismatic Value**
Afrixalus aureus	Golden Leaf-folding Frog	Kruger NP	The specific epithet *aureus* refers to the golden colour of the frog
Breviceps adspersus	Bushveld Rain Frog	Kruger NP Mapungubwe Marekele NP	Terrestrial nests are constructed in a labyrinth of tunnels underground in the soil in which 45 large eggs are laid Females stay with the eggs till the froglets leave the nest
Chiromantis xerampelina	Southern Foam Nest Frog	Kruger NP Mapungubwe Marekele NP	Characteristic white foam nests in which eggs are laid can be seen in trees overhanging water
Hemisus guineesis	Guinea Shovel-nosed Frog	Mapungubwe	The only place in South Africa where this species can be found is in the Mapungubwe region
Hildebrandtia ornata	Southern Ornata Frog	Kruger NP Marekele NP	Spectacular skin colouration - white throughout with black stripes

Hyperolius marmoratus	Painted Reed Frog	Kruger NP Marekele NP	Common, yet beautifully coloured Call in massive choruses
Kassina maculata	Red-legged Kassina	Kruger NP	Call from deep ponds Prominent scarlet red patches found on armpits
Kassina senegalensis	Bubbling Kassina	Kruger NP Mapungubwe Marekele NP	Spectacular skin colouration - Yellow back with black vertebral lines Prefers running to jumping
Phrynobatrachus mababiensis	Dwarf Puddle Frog	Kruger NP Mapungubwe	Tiny frog named after the Mababe Depression in Botswana where the species was originally found
Phrynobatrachus natalensis	Snoring Puddle Frog	Kruger NP Mapungubwe	Can be found in muddy tracks left by cattle and game
Phrynomantis bifasciatus	Banded Rubber Frog	Kruger NP Mapungubwe Marekele NP	Spectacular skin colouration - Black body with two reddish bands and reddish spots
Poyntonophrynus fenoulheti	Northern Pygmy Toad	Kruger NP Mapungubwe	One of only two pygmy toad species in South Africa
Ptychadena oxyrhynchus	Sharp-nosed Grass Frog	Kruger NP	They can jump very far and cover up to 60 times its own body length in one leap (holds record for the world's longest jump)
Pyxicephalus adspersus	Giant Bullfrog	Mapungubwe	The largest frog in South Africa Will attack even people when guarding their larvae
Pyxicephalus edulis	Edible Bullfrog	Kruger NP Mapungubwe Marekele NP	The specific epithet *edulis* refers to the fact that some communities eat this species Adults can bury themselves for almost a year and only emerge during breeding season

Schismaderma carens	Red Toad	Kruger NP Marekele NP	Long repetitive **whoob** call, often confused with the Giant Bullfrog A toad able to climb the bark of trees
Tomopterna krugerensis	Knocking Sand Frog	Mapungubwe Marekele NP	Large eyes make this an attractive frog
Xenopus muelleri	Müller's Platanna	Kruger NP Mapungubwe	They have webbed feet to improve swimming Distinct yellow bellies

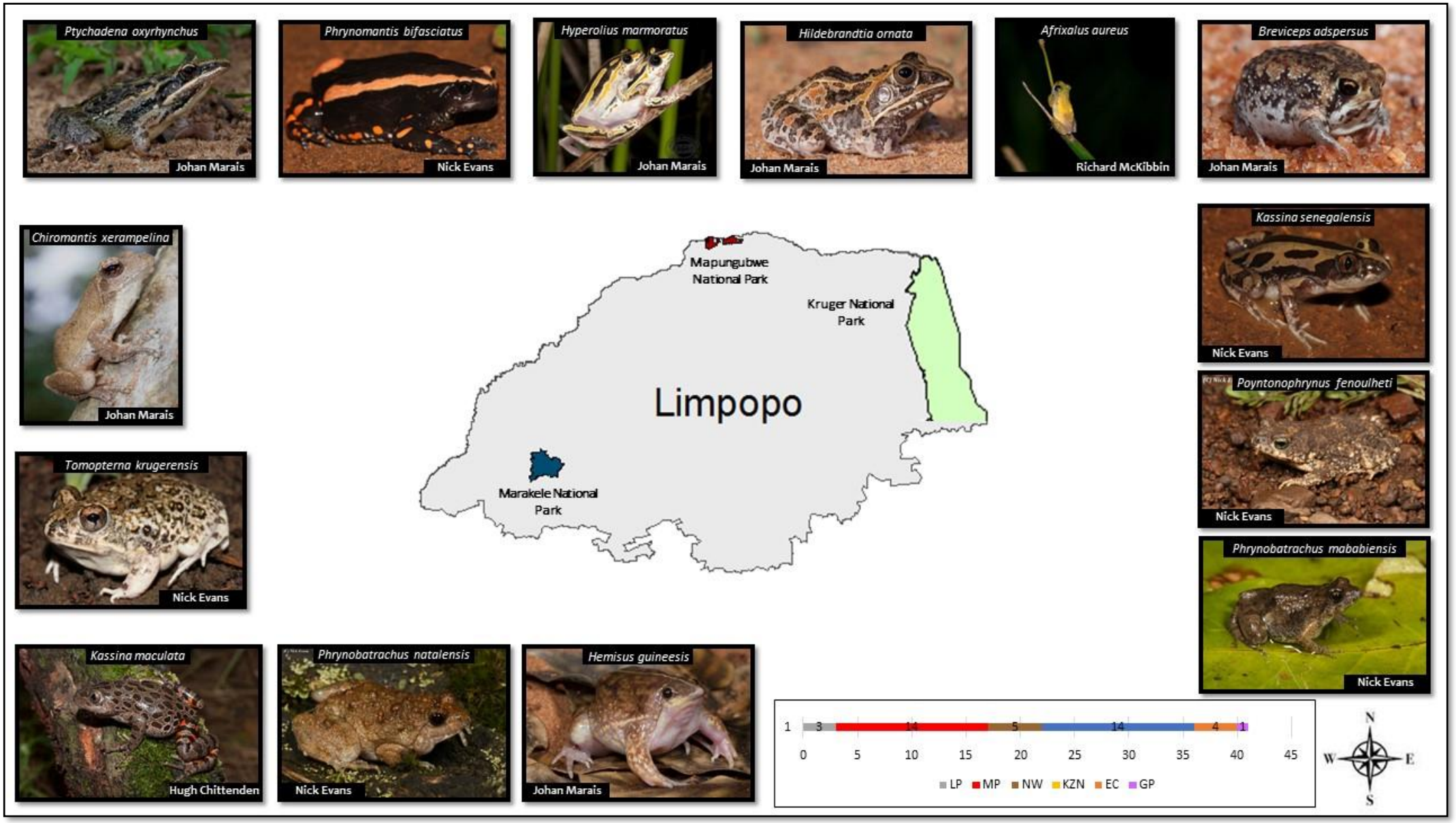


Figure 2.14: Map of Limpopo with the selected parks and charismatic species that can be found in the parks.

North West

Table 2.14: Species found in the North West parks with their criteria

NORTH WEST				
Pilansberg National Park	**Conservation Status**	**Common in Area**	**Endemic To SA**	**Charismatic**
Amietia delalandii (Common River Frog)				*
Breviceps adspersus (Bushveld Rain Frog)				
Cacosternum boettgeri (Boettger's Caco)		*		
Chiromantis xerampelina (Southern Foam Nest Frog)				*
Kassina senegalensis (Bubbling Kassina)		*		
Phrynobatrachus natalensis (Snoring Puddle Frog)				
Phrynomantis bifasciatus (Banded Rubber Frog)		*		
Poyntonophrynus fenoulheti (Northern Pygmy Toad)				*
Poyntonophrynus vertebralis (Southern Pygmy Toad)			*	
Ptychadena anchietae (Plain Grass Frog)		*		*
Ptychadena mossambica(Broad-banded Grass Frog)		*		
Pyxicephalus adspersus (Giant Bullfrog)				*
Pyxicephalus edulis (Edible Bullfrog)				
Schismaderma carens (Schismadera carens)				
Sclerophrys garmani (Eastern Olive Toad)				
Sclerophrys gutturalis (Guttaral Toad)		*		
Sclerophrys poweri (Western Olive Toad)		*		
Tomopterna cryptotis (Tremolo Sand Frog)		*		
Tomopterna krugerensis (Knocking Sand Frog)				*

Tomopterna natalensis (Natal Sand Frog)		*		
Xenopus laevis (Common Platanna)		*		
Madikwe	**Conservation Status**	**Common in Area**	**Endemic To SA**	**Charismatic**
Breviceps adspersus (Bushveld Rain Frog)		*		
Cacosternum boettgeri (Boettger's Caco)		*		
Chiromantis xerampelina (Southern Foam Nest Frog)		*		
Hemisus marmoratus (Mottled Shovel-nosed Frog)				
Hildebrandtia ornata (Southern Ornata Frog)				
Kassina senegalensis (Bubbling Kassina)		*		*
Phrynobatrachus natalensis (Snoring Puddle Frog)				
Phrynomantis bifasciatus (Banded Rubber Frog)		*		*
Poyntonophrynus vertebralis (Southern Pygmy Toad)			*	
Ptychadena anchietae (Plain Grass Frog)				
Ptychadena mossambica(Broad-banded Grass Frog)		*		
Pyxicephalus adspersus (Giant Bullfrog)				
Pyxicephalus edulis (Edible Bullfrog)				*
Schismaderma carens (Schismadera carens)				*
Sclerophrys garmani (Eastern Olive Toad)				
Sclerophrys gutturalis (Guttaral Toad)				
Sclerophrys poweri (Western Olive Toad)		*		
Tomopterna cryptotis (Tremolo Sand Frog)				
Xenopus laevis (Common Platanna)		*		

Table 2.15: Charismatic species of North West

NORTH WEST			
Species Name	**Common Name**	**Park Location**	**Charismatic Value**
Amietia delalandii	Common River Frog	Pilansberg Nature Reserve	A very recognisable call due to the species wide distribution
Chiromantis xerampelina	Southern Foam Nest Frog	Madikwe Pilansberg Nature Reserve	Characteristic white foam nests in which eggs are laid can be seen in trees overhanging water
Kassina senegalensis	Bubbling Kassina	Madikwe Pilansberg Nature Reserve	Spectacular skin colouration - Yellow back with black vertebral lines Prefers running to jumping
Phrynomantis bifasciatus	Banded Rubber Frog	Madikwe Pilansberg Nature Reserve	Spectacular skin colouration - Black body with two reddish bands and reddish spots
Poyntonophrynus fenoulheti	Northern Pygmy Toad	Pilansberg Nature Reserve	One of only two pygmy toad species in South Africa
Pyxicephalus adspersus	Giant Bullfrog	Madikwe Pilansberg Nature Reserve	The largest frog in South Africa Will attack even people when guarding their larvae
Pyxicephalus edulis	Edible Bullfrog	Madikwe Pilansberg Nature Reserve	The specific epithet *edulis* refers to the fact that some communities eat this species Adults can bury themselves for almost a year and only emerge during breeding season

Schismaderma carens	Red Toad	Madikwe Pilansberg Nature Reserve	Long repetitive **whoob** call, often confused with the Giant Bullfrog A toad able to climb the bark of trees
Tomopterna krugerensis	Knocking Sand Frog	Pilansberg Nature Reserve	Large eyes makes this an attractive frog

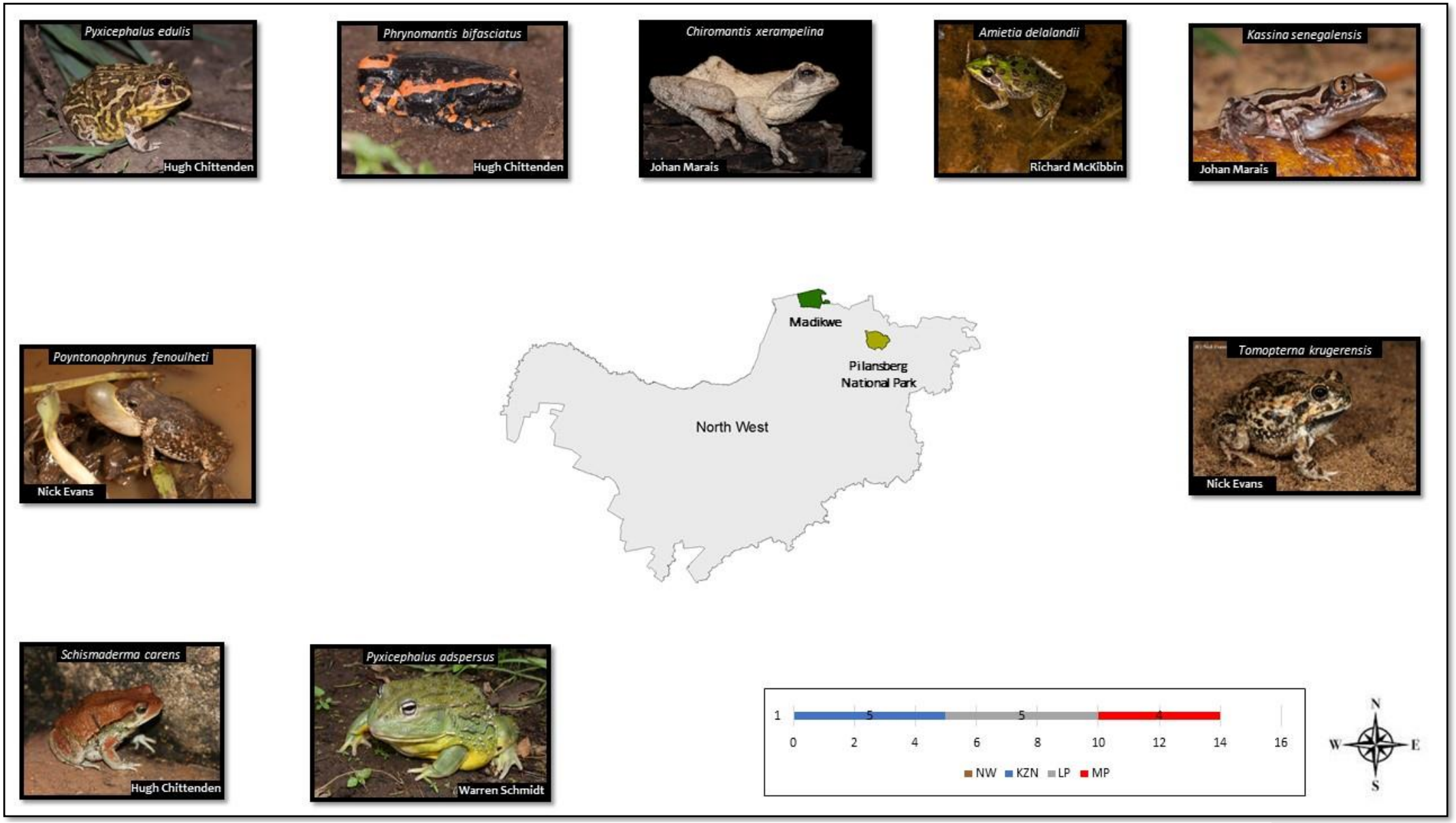


Figure 2.15: Map of North West with the selected parks and charismatic species that can be found in the parks.

Free State

Table 2.16: Species found in the Free State parks with their criteria

FREE STATE				
Golden Gate National Park	**Conservation Status**	**Common in Area**	**Endemic To SA**	**Charismatic**
Amietia delalandii (Common River Frog)				
Amietia poyntoni (Poynton's River Frog)				
Amietia vertebralis (Maluti River Frog)				
Anhydrophryne hewitti (Natal Chirping Frog)			*	
Breviceps adspersus (Bushveld Rain Frog)				
Breviceps mossambicus (Mozambique Rain Frog)				*
Cacosternum boettgeri (Boettger's Caco)		*		*
Cacosternum nanum (Bronze Caco)				
Hadromophryne natalensis (Natal Cascade Frog)				
Kassina senegalensis (Bubbling Kassina)				*
Sclerophrys gutturalis (Guttaral Toad)		*		
*Sclerophrys capensis (*Rauccos Toad*)*				
Semnodactylus wealii (Rattling Frog)				*
Strongylopus fasciatus (Striped Stream Frog)				*
Strongylopus grayii (Clicking Stream Frog)				
Strongylopus wageri (Plain stream Frog)			*	
Tomopterna cryptotis (Tremolo Sand Frog)				
Vandijkophrynus gariepensis (Karoo Skurwepadda)		*		
Xenopus laevis (Common Platanna)		*		

Table 2.17: Charismatic species of Free State

FREE STATE			
Species Name	**Common Name**	**Park Location**	**Charismatic Value**
Kassina senegalensis	Bubbling Kassina	Golden Gate NP	Spectacular skin colouration - Yellow back with black vertebral lines Prefers running to jumping
Cacosternum boettgeri	Boettger's Caco	Golden Gate NP	Call in mass choruses in road side pools after summer rains
Semnodactylus wealii	Rattling Frog	Golden Gate NP	When they feel threatened they pretend to be dead by curling up and remaining motionless
Strongylopus fasciatus	Striped Stream Frog	Golden Gate NP	Known for having longer and slender fingers than most other frog species

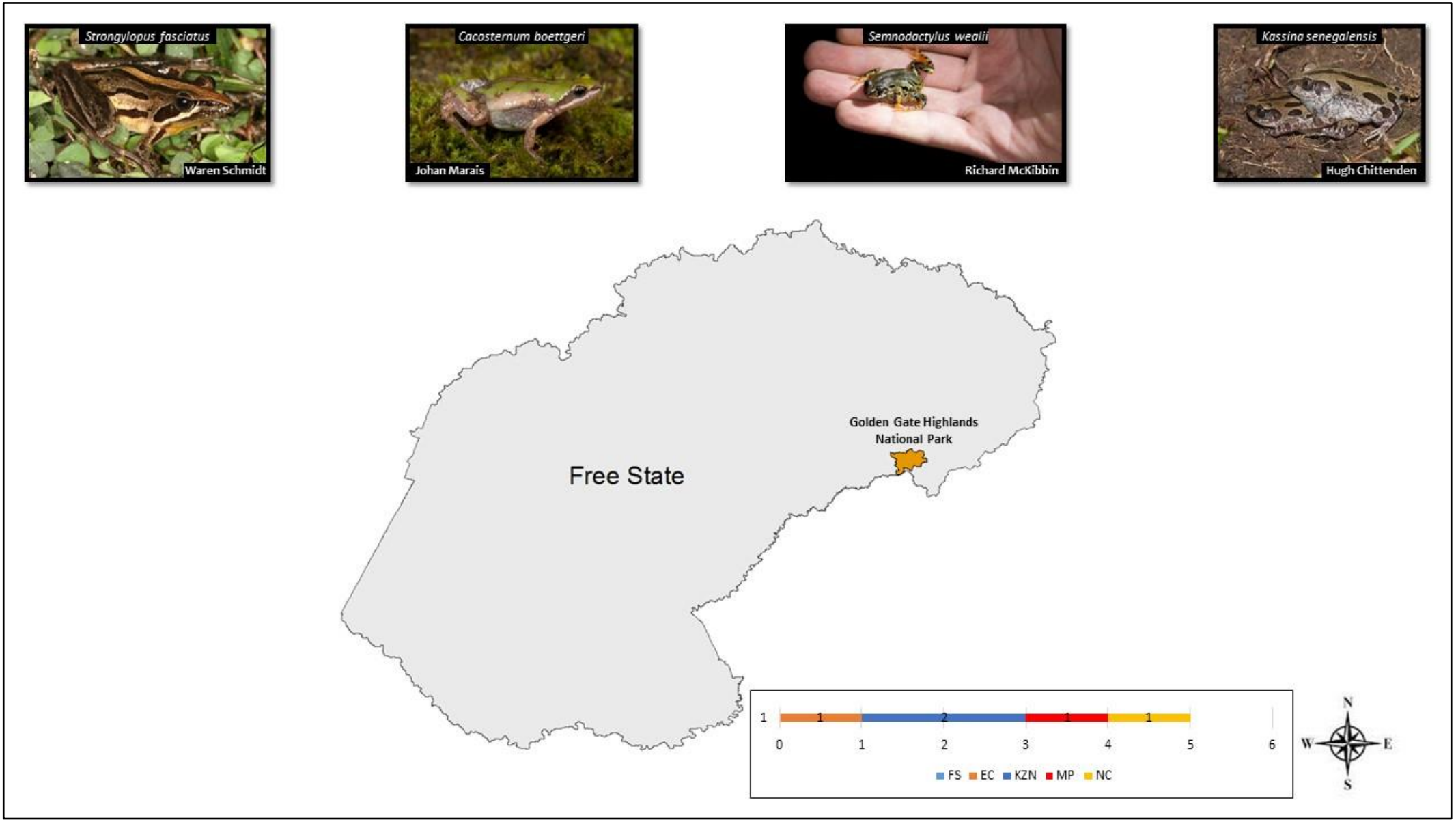


Figure 2.16: Map of Free State with the selected parks and charismatic species that can be found in the parks.

Gauteng

Table 2.18: Species found in the Gauteng parks with their criteria

GAUTENG				
Suikerbosrand	**Conservation Status**	**Common in Area**	**Endemic To SA**	**Charismatic**
Amietia delalandii (Common River Frog)		*		
Amietia poyntoni (Poynton's River Frog)		*		
Cacosternum boettgeri (Boettger's Caco)		*		
Kassina senegalensis (Bubbling Kassina)		*		*
Phrynobatrachus natalensis (Snoring Puddle Frog)				
Pyxicephalus adspersus (Giant Bullfrog)		*		*
Schismaderma carens (Schismadera carens)				
Sclerophrys garmani (Eastern Olive Toad)				
Sclerophrys gutturalis (Guttaral Toad)		*		
Sclerophrys poweri (Western Olive Toad)		*		
Sclerophrys capensis (Rauccos Toad)		*		
Semnodactylus wealii (Rattling Frog)				*
Strongylopus fasciatus (Striped Stream Frog)				*
Tomopterna cryptotis (Tremolo Sand Frog)		*		
Tomopterna natalensis (Natal Sand Frog)		*		
Xenopus laevis (Common Platanna)		*		

Table 2.19: Charismatic species of Gauteng

GAUTENG			
Species Name	**Common Name**	**Park Location**	**Charismatic Value**
Kassina senegalensis	Bubbling Kassina	Suikerbosrand	Spectacular skin colouration - Yellow back with black vertebral lines Prefers running to jumping
Pyxicephalus adspersus	Giant Bullfrog	Suikerbosrand	The largest frog in South Africa Explosive breeders Males will attack even people when guarding their tadpoles One of the few frogs with teeth at front of jaw Males larger than females
Semnodactylus wealii	Rattling Frog	Suikerbosrand	When they feel threatened they pretend to be dead by curling up and remaining motionless
Strongylopus fasciatus	Striped Stream Frog	Suikerbosrand	Known for having longer and slender fingers than most other frog species Call throughout winter

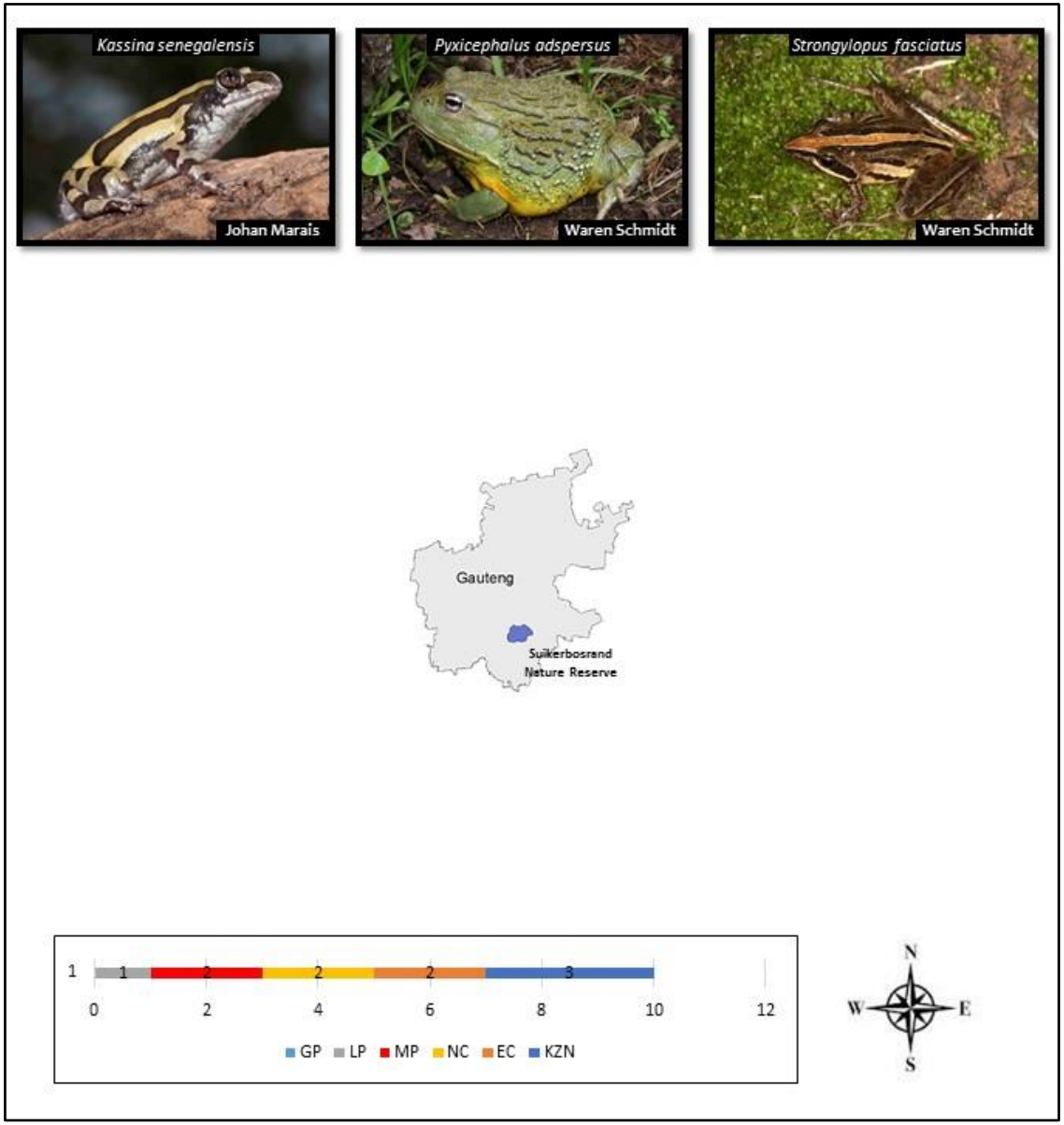


Figure 2.17: Map of Gauteng with the selected parks and charismatic species that can be found in the parks.

Table 2.20: South African Amphibian species that fall in a region that is not part of the researched parks.

Species	Province	Location	CONSERVATION STATUS	COMMON IN AREA	ENDEMIC TO SA	CHARISMATIC
Breviceps macrops (Desert Rain Frog)	Northern Cape	Port Nolloth				*
Amietia vandijki (Van Dijk's River Frog)	Western Cape	Marloth Nature Reserve (Swellendam)			*	
Arthroleptella bicolor (Bainskloof Moss Frog)	Western Cape	Limietberg			*	
Arthroleptella drewesii (Drewe's Moss Frog)	Western Cape	Hermanus/Babilonstoring Mountain			*	*
Arthroleptella landdrosia (Landdroskop Moss Frog)	Western Cape	Swartboskloof/Helderberg mountain			*	
Arthroleptella rugosa (Rough Moss Frog)	Western Cape	Klein Swartberg (Caledon)	CR		*	
Arthroleptella subvoce (Northern Moss Frog)	Western Cape	Groot Winterhoek Mountains	CR		*	
Arthroleptella villiersi (De Villiers' Moss Frog)	Western Cape	Kleinmond/Kogelberg				
Cacosternum karooicum (Karoo Caco)	Western Cape	Vrolijkheid Nature Reserve/Karoo NP			*	
Capensibufo deceptus (Deception Peak Mountain Toadlet)	Western Cape	Du Toitskloof (Paarl)			*	

Capensibufo magistratus (Landdroskop Mountain Toadlet)	Western Cape	Hottentots Holland Nature Reserve			*	
Capensibufo selenophos (Moonlight Mountain Toadlet)	Western Cape	Maanschynkop Nature Reserve			*	
Heleophryne depressa (Cederberg Ghost Frog)	Western Cape	Keeromsberg, Worcester			*	*
Heleophryne purcelli (Cape Ghost Frog)	Western Cape	Betty's Baai (Koggelberg Nature Reserve), Du Toit's Kloof		*	*	*
Poyntonia paludicola (Montane Marsh Frog)	Western Cape	Jonkershoek, Franschhoek Pass	NT		*	
Anhydrophryne rattrayi (Hogsback Frog)	Eastern Cape	Great Fish River Reserve/Hogsback	EN		*	*
Heleophryne hewitti (Hewitt's Ghost Frog)	Eastern Cape	Geelhoutboom river, Elandsberg	EN		*	*
Vandijkophrynus amatolicus (Amatola toad)	Eastern Cape	Hogsback	CR		*	
Anhydrophryne ngongoniensis (Mistbelt Moss Frog)	KwaZulu-Natal	Kokstad Area/Ixopo	EN		*	*
Breviceps bagginsi (Bilbo's Rain Frog)	KwaZulu-Natal	Babanango			*	
Cacosternum striatum (Striped Caco)	KwaZulu-Natal	Franklin			*	
Cacosternum thorini (Hogsback Caco)	KwaZulu-Natal	Hogsback			*	

Natalobatrachus bonebergi (Kloof Frog)	KwaZulu-Natal	Vernon Crooks Nature Reserve	EN		*	*
Breviceps sylvestris (Northern Forest Rain Frog)	Limpopo	Magoebaskloof (Woodbush Forest Reserve)	NT	*	*	*

Table 2.21: Charismatic value of species not occurring in a specific park.

NO-PARK SPECIFIC SPECIES		
Species Name	**Common Name**	**Charismatic Value**
Anhydrophryne ngongoniensis	Mistbelt Moss Frog	Found only in the misbelt area of KZN
Anhydrophryne rattrayi	Hogsback Frog	Named after George Rattray who first discovered the species in the Hogsback area Bird-like call Lives on the ground in mossy forest floor where it lays its eggs Males have hardened nose to dig nest
Arthroleptella drewesii	Drewe's Moss Frog	Tiny cryptic frog with insect-like call
Breviceps sylvestris	Northern Forest Rain Frog	Most threatened of the rain frogs
Heleophryne depressa	Cederberg Ghost Frog	Enigmatic species with very restricted distribution
Heleophryne hewitti	Hewitt's Ghost Frog	Enigmatic species with very restricted distribution
Heleophryne purcelli	Cape Ghost Frog	Enigmatic species with very restricted distribution
Natalobatrachus bonebergi	Kloof Frog	Classic example of frogs that lays its eggs outside of water on rock faces or leaves overhanging water Handsome frog with sharp feature Unique toes Genetically distinct
Vandijkophrynus amatolicus	(Amatola toad)	Can only be found in the area of Hogsback

2.4 Conclusion

The objective of this chapter was to identify biodiversity and conservation hotspots in South Africa that may benefit frog ecotourism. From the above tables and figures it is clear that South Africa has a wide variety of frog species distributed around the different biomes. Fortunately, South Africa has many existing parks that protect a large proportion of our frog species. These parks can equally function to promote frog diversity as a tourist attraction and consequently enhance their conservation. The abovementioned maps and species lists can be used by various parks all over South Africa as a guideline for species lists and distribution maps. The idea behind the creation of these maps is to visualize the areas in each province that attract tourists and to include information from these maps in provincial tourism information booklets.

The 22 identified parks with their surrounding areas can ultimately employ frogging guides to take tourists out on excursions. These frogging lists and maps can be a tool for guides to become informed about the species in his/her environment and can aid as a visual tool for tourists to make frogging more informative.

CHAPTER 3: EMPIRICAL RESULTS

3.1 Introduction

"Frogging" is a well-known term within the frog conservation and enthusiast community where it describes the activity of searching for frogs in nature. Unfortunately, the conservation of amphibians does not receive the same attention from public and conservation authorities as the conservation of more charismatic endangered species such as rhinos or wild dogs (Estren, 2012). These attitudes are largely ascribed to a lack of knowledge about frogs and because most native folklore and mythology about frogs often have negative connotations (Ceriaco, 2012). Tisdell *et al.* (2007) found that the public are more willing to get actively involved in conservation efforts of a particular species once the species becomes more endangered or well known (Tisdell & Wilson, 2012:288). With this in mind, the question can be asked whether the public might become more involved in the conservation of amphibians once it is emphasised that amphibians are threatened and need urgent conservation action. By involving tourists in the conservation and understanding of frogs, it is important to properly understand the market of ecotourism as well as the needs of tourists. Such information can be used to better plan and manage this supplemental amphibian conservation approach, which could contribute to its sustainability.

Volunteer projects (volunteerism) in South Africa are among the most recent forms of responsible tourism in the world (Davide, 2011). Determining how ecotourism could help to conserve frogs requires that more data and information be gathered on this topic, but information is scarce. The NGO Earthwatch (paying volunteers to assist with conservation-related research projects) do have projects involving amphibians, although they only make up one percent of their projects (IRG, 1992 & EarthWatch, 2017). Volunteers that went on nocturnal frog and habitat surveys in the hope of finding clues to the declining numbers of Australian tropical frogs (IRG, 1992), serves as a good example. Another conservation campaign was held in 2008 by Two Oceans Aquarium in South Africa, which serves as an example for modelling future frog ecotourism initiatives. The campaign consisted of The Two Oceans Aquarium that joined 500 other international zoos and aquariums to be part of one of the biggest collaborative efforts to raise awareness's of the dilemma of amphibians (Stern, 2008). The World Association of Zoos and Aquariums and the International Union for the Conservation of Nature declared 2008 the Year of the Frog and the South African aquarium displayed a temporary frog exhibition (*Beyond the Pond*) to celebrate the life and environment of frogs and toads. This frog exhibit helped to raise money for frog breeding programmes and

raised awareness of the threats to frogs and other amphibians amongst visitors (Stern 2008). These kinds of conservation initiatives may help to educate tourists visiting the frog ecotourism destinations on how they can help to mitigate threats facing frogs and their habitats.

There are only a few tourist destinations in South Africa that have established "frogging safaris", but these function outside of the government operated conservation sector. Lake Chrissie near the town of Chrissiesmeer, in Mpumalanga (SAT, 2017 & Chrissiesmeer, 2017) take their tourists out on frogging safaris where the guests can enjoy being surrounded by frog choruses, and partake in the collection, identification of frogs. Chrissiesmeer, also known as Matotoland "frog land" has an annual frogging festival during the first week of December (Chrissiesmeer, 2017). At this festival frog enthusiasts and curious guests can learn about frogs in various interesting activities. The area has a total of 13 different species that can be seen during this festival, including the striped grass frog (*Ptychadena porosissima*) which is well known for its record-breaking jumping abilities*.* The town of Wakkerstroom also had a frogging weekend in January 2017 that was hosted by Kristi Garland (Birdlife South Africa), Nick Evans (KZN Amphibian & Reptile Conservation) and Richard and Candice McKibbin (The Lionheart Experience) (Wakkerstroom, 2017). The weekend primarily focused on frogs and the conservation of frogs. A total of 14 frog species were found during the weekend, including the charismatic Rattling frogs (*Semnodactylus wealii)*.

More of these types of conservation projects, which include tourism, can be created in South Africa to help with conservation and financial aid toward amphibians. According to the Kirklees Council of the United Kingdom (Kirklees, 2014) a questionnaire can be defined as a tool that is used for the collection of information and opinions about a specific issue of interest. It consists of a list of questions with clear instructions on how the questions should be answered. It is always important to make sure that the questions have a definite purpose and that it is related to the objectives of the study. Respondents need to be clearly aware of the purpose of the research and how it will be analysed and used (Kirklees, 2014). However, it should be kept in mind that a questionnaire is not a comprehensive means of evaluation and should be used to support and supplement other procedures (Miller, 2002). This chapter serves as a supplement to the frog ecotourism hotspot analyses from chapter 2 and, will be used to create recommendations on how frogging can be incorporated as a future tourism activity in SANParks and South Africa.

Questionnaires can be used to question citizens/tourists about their opinion on the tourism potential of frogging in South Africa; and whether frog-related tourism can help with amphibian conservation. With the use of the internet, questionnaires can be distributed amongst a broad audience. Questionnaires can be quick and simple to complete and can help to provide the

first attempt to assess the status of all amphibian conservation activities and processes in place for multiple species (see Washington, 2012).

The objective of this chapter was to determine whether tourists would be interested in participating in frog-related ecotourism activities. A questionnaire was compiled and used to retrieve information regarding this subject (ethical number: EMS2016/11/04-0213 & EMS2016/11/04-0214 (online), see Appendix D).

3.2 Method of research

Two different research methods were used in this study to obtain information about amphibian conservation in South Africa, using ecotourism. Firstly, interviews were done with already existing amphibian "friendly" tourist destinations to assess their strategies and obtain any recommendations they might have for similar projects (Qualitative). Secondly, a questionnaire was compiled to be completed online by respondents (visitors to South Africa National Parks) to assess their opinion on including frogging with ecotourism (Quantitative).

3.2.1 Interview Questionnaire

The following section will include the methods of the interview questionnaire.

3.2.1.1 Method of collecting data

A method was needed to determine the success of existing frog-related ecotourism activities at tourism destinations in South Africa. A qualitative survey was conducted by interviewing institutions that are or have at some point provided frogging activities. The only relevant institutions for which information regarding current frogging activities was available were Lake Chrissie, the Wakkerstroom frogging event, Amakhosi Safari Lodge, Kenilworth Racecourse Conservation Area, Tanglewood Farm Private Nature Reserve, Mount Moreland Conservancy and Dune Ridge Country House (see table 3.1). Open-ended questions were asked to gather information on the opinion and experiences of the participant about their frog-related ecotourism activities. The survey method was qualitative in nature and no statistical analyses were done. This method is advantageous, because it gives respondents the opportunity to express their opinions regarding the relevant questions.

Table 3.1: A list of tourism destinations in South Africa that were interviewed for the study, including their locations.

Name of park/company/attraction:	Name of amphibian/frog activity:	Location
Amakhosi Safari Lodge, Private game reserve	Frogging Safari	Pongola: KwaZulu-Natal
Kenilworth Racecourse Conservation Area (KRCA)	KRCA frog walks	Cape Town: Western Cape
Tanglewood Farm Private Nature Reserve	Frogging evenings	Westdean: KwaZulu-Natal
Mount Moreland Conservancy	Frogging evenings	Durban: KwaZulu-Natal
BirdLife centre at Wakkerstroom	Frogging evenings	Wakkerstroom: Mpumalanga
Dune Ridge Country House	Dune Ridge Frog Safari	St. Francis: Eastern Cape
Matotoland Ecotourism Chrissiesmeer Mpumalanga	Paddanag	Chrissiesmeer: Mpumalanga

3.2.1.2 Development of interview questions

The method used to retrieve the type of information needed was an interview questionnaire. A list of tourism destinations that were known to offer frogging events was compiled and a general email was sent out to all of the identified managers to enquire about their willingness to participate in the study. A total of ten tourism destinations were initially contacted to find out if they would be interested in participating of which seven responded. Consquently, these institutions served as sampling size, and completed the interview consisting of open-ended questions. To generate information on the success, failures and recommendations of the tourism entities, questions covering various aspects of amphibian ecotourism activities were asked. Overall, the questions selected reflected the exploratory nature of the sudy. It was agreed that the answers gathered from the survey would only be used for this project; this was done for the confidentiality of the operators. All participants were asked the same questions aimed at the following five points of interest (See Appendix B for an example of the questionnaire):

- successes of their programme;
- failures of their programme;

- whether the project had ended or is continuing;
- recommendations for growing "frogging" tourism; and
- whether any impacts on the environment resulted through these activities.

3.2.1.3 Data Analysis

The steps provided in a document called, *Analysing Qualitative Data* by Ellen Taylor-Powel and Marcus Renner (2003), was used to analyse the data for the open-ended questions of the interview questionnaire and can be summarised as follows:

- Step 1: Get to know the data. The responses were read through to become familiar with the opinions of the participants.
- Step 2: Focus the analysis. The focus was given to the questions that had a useful response contributing to the ecotourism potential of frogs.
- Step 3: Categorize information. Categorize all the same type of responses together. While categorizing the responses other information can also be brought to light that can serve as a new answer to a question that might not have been asked.
- Step 4: Identify patterns and connections within categories. Identify themes and patterns between the different responses to the same question to find matching and contrasting answers.
- Step 5: Interpretation. Summarize all the responses into a valuable text to give a qualitative result.

3.2.2 Online Questionnaire

The following section will include the methods of the interview questionnaire.

3.2.2.1 Method of collecting data

A method was needed to find out if the general public would be interested in partaking in frog-related activities in South Africa. A large number of individuals was required to have useful data and the method used to retrieve this type of information was an online questionnaire that was uploaded onto SANParks website (https://www.SANParks.org/about/news/?id=56912). Due to time and financial constraints an online questionnaire was selected for gathering data and therefor web-based survey was used (Fricker & Schonlau, 2002). SANParks was chosen due to the existing partnership with the NWU tourism department. SANParks publishes questionaires, in partnership with the NWU, on their website on a regular basis. Previous NWU questionaires published on their website received a high success rate, which served as the basis of this study (P. van der Merwe pers. comm.). Non-probability sampling was applied,

more specifically convenience sampling (Patel, 2009 & Mathers *et al.*, 2007). Quantitative research is useful in the collection of large samples sizes, which in turn contributes to the statistical validity of the data (Patel, 2009). This method is advantageous, because the data gathered can be analysed using statistical programmes (Excel and SPSS), where the coding for each question can just be imported into the statistical programme (Mathers *et al.*, 2007).

3.2.2.2 Development of the questionnaire

The questionnaire was developed with the help of TREES, North-West University and SANParks (South African National Parks) marketing division. To generate information on how tourists would feel about taking part in amphibian related activities the questions covered various aspects of amphibian conservation and ecotourism. Previous questionaires published by TREES and NWU and with the help of staff members from the tourism faculty was used to compile appropriate questions. Literature research from chapter 1 and 2 was also used to assemble questions about the demand for amphibian conservation. The questionnaire was edited by a panel of three academics, my study and co-study leaders, and members from SANParks and TREES until a final questionnaire was issued to be published on the website of SANPARKS. The questionnaire was open to all tourists with access to the SANParks website.

The aims of the questionnaire study were to determine:

- the influence of demographics on the different aspects regarding ecotourism and the combination of frog-related activities.
- how respondents perceive amphibian conservation and its necessity.
- respondents' willingness to participate in amphibian tourism activities.
- whether ecotourism frogging activities can contribute towards the conservation of frogs in South Africa.

3.2.2.3 Sampling Method

The link of the questionnaire was posted on SANParks (2017) website (https://www.SANParks .org/about/news/?id=56912). If a person clicked on the link they were redirected to the questionnaire and had the option to complete it.

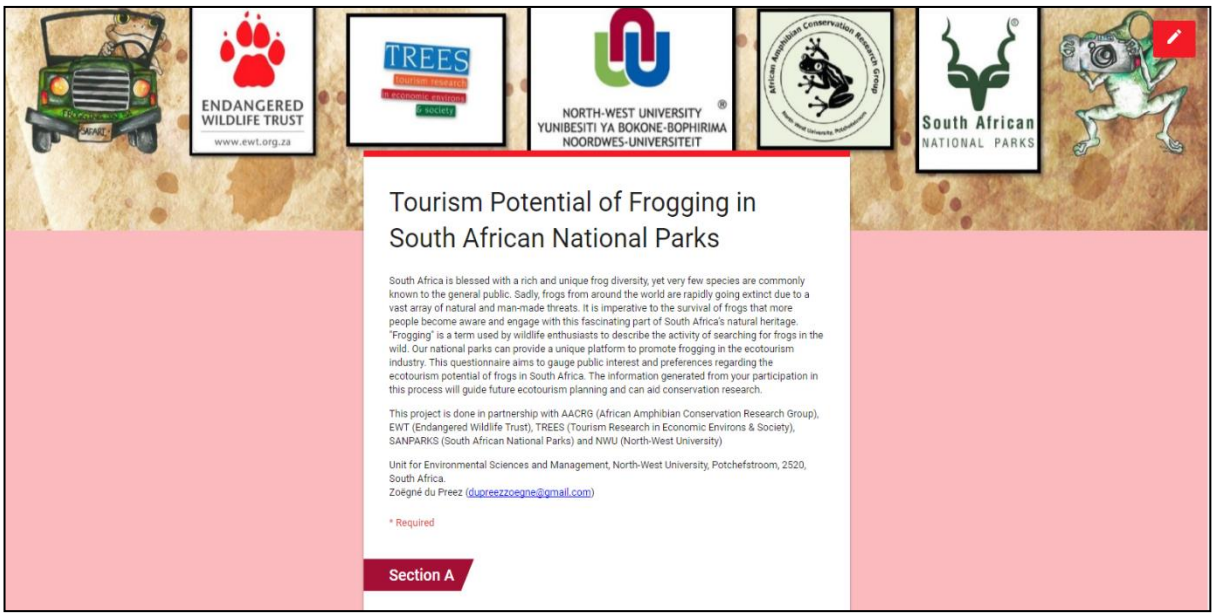


Figure 3.1: Excerpt from the online questionnaire as it appeared online.

The questionnaire was accessible to the public for 6 weeks. The data was collected using Google Forms that offered live and instant access to the feedback. During this period, a total of 356 (n) completed questionnaires were returned by the automated online server.

3.2.2.4 Data Analysis

The data received from the questionnaires were captured in Google Forms and exported to a Microsoft Excel file format for further use and interpretation.

- Descriptive results:

Each question was evaluated individually and either a graph or table was created that best represented the data. Informative answers were displayed in the result section of this chapter in the form of a figure or table and some cases grouped under certain categories for a better interpretation of the results. Respondents with unique responses to open questions were listed in tables and the same process was followed as with the interview questionnaire (see section 3.2.1). The opinions or answers that received the most or least votes were then used to discuss the results.

- Explorative results:

Statistical analysis was done in collaboration with the NWU Statistical Consultation Services. All data were subjected to three analyses namely a factor analysis, an ANOVA test and a Tukey's test. The analyses were done using SPSS 24 (Statistical Package of Social Sciences) software.

Factor analysis: This analysis is a statistical method that is used to analyse if there is a linear relationship between a large sample size composed of many variables and a smaller set of unobservable factors (Yong & Pearce, 2013 & Child, 2006). The factor analysis was used to regroup a large number of variables of the questionnaire into smaller descriptive categories (from now on called factors) based on shared variances. Cronbach's Alpha coefficients were calculated on the identified factors (variables), and Non-parametric correlation tests were done to determine relationship between diffirent factors and the influence they have on one another. The p-value for the correlation coefficient is used to indicate whether or not there is a statistical significance between factors (variables). Effect sizes are used to evaluate the importance of such a significant statistical effect in practice. Effect size is an objective and standardised measure of the magnitude of the effect. Therefore, effect sizes can be used to compare results of different studies, factors (variables) and different scales of measurement as they are independent of measuring units.

ANOVA and Tukey's Post hoc test: ANOVA (Analysis of Variance) is a statistical method used to compare the variance between two or more groups with the variability within each group (van Emded, 2012). This helps to determine whether there is a statistically significant difference in average or mean score between two or more groups. ANOVA tests were performed to determine if the demographic variables (independent variables) influenced the motivational factors on whether specific groups of participants would participate in frog-related activities. To identify whether or not the values were relevant, a Levene's test of homogeneity were performed to test whether the null hypotheses of equal population variances should be rejected. If the Levene's test showed a $p \geq 0.05$, there was no statistically significant difference between the different groups compared with one another. However, if the Levene's test showed a $p \leq 0.05$, at least one of the groups compared to one another in the ANOVA had a significant statistical difference. In such a case Tukey's post-hoc test was performed in order to show which group differed significantly. This test determined to what level (low, medium or high) the demographic variable influenced the motivational factor.

3.3 Results & Discussion

3.3.1 Qualitative results

The following section will include the results of the answers gathered from the interviews.

*Answers for Mount Moreland Conservancy, Tanglewood Farm Private Nature Reserve, and Chrissiesmeer were provided by the same person who is the host of activities at these destinations.

3.3.1.1 Start and end year of the activity:

This question was incorrectly interpreted by most of the interviewees. The goal of the question was to find out in what year they started with frogging activities and whether it is ongoing or when they stopped. Instead, the candidates answered the season when they offer the activity. Depending on the location of the destination and the rainfall pattern the candidates indicated that they mainly offer the activity during the breeding and rainy seasons. Amokhosi Safari Lodge indicated that they mostly do frogging activities from November to March, Kenilworth Racecourse Conservation area does their frogging activities during July and August when it is mostly wet and the other destination all do their activities from September to March.

After analysing the responses and looking at the seasonal rainfall pattern of South Africa (Schulze, 1997) a table was drafted to evaluate whether the different destinations are hosting their frogging activities during the optimal time of the year for increasing the likelihood of encountering frogs.

Table 3.2: Current and suggested timing of frogging activities at the different destinations.

Rainfall season	Province	Destination	Current season of activities	Evaluation
All year	Western Cape (east part)	None		
	Eastern Cape (west part)	Dune Ridge Country House	September - March	Activities can be scheduled at more months of the year.
Winter	Western Cape (west part)	Kenilworth Racecourse Conservation Area (KRCA)	July – August	Activities are held at the right time of the year.

	Northern Cape (west part)	None		
Early summer - December	North-central part of South Africa	Matotoland Ecotourism Chrissiesmeer Mpumalanga	September - March	Activities are held at the right time of the year.
		BirdLife centre at Wakkerstroom	September - March	Activities are held at the right time of the year.
Mid-Summer - January	Northern part of South Africa	Amakhosi Safari Lodge, Private game reserve	November – March	Activities are held at the right time of the year.
Late Summer - February	Central South Africa	Mount Moreland Conservancy	September - March	Activities are held at the right time of the year.
		Tanglewood Farm Private Nature Reserve	September - March	Activities are held at the right time of the year.
Very Late Summer - March-May	Most parts of the Northern Cape	None		

This information shows that frogging is currently a seasonal activity, but due to the wide diversity of frogs all over South Africa and the different geographically distinct rainfall patterns, the activities can take place throughout the year in different parts of the county. It is clear that there remains a large part of South Africa that can be promoted for frogging activities to benefit the conservation of frogs in the various rainfall belts. If destinations throughout the country start hosting frogging events, frogging would not have to be restricted to being only a seasonal activity.

3.3.1.2 Scope of the activity:

Table 3.3: Current activities provided by the interviewed destination.

Name of park/company/attraction:	Answer:
Amakhosi Safari Lodge, Private game reserve	Frogging starts at dusk and is guided by an experienced person; one or more wetland areas

	are visited locating frogs mainly through their calls. Frogs found are then carefully placed in a small bottle for observation and then released again. Interesting info about the frogs is shared as well as the importance of conserving wetlands.
Kenilworth Racecourse Conservation Area (KRCA)	Members of the public are invited to attend a frog walk in the conservation area at night, mostly to see the Critically Endangered Micro Frog, *Microbatrachella capensis* (one of the smallest frogs in the country), but also other amphibians. Nets and torches are used to locate and capture frogs. The frogs are put on a viewing tray for the public to take photographs. Members of the public are educated about the conservation status of the Micro Frog and the role of amphibians as ecosystem indicators in ecosystems.
Tanglewood Farm Private Nature Reserve	Frogging takes place during the evening two times a month with an average of 10-15 people attending. The tourist gets educated about frogs and their role in nature and then they help to catch the frogs and can take pictures.
Mount Moreland Conservancy	
BirdLife centre at Wakkerstroom	
Dune Ridge Country House	Aimed at creating awareness about the environment and the amphibian crisis due to over population, building and expansion of towns, pollution and the over growth of alien vegetation.
Matotoland Ecotourism Chrissiesmeer Mpumalanga	To introduce amphibians to people and create awareness about the vital role that they play in nature. To create activities for families to enjoy together.

The most common frogging activities that are shared at each of these tourism destinations are the observing and catching of frogs from dusk. The tourists are taken out by a guide/expert and when a frog is found the guide will carefully catch it and place it in a container for tourists to then look and take photos. The activities also include educating the tourists about the

diversity of frog species and the importance of frogs to ecosystems. Some of the destinations have specific frog species that occur in the area so the frogging experience is more focused on a specific species, for example the Micro Frog at KRCA.

3.3.1.3 Successes of the project:

Table 3.4: Current or past success the different destinations feel they accomplished.

Name of park/company/attraction:	Answer:
Amakhosi Safari Lodge, Private game reserve	A lot of people enquire about the frogging activities.
Kenilworth Racecourse Conservation Area (KRCA)	With sufficient and educated staff (guides) the frog walks are a success and have been running since 2008.
Tanglewood Farm Private Nature Reserve	There are always sightings of rare frogs. On average, at least ten species can be found during a frogging trip. It's a fun way of promoting frogs and their conservation.
Mount Moreland Conservancy	
BirdLife centre at Wakkerstroom	
Dune Ridge Country House	Guests are made aware of amphibian conservation. By creating awareness even if it is in small numbers it's a handful of people more that might just treat the environment a little better and spread the word.
Matotoland Ecotourism Chrissiesmeer Mpumalanga	A lot of success in terms of awareness has been made over the past few years and over 200 people attended the 2016 "Paddanag".

In general, the destinations aim to create amphibian awareness towards the public about amphibian declines. They educate tourists on how to contribute towards amphibian conservation, and they are creating a positive attitude towards frogs. It is also important that the guides that take people out on the frogging trips are trained in frog identification. If the frogging activities are kept interesting, well promoted and contribute to conservation as it should then the activity can be a huge success (KRCA is an example).

3.3.1.4 Failures of the project:

Table 3.5: Failures that the interviewees encountered with their frogging events.

Name of park/company/attraction:	Answer:
Amakhosi Safari Lodge, Private game reserve	Even though a lot of people enquire about the frogging activities, the attendance rate isn't

	always as successful. In the dry season, there is a limited period for frogging.
Kenilworth Racecourse Conservation Area (KRCA)	The frog walks are climate dependant, there are always tourists who are willing to attend but on certain days (when it is too windy/ raining) we have to cancel the event. When KRCA's seasonal wetlands do not fill to maximum capacity, the Micro Frog calls can't be heard, and frogging events can't be arranged (due to the Micro Frog being the main theme of the frog walks).
Tanglewood Farm Private Nature Reserve	The destinations would like more people to attend. Not bigger groups, but having the events regularly and not once or twice a year.
Mount Moreland Conservancy	
BirdLife centre at Wakkerstroom	
Dune Ridge Country House	None
Matotoland Ecotourism Chrissiesmeer Mpumalanga	Lack of marketing.

Most of the interviewers are of the opinion that the biggest hindrance to growing success in the frogging industry is low numbers that sign up for the activities. Seasonality and weather conditions also play a role in the low interest of tourists. Due to frogging being a season-bound activity, the destinations can promote frogging activities only in season. Further, the trigger for events should not only be focused on one specific charismatic species, but rather the community of frogs from the region of interest.

3.3.1.5 Your recommendations to grow "frogging" as a tourism activity:

Table 3.6 Recommendations the interviewed destinations made to grow frogging as an ecotourism activity.

Name of park/company/attraction:	Answer:
Amakhosi Safari Lodge, Private game reserve	Try and appeal to adventure tourists, younger people and conservation students.
Kenilworth Racecourse Conservation Area (KRCA)	Frogging activities should be promoted better in the surrounding communities, and events should be promoted on destination websites, Facebook and the local newspapers.

Tanglewood Farm Private Nature Reserve	Organize and advertise more events! There's very few around. Wakkerstroom invites experts to talk to the tourists, other destinations can also make use of them.
Mount Moreland Conservancy	
BirdLife centre at Wakkerstroom	
Dune Ridge Country House	People need to know how important frogs are and what great indicators they are to the immediate conditions of the environment.
Matotoland Ecotourism Chrissiesmeer Mpumalanga	Make use of more social platforms to promote the activities and to create awareness about threatened and endangered species.

All the respondents recommend that more frogging events should be organised throughout the breeding/raining season and these events should be promoted through various platforms to attract different kinds of tourists. However, no one commented on combining frogging with other types of activities that already attract tourists to the frogging destinations. The destinations can also follow the example of Wakkerstroom and invite experts to the event that can build a bridge between tourists and social science.

3.3.2 Quantitative results (descriptive and explorative)

3.3.2.1) Socio-Demographic Information – Descriptive results

This section contains the socio-demographic information of the respondents. The following will be discussed: gender, home language, marital status, province of residence, the highest level of education and accompanying children.

The results (Table 3.7) indicate that the respondents are mainly female (53%), English speaking (53%), married (50%), and between the age of 25 and 64. The Gauteng province (41,9%) in South Africa is their dominant province of residence, most have a degree or diploma (39%), and are employed (56,5%) earning a salary higher than R552 001 (31%) per-year.

Table 3.7: Socio-demographic information of the 356 participants

Demographic information asked	**Results**
Gender	Female: 53% Male: 47%
Age	13-17 Years (Teenager): 1% 18-24 Years (Young Adult): 6% 25-40 Years (Adult): 42%

	41-64 Years (Adult): 42% 65+ Years (Elderly): 9%
Language	English: 53% Afrikaans: 41% Other: 6% (including four official South African languages and nine European languages)
Marital Status	Married: 50% Single: 32% Long-term relationship: 12% Divorce: 5% Widow(er): 2%
Province of residence	Gauteng: 41,9% Western Cape: 15,2% North-West: 12,1% KwaZulu-Natal: 10,7% Eastern Cape: 3,4% Limpopo: 2,2% Mpumalanga: 5,1% Free State: 3,4% Northern Cape: 0,3% International: 5,9%
Level of qualification	Grade 10: 1% Matric: 20% Diploma/Degree: 39% Post-Graduate: 33% Doctors Degree: 7%
Employment Status	Student: 14%

	Salaried employment 56,5% Retired: 9,8% Self-employed: 17,1% Unable to work: 0,3% Currently looking for work: 1,1% Volunteer: 0,3% Other: 0,3%
Income	<R20 000: 11% R20 0001-R140 000: 15% R140 001-R221 000: 9% R221 001-R302 000: 9% R305 001-R552 000: 12% R552 001+: 31%

The demographic information was important for further analysis of questions asked in section B and C of the questionnaire. The influence of demographic variables on respondent's knowledge of and attitude towards frogs and ecotourism will be discussed in this section.

- **Ecotourism exposure**

The respondents were asked at which age they were first exposed to nature-based/ecotourism. The highest percentage of respondents (56%) started visiting nature-based destinations from the age of 3 years old. In fact, only 12% of the respondents were exposed to ecotourism for the first time as an adult (older than 18 years).

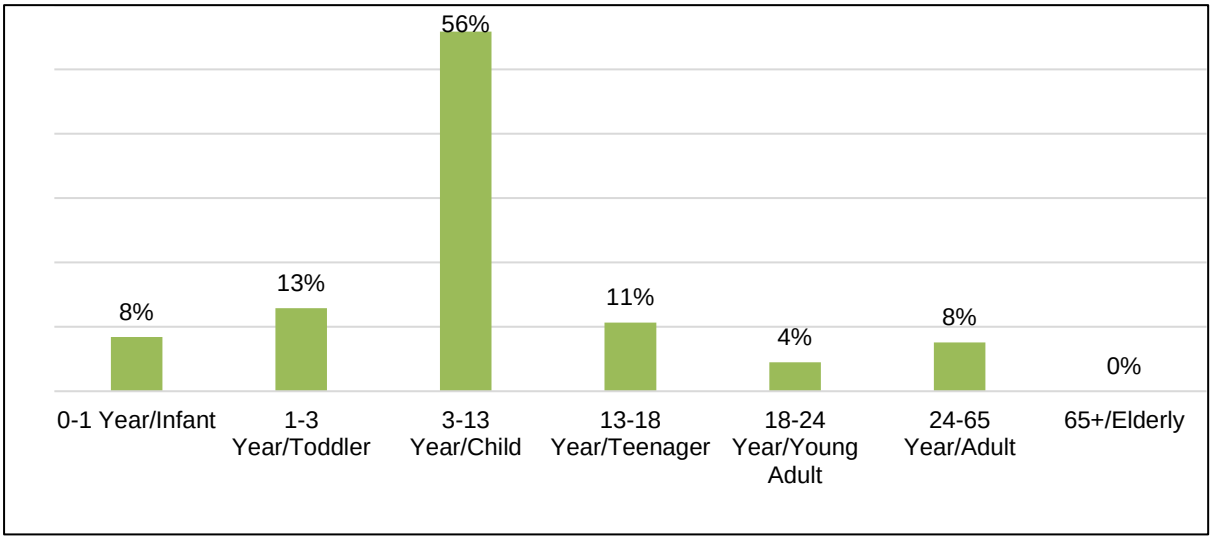


Figure 3.2: Age respondents were first exposed to ecotourism.

According to an article on Family Eco Travel written by Irene Lane (2011) it is important to expose children to ecotourism at a very young age as it marks milestones for a child's personal growth and future development. Analysing the results, it is clear that most of the respondents were exposed to ecotourism at a very young age and this will most probably have an effect on the way most of the questions were answered. The experiences they had as young children shaped the way they feel about ecotourism and the conservation of nature.

- **Frog exposure**

The respondents were asked their feelings when they experienced their first encounter with frogs. 68% of the respondents found their first encounter with frogs exciting, 10% experienced their encounter as stressful and terrifying and only 2% as boring. A number of responses were received by respondents that described their first encounters including; playing with frogs as kids, to learning about them during formal training and using them for recreational angling.

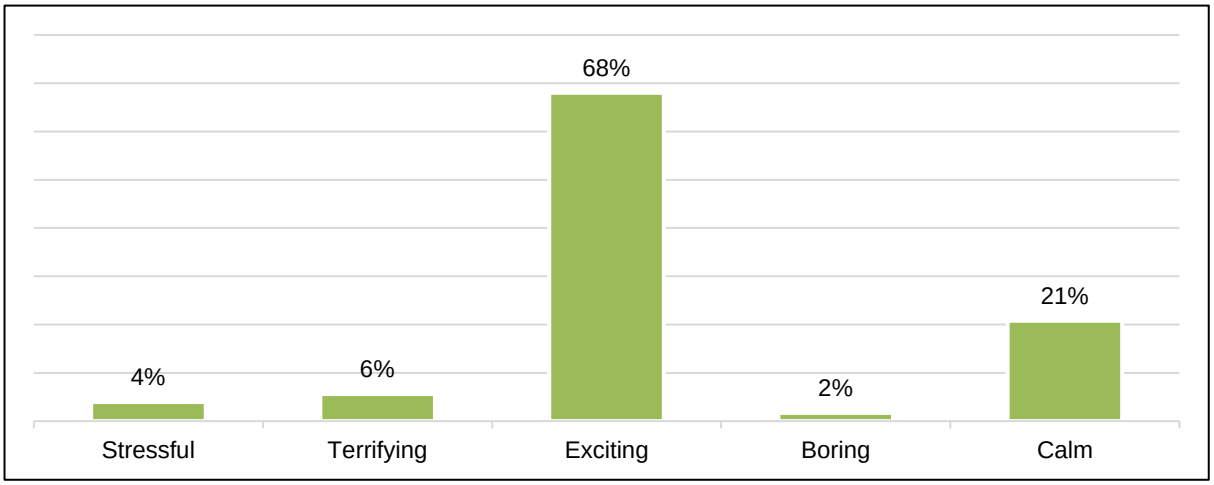


Figure 3.3: Ratio of participants' emotional response to their first encounter with frogs.

To some people frogs are cute and interesting creatures, while others find them disgusting and in extreme cases have a fear/phobia of frogs (Ranidaphobia) (Anthony & McCabe, 2005 & Seymour, 2008). Their learning experiences can influence people's attitudes towards frogs. If a child's first encounter with frogs was exciting and resourceful, they are more likely to be supportive of conservation efforts, whereas if someone's first encounter with frogs is stressful, they might feel repelled by frogs and not get involved with their conservation (Anthony & McCabe, 2005 & Seymour, 2008). If the goal is to encourage more people to help conserve frogs and if children are included, it must be ensured that their early encounters with frogs are positive, including the sharing of the correct facts about these animals.

- **Preference of nature-based destinations**

Multiple options of nature-based destinations were given to the respondents to find out which nature-based destinations are a favourite to visit. Wildlife reserves (88%) together with adventure activities (84%), oceans and islands (83%) and scenic areas (valleys, mountains, hills) (81%) received the highest percentage. Botanical gardens received the lowest

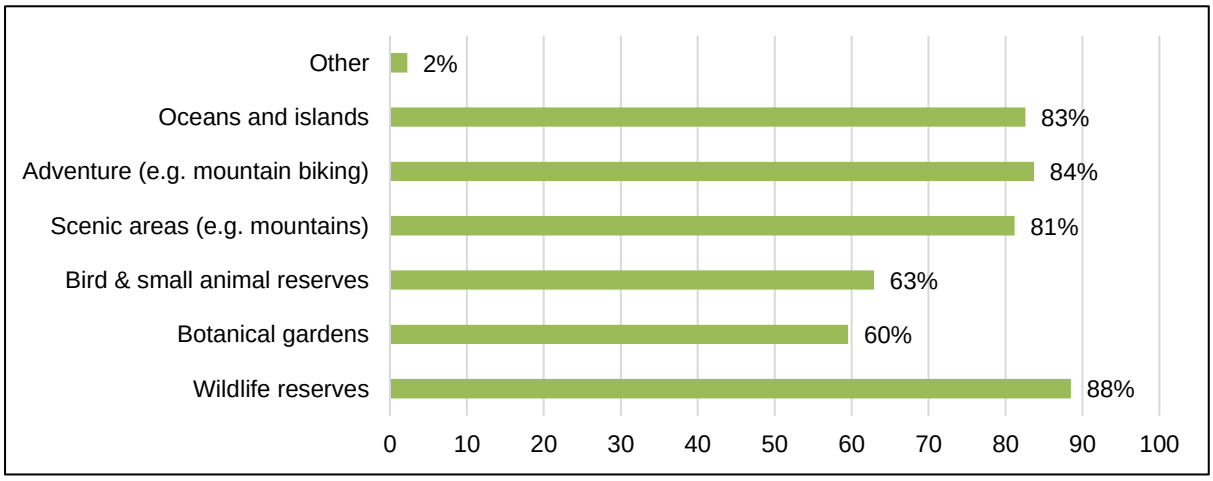


Figure 3.4: Nature based destinations respondents like to visit when on holiday.

preference.

In chapter 2 it was discussed that frogs could be found in all of South Africa's biomes. Therefore, frog-related activities can be held at any of the above-mentioned nature-based destinations, but are more likely to be held at reserves and botanical gardens than at oceans and islands. Botanical Gardens received the lowest percentage and therefore frog-related ecotourism activities being held at a botanical garden can also be an appealing factor for tourists to visit botanical gardens more often.

- **Preference for holiday activities**

Respondents were given a choice of six options to determine their preferred holiday activities. By far the majority of respondents prefer being in nature (88%) and the rest of the activities received a much lower rating with adventure activities having a 37% interest (see figure 3.5).

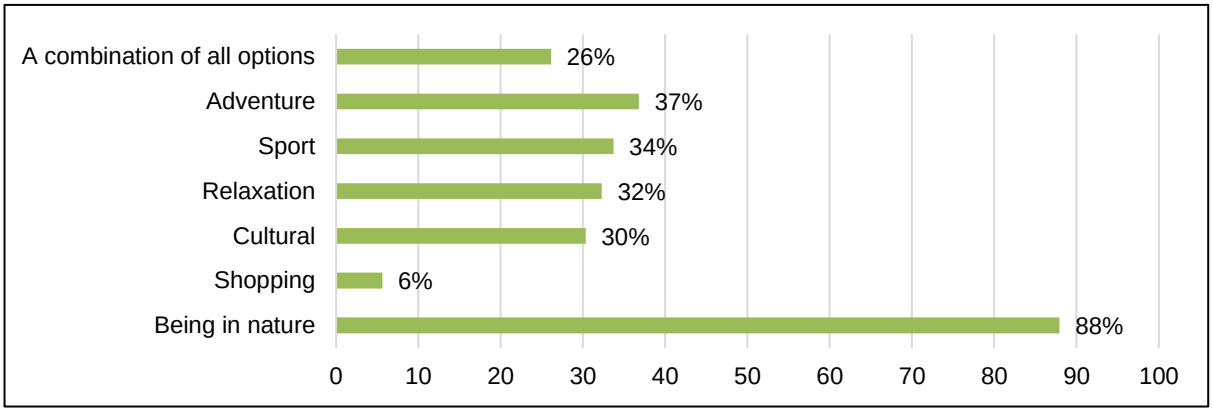


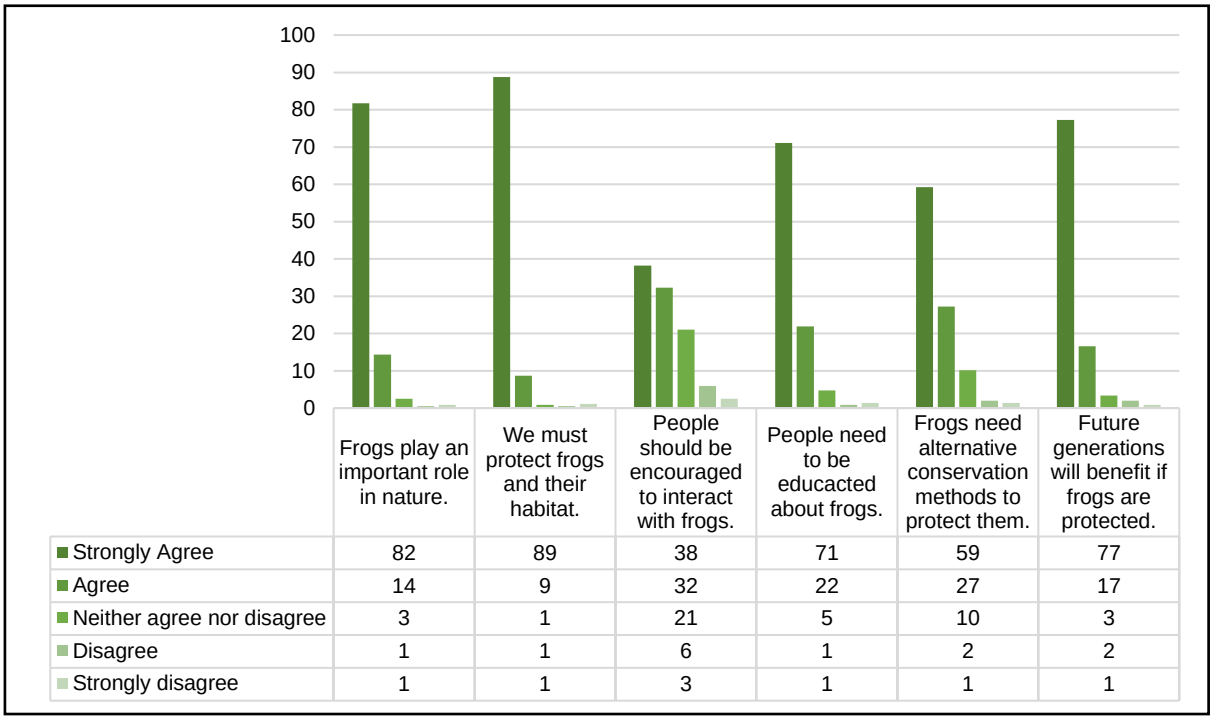
Figure 3.5: Different types of holiday activities participants likes to do when they are on holiday.

Most of the respondents indicated that they like to visit nature-based destinations. This high percentage can be ascribed to the fact that the questionnaire was published on SANParks website and associated nature-based websites and people that visit those webpages are interested in nature. A recommendation is to distribute the questionnaire on different types of platforms to get an indication of the general public's interests in frog-related tourism, for example; Facebook, twitter, conservation programmes like 50/50, tourism magazines. Another initiative that can be incorporated is to combine frog-related activities with other types of destinations that are not nature-based alone, for example, when tourists go on adventure activities an information session that includes wildlife species from that region can be provided.

3.3.2.2) Personal-Demographic Information – Descriptive results

- **Frog interests (Level of agreement)**

The respondents strongly agree that frogs play an important role in nature (82%) and that they together with their habitats should be protected (89%). Only 38% feel that people should be encouraged to interact with frogs. The majority of the respondents (59%) indicated that alternative methods are needed to conserve frogs, and that future generations will benefit from the conservation of frogs (77%).



	Frogs play an important role in nature.	We must protect frogs and their habitat.	People should be encouraged to interact with frogs.	People need to be educacted about frogs.	Frogs need alternative conservation methods to protect them.	Future generations will benefit if frogs are protected.
Strongly Agree	82	89	38	71	59	77
Agree	14	9	32	22	27	17
Neither agree nor disagree	3	1	21	5	10	3
Disagree	1	1	6	1	2	2
Strongly disagree	1	1	3	1	1	1

Figure 3.6: Conservation and educational responses about frogs by respondents.

It is clear that most of the respondents are aware that frogs play an important role in nature, should be conserved and that people should be educated about frogs. It is thus very important to send out the message that the global community should get involved with the conservation of frogs and that it is not only the responsibility of the research and conservation community.

- **Frog identification**

Respondents were asked what type of frog identification material they owned, and secondly if they can identify any specific frog calls. 41% said that they could identify at least one frog call. Interestingly, hard copy books are still more popular than mobile applications of frogs (60% vs 10% ownership).

Tourism destinations that offer frog-related tourism activities can use this as an opportunity to market frog identification books and mobile applications at their destination. They can also sell

different types of books at their curio shops, and the profit of the books they sell can be used by the tourism destination to help with the conservation of the fogs in the park. The money can also be used to help with better marketing and infrastructure specifically for the frog-related activities. The guides that take the tourists out on frogging events can then also teach the tourists some of the familiar frog calls and in doing that educate them about the common species that they might find in their gardens.

3.3.2.3) Frogs and Nature-based Tourism – Explorative results

The following section discusses whether the participants felt that frogging activities could be offered at nature-based destinations and in SANParks reserves. Over various questions, participants were asked to rate the reasons why they like to visit specific holiday destinations and why they would participate in frog related activities.

- **Factors influencing participation in frog-related activities**

Due to this research being a first of its kind, an exploratory approach was followed. Before a factor analysis test could be done a Kaiser-Meyer-Olkin (KMO) test was done to measure if the data from the questionnaires was suited for a factor analysis (Glen, 2017). The scores for the KMO tests ranged between 0.742 and 0.890 for the various questions, which exceeds the necessary minimum acceptable threshold of 0.6 (Field, 2006). This meant that a factor analysis could be done. The factor analysis identified ten factors that participants felt had the biggest influence on whether they will participate in frog-related activities or not (Table 3.8). These factors were determined by the factor analysis combining items with similar underlying constructs together. The main factors identified were; education, interest, conservation, social aspect, relaxation, experiences, interactive excursions, additional activities, push factors and pull factors. With the results from the factor analyses the ten identified factors is then compared with each other to determine which factors had overall the highest influence on the decision making of participants. To determine what type of influence the factor has on participants the results can be interpreted by looking at the effect size of each factor (Table 3.8), a effect size value ≥ 0,1 has a small influence, a effect size value ≥ 0,3 a medium influence and a effect size value ≥ 0,5 a high influence on decision making for visiting a nature-based destination and a destination that offers frog-related tourism activities.

Table 3.8: Identified factors with the highest influence on decision making among participants.

			Factors									
			Education	**Level of Interest**	**Conservation**	**Social aspect**	**Relaxation**	**Previous Experiences**	**Interactive excursion**	**Additional activities**	**Push factors**	**Pull factors**
Factors	**Education**	**Effect Sizes**	1,000	0,551**	0,323**	0,023	0,126*	0,180**	0,421**	0,286**	-0,183**	-0,195**
	Level of interest		0,551**	1,000	0,535**	0,186**	0,239**	0,321**	0,649**	0,494**	-0,217**	-0,222**
	Conservation		0,323**	0,535**	1,000	0,377**	0,333**	0,326**	0,462**	0,433**	-0,064	-0,052
	Social aspect		0,023	0,186**	0,377**	1,000	0,344**	0,583**	0,276**	0,462**	0,137**	0,083
	Relaxation		0,126*	0,239**	0,333**	0,344**	1,000	0,423**	0,224**	0,269**	-0,025	0,086
	Previous Experiences		0,180**	0,321**	0,326**	0,583**	0,423**	1,000	0,339**	0,471**	0,047	0,012
	Interactive excursions		0,421**	0,649**	0,462**	0,276**	0,224**	0,339**	1,000	0,568**	-0,217**	-0,229**
	Additional activities		0,286**	0,494**	0,433**	0,462**	0,269**	0,471**	0,568**	1,000	-0,011	-0,122*
	Push factors		-0,183**	-0,217**	-0,064	0,137**	-0,025	0,047	-0,217**	-0,011	1,000	0,617**
	Pull factors		-0,195**	-0,222**	-0,052	0,083	0,086	0,012	-0,229**	-0,122*	0,617**	1,000

** Correlation is significant at the 0.01 level (2-tailed).	Theoretically 99% confident the answer is reliable.
* Correlation is significant at the 0.05 level (2-tailed).	Theoretically 95% confident the answer is reliable.

Small	Medium	Large
p ≥ 0,1	p ≥ 0,3	p ≥ 0,5

- *Education:*

Factors that had a significant statistical impact concerning the educational factor were interest, conservation, relaxation, experiences, interactive excursions, additional activities, push factors and pull factors. According to the effect sizes the educational component is of medium importance (0,323 ≤ p ≤ 0,421) concerning the interactive excursion and conservation components but is of large importance (p = 0,551) concerning the interest component. The educational component is of little importance (-0,195 ≤ p ≤ 0,286) to the remaining factors mentioned above. The level of education contributes significantly to whether the public will be interested in frogs, with less educated individuals being less interested in frogs. Furthermore, the level of education also affects whether individuals will partake in interactive activities and help with conservation of frogs, but to a lesser extent.

- *Level of interest:*

Factors that had a significant statistical impact with regard to the level of interest were education, conservation, relaxation, social aspect, experiences, interactive excursions, additional activities, push factors and pull factors. With relation to the effect sizes, the level of interest is of large importance (p is between 0,535 and 0,649) with regards to education, conservation and interactive excursion. This means that the participants that are more interested in frogs overall are willing to participate in frogging trips, contribute to conservation and increase their knowledge regarding frogs. The level of interest is of medium importance (p is between 0,321 and 0,494) with regards to the experience and additional activities components, and of little importance (p is between -0,222 and 0,239) to the rest of the factors.

- *Conservation:*

Factors that had a significant statistical impact with regards to conservation were education, interest, relaxation, social aspect, experiences, interactive excursions and additional activities. The conservation component is the only factor that affects level of interest to a high degree (p = 0,535). The conclusion can be drawn that when someone is interested in frogs they will be more likely to help to conserve them. Therefore, future programmes should focus on making frogs more appealing and interesting for tourists. Also, if conservation programmes are more fun, people will find the conservation programmes interesting and will be more interested in participating. It is important to note that the push and pull factors have no statistically significant influence on conservation.

- *Social aspect:*

Factors that had a significant statistical impact on the social component were interest, conservation, relaxation, experiences, interactive excursions, additional activities and push factors. The social aspect can be described as the degree to which participants like to socialise with family, friends or other enthusiasts during activities. The socialising aspect is of medium importance (p is between 0,344 and 0,462) with regards to the conservation, relaxation and additional activities components, but is of high importance with regards to the experience component (p = 0,583). This could mean that the people who had positive and exciting past experiences with frogs like to go on frogging trips with other people where they can talk about frogs and share their previous and current experiences and knowledge.

- *Previous Experiences:*

Factors that had a significant statistical impact with regards to the experiences component were education, interest, conservation, social aspect, relaxation, interactive excursions and additional activities. The experience component includes previous experiences with regards to frogs; meaning if tourists have had an uplifting or stressful experience with frogs. This component is of medium importance (p is between 0,321 and 0,471) with regards to the conservation, relaxation, interest, interactive excursions and additional activities components, but is of large importance with regards to the socialising component (p = 0,583). Past experiences participants had with frogs would determine if they would socialise with other people by talking about frogs and taking part in frog-related activities with other people.

- *Relaxation:*

Factors that had a significant statistical impact with regards to the relaxation factor were education, interest, conservation, experiences, social aspect, interactive excursions and additional activities. According to the effect sizes, the relaxation component is not of great importance with regard to any of the specified components, and are of medium to small importance (p is between 0,126 and 0,344) with regards to the abovementioned factors. One can conclude that most nature enthusiasts do not feel the need to relax by means of sleeping or going to a spa etc., but find spending time in nature more relaxing.

- *Interactive excursions:*

All of the factors found in table 3.8 had a significant statistical impact with regards to the interactive excursion factor. According to the effect sizes the interactive excursion factor is of medium importance (p is between 0,339 and 0,462) with regards to the education,

conservation and experience components, and of large importance (p is between 0,568 and 0,649) with regards to the interest and additional activities component. People with interest in frogs are more likely to go on interactive excursions such as frogging or frog-related activities.

- *Additional activities:*

Factors that had a significant statistical impact on additional activities were education, conservation, relaxation, interest, social aspect, experiences, interactive excursions and pull factors. The additional activities component includes entertainment activities that is more than just a frogging event at a tourism destination. This may include frog-related activities for children, frog displays, photography, frog identification courses etc. With relation to the effect sizes, the additional activities component is of large importance (p = 0,568) with regards interactive excursion. This means that the participants that are more interested in frogs overall will be willing to go out on frogging trips and also take part in different kinds of frog-related activities.

- *Push factor:*

Factors that had a significant statistical impact with regards to the push factor were interest, education, interactive excursions, and social and pull factors. The push factor is the central motivator of a person for why he/she might want to visit a specific destination for example; to escape every day routines, rest and relaxation, health and fitness, adventure and social interactions. Push factors are of small importance (p is between -0,217 and 0,137) with regards to all the factors mentioned above, except for the pull factor (p = 0,617). This means that if a destination has a lot to offer to satisfy the internal travel motives of a person, the participant will most likely want to visit that specific destination. Thus, if a person has an internal motive to visit a destination to help with conservation or to view a unique species and the destination in return offers that satisfaction to the tourist he/she will most likely visit that destination again.

- *Pull factor:*

Factors that had a significant statistical impact with regards to the pull factor were interest, education, interest, interactive excursions, additional activities and push factors. The pull factor develops due to the attractiveness of a destination or because of what a destination has to offer to fulfil the desires of a tourist for example; recreation facilities, idyllic scenery etc. Pull factors are of small importance (p is between -0,229 and -0,122) with regards to all the factors mentioned above, except for the push factor on which the pull factor has a high influence (p = 0,617). Thus, the same conclusion can be made as for factor 9.

The results of the factor analysis show that various factors will influence whether participants will participate in frog-related activities. The factor analysis revealed four factors that have the highest influence on decision making when it comes to participation in frog-related activities. The p-values of these were ranging from 0.535-0.649, which indicates that the reliability of measurement of each of the four factors is high and therefore viable for use. These factors are; level of interest, conservation, previous experiences and interactive excursions. These factors were further analysed using ANOVA tests to determine how the factors are influenced by demographic profiles.

- **Role of demographics in frog ecotourism**

Analysis of variance (ANOVA) tests and Tukey's multiple comparisons were used to investigate any significant differences between the motivational factors (level of interest, conservation, previous experience and interactive excursions), gathered from the factor analysis, of the participants and their demographic information. There was no practical statistically significant difference for the interactive excursion component with any of the demographic factors and was therefore not discussed. The paired factors that shows practical statistically significant differences will be discussed. The amount of variance between groups indicates that different demographic profiles will greatly affect frog-related experiences, interests and conservation efforts.

- *Influence of home language on motivational factors:*

The level of interest did indicate a practical statistical significance (p = 0,027), but not a large significant variance within the different groups. Based on the ANOVA test done for home languages the level of interest had overall a much higher influence on the participants than level of education and social aspect that also offered a practical statistical significance in p-value. Conservation and experience, however showed no practical statistical significance difference between the different language groups.

After doing Tukey's test (Table 3.9) the results indicated that the home language of the participants had a practical statistically significant difference, within the various groups (English, Afrikaans and Other), on the motivational factors; education and Push factors. Tukey's test indicated that participants that spoke English as home language (mean value = 3,033), regard the education motive as more important than participants who speak home language other than Afrikaans (mean value =2,450).

The participants that speak "other" home languages (mean = 2,986), regards push factors as more important than the English speaking participants (mean = 2,553). Tourism destinations that offer frog-related activities should accommodate as many types of home languages as

possible to trigger their level of interest, push factors and education in the tourism product. For the English-speaking participant's education is especially important so an educational factor about frogs should always be included in the frog-related activity.

Table 3.9: Tukey's test results of the influence that education and push factors have on different home language groups. Red figures indicate a low influence and green figures a high influence.

TUKEY'S TEST				
Home Language		**N**	**Tukey's Mean Value Subset for alpha = 0,05**	
			1	**2**
Education	**English**	189		3,033
	Afrikaans	147	2,852	2,852
	Other	20	2,450	
Push Factor	**English**	189	2,553	
	Afrikaans	147	2,635	2,635
	Other	20		2,986

- *Influence of age on motivational factors:*

The level of interest showed no practical statistical significance between different age groups, but conservation (p = 0,005) and previous experience (p = 0,01) indicated practical statistical significance differences for different age groups (Table 3.10). Based on the ANOVA test done for age, conservation and previous experience had overall a much higher influence on the participants than the social aspect, relaxation and additional activities that also offered a practical statistical significance in p-value.

Table 3.10: Tukey's test results of the influence that conservation has on different age groups. Red figures indicate a low influence and green figures a high influence.

TUKEY'S TEST					
Age		**N**	**Tukey's Mean Value Subset for alpha = 0,05**		
			1	**2**	**3**
Conservatio	**18-24 Years**	189			4,6842
	25-40 Years	147		4,3244	4,3244

	41-64 Years	20	4,2472	4,2472	
	65+ Years	189	3,8824		
Experience	**18-24 Years**	189			4,2368
	25-40 Years	147		3,9027	3,9027
	41-64 Years	20	3,6308	3,6308	
	65+ Years	189	3,2574		

Based on the ANOVA and Tukey's test the ages 18-24 received the highest mean value (4,6842) and ages 65+ received the lowest mean value (3,8824) for the conservation factor. This indicates that people between the age of 18 and 24 are keen on contributing to conservation of species, and that conservation as a motivational factor will have a higher influence on them as the participants in the age group of 65+. When age group of 65+ visit the destinations, they can be introduced to the aspect of conservation, but the focus should rather be on other factors that have a higher influence on them than conservation.

The ANOVA and Tukey's tests revealed that ages 18-24 received the highest mean value (4,2368) and ages 65+ received the lowest mean value (3,2574) for the experience factor. This indicates that younger people like to visit destinations to have a new and great experience, especially the age group of 18-24. Considering both experience and conservation, it is evident that these factors aren't the main motivators for people the age of 65+ to participate in activities. Studying the results there wasn't a specific factor that had a higher influence on the age group 65+. This provides an opportunity for further studies to determine the factors that will specifically motivate the age group 65+ to participate in frog-related activities.

- *Influence of province of residence on motivational factors:*

The Experience factor showed no practical statistical significance between different provinces of residence, but conservation ($p = 0,038$) and interest ($p = 0,013$) indicated a practical statistical significant difference. Based on the ANOVA test for province of residence the level of interest and conservation had overall a much higher influence on the participants than additional activities that also offered a practical statistical significance in p-value, but after doing Tukey's test no variance between the different provinces was noted (table 3.11).

This indicates that conservation and interest is an overall motivation for the participants and not only for specific groups of participants. People that stay in provinces that are more focused on conservation will be more motivated to participate in activities if conservation is a motivational factor. For example, in KwaZulu-Natal there are a lot of different frog species,

including several threatened species and therefore the participants from KZN seem to be already aware of conservation in their area (due to the high mean value p = 4,7675) and are also more prone to help with conservation when partaking in frog-related activities. NGO's such as Endangered Wildlife Trust have active conservation projects on frogs in KZN. Thus, when people get more exposed to frogs, they will become more aware about them and the conservation effort needed for protection.

Table 3.11: Tukey's test results of the influence that conservation and level of interest have on participants from different provinces.

TUKEY'S TEST				TUKEY'S TEST			
	Province of Residence	N	Tukey's Mean Value Subset for alpha = 0,05		Province of residence	N	Tukey's Mean Value Subset for alpha = 0,05
			1				1
Conservation	International (INT)	21	4,3175	Interest	International (INT)	21	3.6508
	North West (NW)	43	4,3450		Mpumalanga (MP)	18	3.8426
	Mpumalanga (MP)	18	4,4537		North West (NW)	43	3.8527
	Limpopo (L)	8	4,5000		Gauteng (GP)	149	4.1611
	Gauteng (GP)	149	4,5313		Free State (FS)	12	4.2083
	Western Cape (WC)	54	4,5898		Limpopo (L)	8	4.2708
	Eastern Cape (EC)	12	4,7222		Western Cape (WC)	54	4.3025
	Free State (FS)	12	4,7222		Eastern Cape (EC)	12	4.3333
	KwaZulu-Natal (KZN)	38	4,7675		KwaZulu-Natal (KZN)	38	4.3553

After doing Tukey's test (table 3.12 & table 3.13) it indicated that the province of residence of the participants had a practical statistically significant difference, within the various groups, on the motivational factors; education, relaxation, social aspect and additional activities. Participants that came from Limpopo (mean value = 3,4375), regard the education motive as more important than participants who are international (mean value = 2,3095). The participants that came from the Free State (mean = 3,7292), regard the social aspect as more important than the international and Limpopo participants (mean is between 2,7381 and 2,7656). In Table 3.13 Tukey's test indicated that participants that came from the Free State

(mean value = 4,7292), regard the relaxation motive as more important than participants who are from Limpopo (mean value = 3,5938). Lastly the participants from the Free State (mean = 4,0278) are more motived by additional activities than the international participants (mean = 2,7619). From the results it is clear that participants from different provinces are motivated by different factors, depending on their lifestyle and the type of holiday activities that they want to enjoy. Participants from the Free State are very flexible and would easily be motivated by various factors, while the international participants are more set in their ways and the type of holiday experience they want, so frogging destinations would have to market more for the international tourists to motivate them to participate. International tourists visit destinations for specific reasons, due to the short time they have available, and therefore it is also important to consider combining frog-related activities with other activities. For example; when tourists go out on game drives they can also be educated about the calls frogs make.

Table 3.12: Tukey's test results of the influence that education and social aspects have on participants from different provinces.

TUKEY'S TEST					TUKEY'S TEST				
Province of residence		N	Tukey's Mean Value Subset for alpha = 0,05		Province of residence		N	Tukey's Mean Value Subset for alpha = 0,05	
			1	2				1	2
Education	International (INT)	21	2,3095		Social	International (INT)	21	2,7381	
	Free State (FS)	12	2,6667	2,6667		Limpopo (L)	8	2,7656	
	Gauteng (GP)	149	2,8540	2,8540		Mpumalanga (MP)	18	3,0208	3,0208
	Mpumalanga (MP)	18	2,8889	2,8889		Eastern Cape (EC)	12	3,0729	3,0729
	KwaZulu-Natal (KZN)	38	3,0066	3,0066		Gauteng (GP)	149	3,1116	3,1116
	Western Cape (WC)	54	3,0602	3,0602		Western Cape (WC)	54	3,1134	3,1134
	North West (NW)	43	3,1105	3,1105		North West (NW)	43	3,1831	3,1831
	Eastern Cape (EC)	12	3,3542	3,3542		KwaZulu-Natal (KZN)	38	3,3454	3,3454

	Limpopo (L)	8		3,4375			**Free State (FS)**	12		3,7292

Table 3.13: Tukey's test results of the influence that relaxation and additional activities have on participants from different provinces.

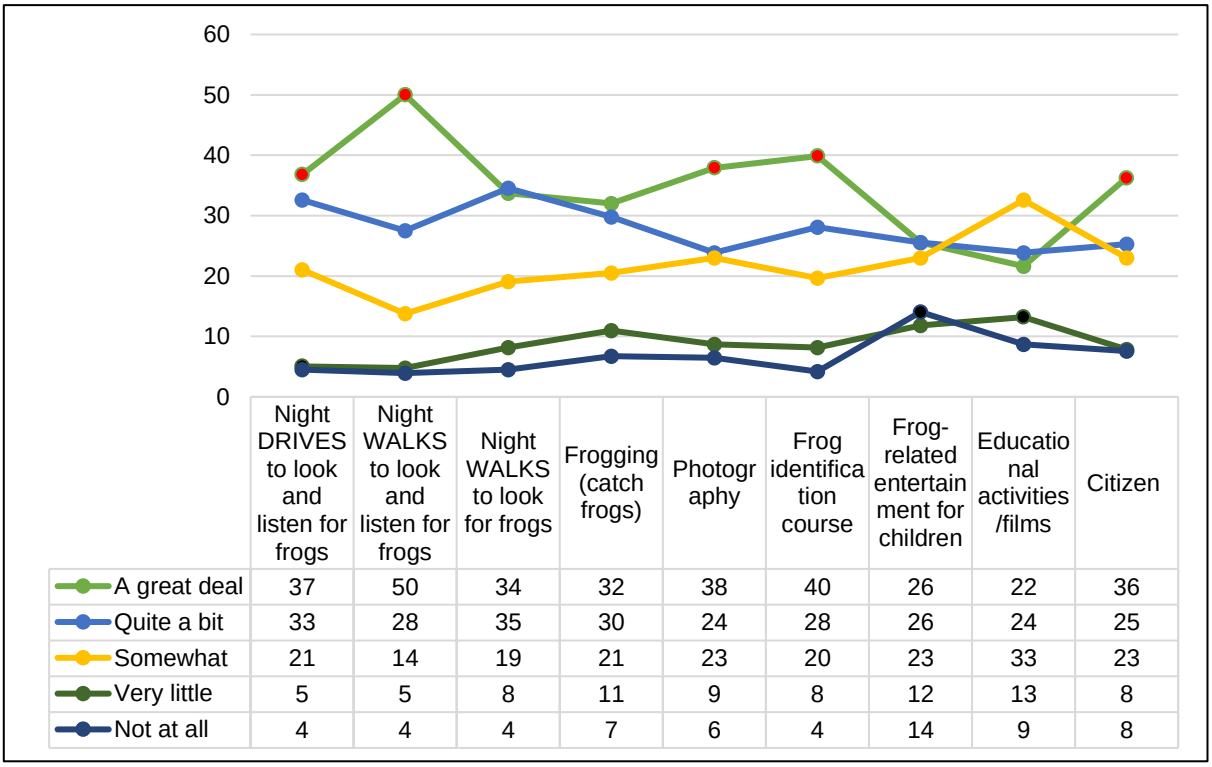
TUKEY'S TEST						**TUKEY'S TEST**				
Province of residence		**N**	**Tukey's Mean Value Subset for alpha = 0,05**			**Province of residence**		**N**	**Tukey's Mean Value Subset for alpha = 0,05**	
			1	**2**					**1**	**2**
Relaxation	**Limpopo (L)**	8	3,5938			**Additional activities**	**International (INT)**	21	2,7619	
	Eastern Cape (EC)	12	3,9792	3,9792			**Limpopo (L)**	8	3,2500	3,2500
	International (INT)	21	4,1071	4,1071			**Mpumalanga (MP)**	18	3,3148	3,3148
	North West (NW)	43	4,1221	4,1221			**Gauteng (GP)**	149	3,4228	3,4228
	Western Cape (WC)	54	4,1435	4,1435			**KwaZulu-Natal (KZN)**	38	3,6316	3,6316
	Gauteng (GP)	149	4,2248	4,2248			**North West (NW)**	43	3,6512	3,6512
	Mpumalanga (MP)	18	4,2361	4,2361			**Eastern Cape (EC)**	12	3,6667	3,6667
	KwaZulu-Natal (KZN)	38	4,4211	4,4211			**Western Cape (WC)**	54	3,6728	3,6728
	Free State (FS)	12		4,7292			**Free State (FS)**	12		4,0278

3.3.2.4) Frog-related activities and frogging trips – Descriptive results

The following section provides the results on the type of frog-related activities that tourists would like to participate in, as well as the distances that they are willing to travel.

- **Frog-related activities that participants would be willing to undertake**

The results show that 50% of participants are interested in doing night walks during which they can look and listen for frogs, and 40% of participants are interested in doing a frog identification course.



	Night DRIVES to look and listen for frogs	Night WALKS to look and listen for frogs	Night WALKS to look for frogs	Frogging (catch frogs)	Photography	Frog identification course	Frog-related entertainment for children	Educational activities /films	Citizen
A great deal	37	50	34	32	38	40	26	22	36
Quite a bit	33	28	35	30	24	28	26	24	25
Somewhat	21	14	19	21	23	20	23	33	23
Very little	5	5	8	11	9	8	12	13	8
Not at all	4	4	4	7	6	4	14	9	8

Figure 3.7: Frog-related activities participants would like to take part in. Top 5 activities are indicated with red dots; black dots indicate least favoured activities. The numbers in the table are percentages.

The participants aren't very keen on doing frog-related activities where entertainment for children is included or where they have to watch educational films. This result could have been influenced by the age of the participants and whether the participants have children or not. It is thus very important that the tourism destination should know the type of tourists they receive. When there are groups with a lot of children there should be additional activities included for the children. When there is a group of young nature enthusiasts they should be given the opportunity to spend as much time as possible on interactive excursions rather than watching educational films.

Some additional suggestions for activities made by participants included; assisting with re-establishment of frogs into nature and combining frogging trips with other nocturnal animal expeditions.

- **Travel distance to attend specific frog-related activities**

33% of the participants are willing to travel to partake in frog-related activities and 51% indicated that they might travel, which is higher than the 16% that are not willing to travel (Figure 3.8).

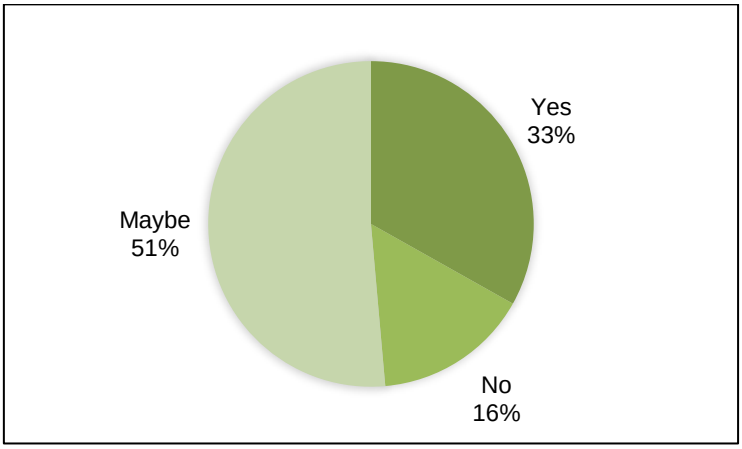


Figure 3.8: The possibility that participants would travel to take part in a frog-related ecotourism activity.

Tourism destinations should offer intriguing frog-related activities that would convince the 51% of "maybes" to travel to the destination to partake in the activities. In response to the question of how far participants are prepared to travel, most of the participants indicated that they are prepared to travel between 50 and 150km for frog-related activities (Fig 3.9). This means that all the destinations within a specific province that offer frog related activities should market their activities and make them interesting for the local and regional community that will be prepared to travel to them.

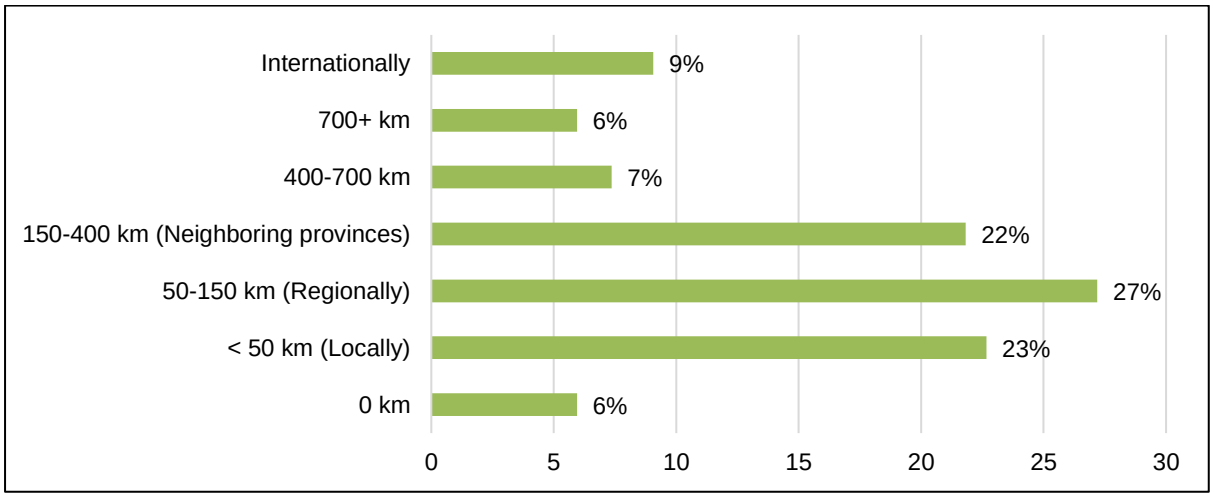


Figure 3.9: The distance participants are prepared to travel to visit a frogging destinations.

3.4. Conclusion

The purpose of this chapter was to provide results of the survey data collected, recorded and analysed. The chapter consists of two sections, an interview questionnaire and an online questionnaire. The interview questionnaire provided qualitative results and the online questionnaire provided quantitative results. The following conclusions could be made from the two sections:

3.4.1 Qualitative results

Organisers of existing tourism destinations were interviewed to determine their success with frog-related tourism activities and to find out if there might be a niche for this type of tourism product in the ecotourism industry. The owners of seven tourism destinations were interviewed to generate information on the success, failures and recommendations of the tourism destination. The following conclusions can be made for these main questions asked to the interviewers.

- Successes of their program: The activities create awareness of conservation amongst the tourists who partake in the frogging events. It was noted that if the frogging activities are kept interesting, well promoted and contributes to conservation in the right way the likelihood increases that people will attend them.

- Failures of their program: Due to frogs being active only during certain seasons most destinations felt that frogging is only a seasonal activity and can't be promoted throughout the year. They also struggle to get a high numbers of tourists to attend the events and the numbers of visitors fluctuate all the time.

- Recommendations for growing "frogging" tourism: The recommendations that were provided were focussed on marking, including better promotion of the events.

<u>Recommendations from this study:</u>

- Even though frogs are only active during certain seasons of the year, focus for frogging-related ecotourism should be given to all the biomes in South Africa that fall within different seasonal time zones. For example, the destinations that have a rainfall period during summer can promote their frogging activities during that time of the year, while destinations that receive winter rainfall can promote their activities during another

time of the year. In doing so frogging destinations will be available for frog-related activities across South Africa and throughout most of the year.

- Each destination can train guides to accompany tourists on frogging events. The guides can use the species lists from chapter 2 to familiarize him/herself with the species found in the relative areas. The guides can also modify the frogging events based on the type of tourists that attends. For example, if it is families with children the event can be more children friendly where the guides explain everything on a level that children will understand, and he can also offer additional activities like educational films or a colouring competition for the kids while he educates the parents. Another example is when more experienced tourists visit the destination that has previously taken part in frogging events a more in-depth frogging excursion can be done where the tourists are also actively involved in the searching for frogs.
- A recommendation for future studies is to attend a frogging event and to hand out questionnaires there to find out if the tourists enjoyed the event, if they would participate in something similar again and what they feel needs to be improved to keep frogging interesting.

3.4.2 Quantitative results

The majority of the respondents fell in the age groups of 25-40 and 41-64 and consisted of 53% female and 47% male. Most of the respondents spoke English as their first language, were married, lived in Gauteng and had a diploma or degree. Fifty-six percent (56%) of the participants were first exposed to nature-based tourism between the ages of three and thirteen and 68% of the participants felt that their first encounter with frogs was exciting. The destinations participants most like to visit are wildlife reserves and destinations where they can partake in adventure activities. Looking at this general profile of the participants it can be concluded that frog-related activities should be moulded in a way that will allow any age group to partake in it. Secondly, if a guide is trained to take the tourists out on the frogging event it would help immensely if he/she can speak both English and Afrikaans (or other languages relevant to the destination). Thirdly if children are accompanying their parents on these trips, their encounter with frogs should be positive and exciting in order for the experience to imprint the concept of conservation on their minds.

Factor analyses were done that revealed ten main factors (conservation, level of interest, education, the social aspect, relaxation, experience, additional activities, interactive excursions, push factors and pull factors) that participants felt will influence their decision to partake in frog-related activities. Four of these factors (conservation, level of interest,

experience and interactive excursion) stood out as the factors that have the highest influence on decision making when it comes to the participation in frog-related activities. To test if these four factors were indeed the main motivational factors further ANOVA and Tukey's tests were done.

ANOVA and Tukey's tests were done to determine if statistically significant differences existed when the four factors were compared to the different demographic information of the participants. For most of the participants the level of interest in frogs, their opinion about conservation and their previous experiences with frogs and the future experiences they want to build, had the highest influence on their final decision to partake in frog-related activities. Interestingly none of the four motivational factors had a high influence on the age group of 65+. Therefore, operators should identify other factors that will motivate them to participate in frog related activities.

The overall conclusion is that frogging destinations should always attempt to make the frogging activities as interesting as possible to trigger the motivational factors of possible tourists; secondly, they should promote that activities are there to primarily conserve the frogs; and thirdly, the activities should be a fun and pleasant experience so that children who participate find frogs interesting and so that tourists would want to partake in frog-related activities again in the future. If all the destinations focussed on these main motivational factors frog-related ecotourism can become a huge success. The income generated or the concept of frog awareness will undoubtedly contribute towards the conservation of frogs for future generations.

CHAPTER 4: CONCLUSION & RECOMMENDATION

4.1 Introduction

The aim of this Chapter is to draw conclusions, make recommendations and to state the contribution that this study will make to the conservation of frogs in South Africa, and possibly as an example for countries elsewhere. The primary objective of the study was to determine the ecotourism potential of frogs in South Africa and especially in South African National Parks (SANParks). In addition to the existing conservation plans, South Africa needs the involvement of managers of conservation areas where threatened or important frog species are found as well as the buy-in from communities to help with frog conservation and fundraising. In so doing, ecotourism can be an innovative conservation tool, especially given the number of tourists interested in nature-based tourism in South Africa, and who may be introduced to the wonders and excitement of frogging. There are a few tourism destinations that already offer frog-related ecotourism activities on a small scale and these destinations can be the platform for the creation and promotion of more activities and frogging destinations throughout South Africa. Before existing tourism destinations can start to promote frog-related activities an outline is needed on how to choose the right destinations that overlap frogging hotpots, and the demographic market for frog-related activities should be understood. In achieving this goal, the following objectives were met:

- **Objective 1:** Conduct a literature review on the history of frog conservation in South Africa and on combining frogging with ecotourism. This objective is addressed in Chapter 1. Firstly, the state of amphibians worldwide, and the plea for conservation efforts given the various threats towards frogs were discussed. Secondly the conservation timeline of frogs in South Africa was demonstrated using a chronological outline of when amphibian conservation in South Africa started and how it has grown. This chapter also provided information on the various amphibian conservation strategies that are in place globally and in South Africa and how effective these strategies are. Finally, the chapter was concluded with a discussion on how ecotourism can be used as a conservation tool for frogs and how to make frogs more appealing to the general public.
- **Objective 2:** Identify the biodiversity and conservation hotspots in South Africa that will benefit ecotourism of frogs. This objective is addressed in Chapter 2. The chapter starts with an introduction on the diversity of frogs in South Africa and the various biomes in

which they are found. This information was used to create species lists of all South African frog species. Suitable National Parks where frog-related ecotourism activities could take place were selected based on set criteria, and lists were compiled of frogs that can be found in these parks, together with a charismatic description of each species. This was done to give tourists information on which frogs they can find when visiting a specific park and to make the frogs more appealing to the tourists. The chapter was concluded with provincial maps created in ArcGIS with the locations of the various parks within the province and photos of the relevant charismatic frog species. The maps and lists drafted in this chapter can be used by the 22 parks and other parks in each province to respresent the frog diversity that can be found in each of the parks, Furthermore the parks can use the maps and lists as marketing tools to attract more toruists to the parks. If the maps are published in South African frog identification or tourism books, then future tourists can plan their holidays and include forg-related ecotourism activites in their holidays. Guides of the parks can also be trained by making use of the lists so that they are more educated on what type of species occours in the park and to be able to give more information to the tourists on the species that they encounter during frogging trips.

- **Objective 3:** Assess the success of current frog-related ecotourism activities and whether they contribute towards the conservation of frogs. This objective is addressed in Chapter 3. Tourism destinations that already offer frog-related activities to tourists were researched and organisers of these destinations were interviewed about their successes and challenges in the frog tourism industry. Qualitative results were generated from this survey. Various questions were asked to generate information on the success, failures and future recommendations of the tourism destinations. Experience drawn from this fledgling industry can be used to improve this tourism product.

- **Objective 4:** Assess the knowledge and opinion of tourists on frog conservation, and determine their preferences for frog-related activities. This objective is addressed in Chapter 3. To determine whether tourists would be interested in participating in frog-related activities an online questionnaire was published on SANParks website for anyone to fill in with access to the SANParks website. An exploratory factor analysis was conducted to find out which factors are the main motivators for tourists to participate in frog-related activities, and ANOVA and Tukey's tests were done to determine the influence that demographic variables have on motivational factors.

- **Objective 5:** Draw conclusions and make recommendations with regard to management aspects of frog-related ecotourism activities in South Africa and especially for the national parks (SANParks). This objective will be discussed in the section to follow. Recommendations will be made on what type of frog-related activities can be held at destinations, how to make children more aware and interested in frogs, and lastly on how to educate the staff that will offer frog-related activities to tourists.

4.2 Main contributions of the research

The study made the following contributions to the field of ecotourism and conservation science:

- It is the first time that the use of frog-related ecotourism is presented as a way to contribute to the conservation of frogs in South Africa.
- The results of this research will help SANParks and various other nature-based tourism destinations to promote frog-related ecotourism activities to the right demographic profiles and to develop the interest of frogs for tourists and public.
- The species lists, and maps created in Chapter 2 can be used by SANParks and other tourism destinations as visual aids to generate interest in frogs for the tourists and to spark their curiosity.
- The concept of the study was presented at the Amphibian Conservation Research Symposium in 2016 and the Herpetological Association of Africa Conference in January 2017. At both of these events the scientists that attended were very supportive of the study concept.
- A contribution was also made to the literature on ecotourism on clarifying which factors are likely to motivate tourists to take part in frog-related activities and what their preferences for activities are.
- Finally, this study contributed to the research concerning the ecotourism potential of frogs in South Africa.

4.3 Conclusions

Conclusions are discussed in relation to each of the four objectives.

- **Conclusions from the literature study:**

The conclusions of the literature study are based on the following key areas: the state of amphibians worldwide, the state of amphibians in South Africa, amphibian conservation strategies and lastly ecotourism as an alternative conservation strategy.

Amphibians play a crucial role in their ecosystems and are of evolutionary significance (Collins *et al.*, 2007 & Angulo *et al.*, 2011). There is an increase in conservation effort all around the world for amphibians due to frog species declining because of anthropogenic threats (Mokhatla *et al.*, 2012). Almost 50% of all amphibian species in South Africa are affected by various threats including; agriculture and aqua-culture, invasive species, problematic species and genes, biological resource usage, pollution, residential and commercial development and natural modifications due to fire, water quality and weather (Measey, 2011). Various conservation actions have been launched in South Africa to help prevent the decline in species numbers.

The conservation of South African amphibian species has received increasing attention since the update of the Atlas and Red Data Book in 2004. More recently, SANBI has published a strategy for frog conservation in South Africa (Measey, 2011). What seems to be missing from the conservation literature is the approach of using ecotourism as a conservation tool and the inclusion of ecotourism activities with frog-related activities. There is limited documentation available on the use of frog-related ecotourism and the success rate of this type of ecotourism as a conservation tool in South Africa. There is also no outline available on how to approach the ecotourism sector and how to link it with the conservation of frogs. However, in 2007 the Amphibian Conservation Action Plan was published by the IUCN and updated in 2015 (Bishop *et al*., 2012 & IUCN, 2017). Four main focus points were recommended as crucial priorities to be practised for global amphibian conservation (Moore *et al*., 2008). These ACAP focus points are very flexible and can be combined with any type of conservation action and it was therefore decided that these ACAP strategies can be combined with the conservation of frogs by means of ecotourism. The four focus points and the way they can be combined with ecotourism is as follows:

1. **Create better understanding and awareness of the causes of declines and extinctions**

   Tourists will learn more about frogs and their habitats. By going on trips into the field they will also have a better understanding of the lifecycle of frogs and the threats towards them.

2. **Constant documentation of amphibian diversity, and population changes**

   The frog sightings recorded by tourists during their frogging trips can be logged onto an application that sends information through to researchers for future studies. This information can be species names, location, photos etc. In this way tourists can contribute towards amphibian conservation by giving a better picture of what is happening to SouthAfrica’s frog diversity.

3. **Development and application of long-term conservation programmes or projects**

   Creating tourism-friendly frogging activities in parks will simultaneously require an amphibian management plan. Thus, introducing tourists to frogs as a tourist product, will 1) help with the management of frogs, 2) provide financial aid by tourists who pay for activities, 3) provide an opportunity for conservation to spread to the home towns of the tourists and 4) create word of mouth marketing.

4. **Emergency responses to immediate or near-potential crises**
   The frogging hotspots will continuously be monitored as frogging becomes a more popular attraction, and consequently receive more conservation attention than before. So, when a threat, either due to a tourism activity, human threat or natural threat, is noticed, resources will already be in place that can be directed towards mitigation strategies.

The ACAP is the most ambitious programme developed to date, to combat the extinction of species and international communities need to take part in this plan (Gascon *et al.,* 2007). By involving SANParks and other ecotourism destinations South Africa can form the basis of a frog conservation strategy involving ecotourism. It should however be emphasized that the ecotourism activities should be sustainable where the needs of the tourists, tourism destination and local community are met while the environment is still being protected (Cernat & Gourdon, 2007). To make sure the activities are sustainable the following positive and negative effects of ecotourism is given with solutions on how to minimize the negative effects.

Possible positive effects*:* Tourists can help with conservation by financial assistance, either by giving a donation or through an entrance fee at parks. Usually an entrance fee is a better way to collect money for conservation (Tisdell & Wilson, 2012). If tourists visit a nature reserve and an amphibian awareness program is advertised at the park it can develop a positive attitude and favourable behaviour towards the conservation of frogs. Tourists may become more willing to support government policies that help to conserve species or adopt personal behaviours to help conserve species, for example, drive slower during rainy seasons to not cause amphibian road kill. A major positive effect is that any park or reserve that focusses on the conservation of a specific animal species may provide opportunities for the involvement of local volunteers and volunteering groups (Tisdell & Wilson, 2012). This will add to the social support for the conservation of amphibians. Creating tourism opportunities for amphibians will also create job opportunities as more local community members will get involved in the conservation of amphibians, management of visitors wishing to view amphibians, provide social encouragements, and allow for the gathering of scientific information and the building of infrastructure (Tisdell & Wilson, 2012). Ultimately, community members can make an

important contribution to the success of a tourism activity and should be involved where possible.

Possible negative effects: Tourism can also have negative impacts on the conservation of frogs and can change their natural habitats. Tourists should always be aware of their ecological footprint in the park and be informed about the rules in the park, for instance, tourists should not be allowed to collect and handle frogs and other animals in the park without the necessary permits or supervision or tourists should only drive and walk on designated areas to ensure that they do not injure or kill animals and especially frogs in their natural habitats. The parks can also have regulations on the number of tourists that are allowed to visit a frogging site at a time. In breeding areas of frog's boardwalks can be built to ensure that tourists don't disturb breeding pairs or egg clutches. Artificial infrastructure like buildings, lighting, boardwalk etc. should be constructed in such a manner that they do not damage amphibian habitat. Measures should be in place for tourists to rather go out on guided tours in high risk areas where frogs are likely to be killed by trampling. Clearly there are various ways in which tourism activities can also harm frogs and their habitats, but that is why it is important for guides and parks to develop plans against these negative effects.

To eliminate the negative impacts of tourism activities at frogging sites a frogging guide can be employed to escort tourists out on frogging events. The guide can educate tourists on how not to harm the frogs in any way. This type of tourism activity requires the guide to have skills in interpretation, skills to motivate tourists to modify their behaviour to minimize impacts on the resources, instil conservation values, and provide knowledge (Black, 2007).

Linking frogging experiences with nature-based tourism activities can promote amphibians in the park. The focus should not only be on the specific attraction visited, but multiple attractions within that particular region in order to make it a tourism hobby that can grow within South Africa and beyond its borders. Once this goal has been reached, a multiplier effect will occur where tourists will travel all over the country and maybe even the world to view amphibians and spend money that in turn will help the economy of conservation to grow and provide funds for conservation. For some countries tourism is one of the major foreign exchange earners, and if nature-based tourism is correctly promoted and marketed it can change to a multibillion-dollar industry (Tisdell & Wilson, 2012). This may even result in the development of more nature reserves and nature-based attractions to conserve even more fauna and flora groups and not only the current species with high tourism value.

- **Conclusion with regards to the biodiversity and conservation hotspots**

The conclusions regarding the biodiversity and conservation hotspots in South Africa that will benefit the ecotourism potential of frogs are based on the following key areas: diversity of

frogs in South Africa, the creation of species lists, criteria used to identify suitable parks and frogging hotspot maps.

The rich frog diversity of South Africa can be ascribed to the wide variety of landscapes, climates and habitats that South Africa has to offer (du Preez & Carruthers, 2017). Frogs have adapted to all the nine biomes found in South Africa and are therefore unevenly distributed all over the country. Various frog species are dependent on moisture for their survival and therefore the highest frog species richness is found in KwaZulu-Natal (province with highest rainfall), while the Western Cape boasts the highest number of endemic species (Measey *et al*., 2011). To determine which existing parks in South Africa can start to host frog-related ecotourism activities, a systematic reference for tourism hotspots in South Africa was established. The overlap between tourism and amphibian diversity hotspots was identified and an ecotourism strategy that will help with the conservation of frogs was the end product of the chapter.

The criteria used to identify suitable parks were; biomes, species richness, endemicity of species, conservation status, charismatic value and park attributes. Based on these criteria 22 parks were selected for the purpose of the study. Fortunately, 14 of the selected parks are SANParks and the management of SANParks can start a new initiative to help protect a large proportion of South Africa's frog species. These parks can equally function to promote frog diversity as a tourist attraction and consequently enhance their conservation. The maps and species lists created could be used by SANParks and other tourism destinations by incorporating them into their tourism management plans. The maps provide a visual impression of the frogging hotspots within each province that tourists can visit. The parks can ultimately provide frog-related activities that link with information from these maps to make the attraction and activities more appealing and educational. The identified parks together with their surrounding areas can employ frogging guides to be responsible for the frog-related activities and also to take tourists out on frogging excursions. The lists created for each province and park will be a helpful tool for the guides to become informed about the species in their immediate area. Involving the community in this project will make the concept of sustainable frog related-ecotourism more feasible. Also, if the parks make use of an educated guide it will curtail any harmful impact that tourists may have on the environment.

- **Conclusion with regards to the current frog-related ecotourism activities**

The conclusions regarding the current frog-related activities held at a few tourism destinations in South Africa are based on the following key areas: description of existing frogging

destinations, interviews done with them to determine their success rate, analysis of qualitative results and conclusion about the industry.

Management staff of Lake Chrissie, the Wakkerstroom frogging event, Amakhosi Safari Lodge, Kenilworth Racecourse Conservation Area, Tanglewood Farm Private Nature Reserve, Mount Moreland Conservancy and Dune Ridge Country House were interviewed to find out what type of frog-related events they offer and what they felt the disadvantages and successes were. Most of the activities that destinations provide aim to create awareness of frog conservation amongst tourists. Destinations that keep their activities interesting, educational and well promoted have a higher attendance rate than their competitors. The different kinds of activities that they offer include frogging excursions (go out to look for frogs), events where scientists come to speak about frogs and interactive excursions for children. The potential therefore exists for more activities to be held at these destinations as well as for SANParks to broaden the demographic profile of tourists that would be interested in partaking in frog-related ecotourism activities. The destinations felt that the frogging events can only be a seasonal activity due to frogs being active only during certain seasons. They also struggle to get a high number of tourists to attend the events and the numbers of visitors fluctuate all the time. However, there remains a large part of South Africa where frogging destinations haven't started to promote frogging as an activity. As soon as these destinations start to offer the activities, frogging would not have to be restricted to being only a seasonal activity, due to different rainfall seasons over South Africa.

There are numerous recommendations that can improve the attractiveness of frogging destinations and to increase the number of visitors to the destinations, these recommendations will be discussed in the recommendation section of this chapter.

- **Conclusion with regards to the knowledge and participation rate of tourists**

The conclusions regarding the assessment of the knowledge and opinion of tourists on frogs in conservation and their williness to participate in frog-related activities are based on the following key areas: the online questionnaire, analysis of quantitative results and conclusion about willingness to participate.

When involving tourists in the conservation of frogs, it is important to properly understand the market of ecotourism as well as the needs of tourists. The aim of the online questionnaire was to assess the knowledge and opinion of tourists on frogs, determine if respondents would be interested in participating in frogging activities, the factors that will influence their motivations and the demographic profiles mostlikely to be interested. A total of 356 participants filled in

and completed the online questionnaire published on SANParks website and useful feedback were received. The questionnaire consisted of socio-demographic questions, personal demographic questions, frogs and nature-based questions and frog-related activities questions.

Results that stood out from the demographic answers were:

- Most of the respondents were female (53%)
- Most of the respondents were between the age group of 25-64
- Most came from Gauteng
- 56% of the participants were first exposed to nature-based tourism between the ages 3-13
- 68% of the participants felt that their first encounter with frogs was exciting

The conclusion that can be made from these results is that both men and woman would like to participate in frogging activities and that a wide age group would be interested. Therefore, activities should be held in a way that will interest a broad age group. Activities should also be promoted in provinces all over South Africa and not only in provinces with the highest abundance of frogs or where most tourism destinations are situated. The participants from Gauteng would be more interested in travelling to other provinces to experience frogs in their habitats, most probably due to the small number of species with charismatic value found in Gauteng. It is also clear that many people are exposed to nature-based ecotourism at a very young age and therefore people with children should be motivated to bring their children with them on these frogging excursions so that the children are exposed to frogs from a very young age. This will educate them about frogs from a very young age and make them less “hateful/afraid” towards them.

An exploratory factor analysis was conducted, and ten main motivational factors were identified. These were; education, level of interest, conservation, additional activities, social aspect, interactive excursions, experience, relaxation, and push factors and pull factors. From these ten factors, four factors stood out as the factors having the highest influence on participants (conservation, experience, level of interest and interactive excursions). An ANOVA and Tukey’s test were then conducted to determine how the factors influenced the various demographic profiles. For most of the participants the level of interest in frogs, their opinion about conservation and their previous experiences with frogs and the future experiences they wanted to build, had the highest influences on their final decision to partake in frog-related activities. What stood out most from the results was the following:

- None of the ten identified motivational factors had a high influence on the age group of 65+, therefore other factors have an influence on participants older than 65.
- For English speaking participants, education was a high motivational factor
- The push factors of an international tourists have a higher influence on their decision making (International participants have a limited time available when touring and have specific things they want to experience)

The conclusion that can be made from the exploratory results is that different demographical profiles are motivated by different factors. Thus, when a destination wants to hold a frogging event and they want to target a specific market, they should always approach them with the right motivational factor. For instance, if they want to attract participants between the ages of 18 and 24 the factors of conservation and experience should be the main promotional factors. For participants with children additional activities for children should be available. For international tourist's frog-related activities should be combined with activities like night drives, as international tourists have limited time.

Lastly, questions were asked to determine what type of activities participants would like to partake in and how far they are prepared to travel. Activities that participants are most keen on participate in are: night walks/drives, photography, frog identification and citizen science. These are all flexible activities that can be held at any destination. Most participants are also prepared to travel a regional distance of about 150km to participate in frog-related activities. This gives all the tourism destinations within a specific province that offer frog related activities the opportunity to market their activities and make them interesting for the local and regional community that will be prepared to travel to them.

4.4 Recommendations of the study

The recommendations based on this study are divided into three sections: Firstly, recommendations on how to educate the general public and to motivate them to visit frog-related ecotourism destinations, secondly what type of frog-related activities can be held at destinations, and lastly recommendations on how to educate the destinations that will offer frog-related activities to tourists are provided.

4.4.1 Educating and motivating the general public

Education efforts should be aimed at the general public and starting from a young age to induce a positive perception of frogs. This includes amphibian related talks at primary school and pre-primary level. The management from the frogging tourism destination can give visual presentations and displays and the children can also be taught some frog calls of the species

they can find in their gardens. Another way to promote frog conservation is to teach them about the life styles of frogs and how garden ponds can be made frog-friendly. This will motivate them to start to conserve frogs at a young age and be more interested in them. Ultimately schools can become part of a project where the children are educated about the frogs and come and visit the frogging sites.

SANParks and other frogging tourism destinations should engage in partnerships with other institutions that also have to do with frog-related products. For example, in the curio shops, frog books can be sold and the profit made can then be used to help with the conservation of frogs. The local community must be involved by being informed about the frogging activities in the park, being educated about the need for frogs in the environment, taking ownership of the conservation of frogs, becoming involved in the activities (being frogging guides) and they can also make frog-related curios that can be sold at the destinations to also help the community with an income.

To attract local communities to frogging activities at the parks a frogging event can be well marketed and a frog specialist can give a presentation at the event. The park can also promote specific frogging days for kids where guides then take them out to frog ponds with nets and teach them how to catch and identify frogs without injuring them. The general public can ultimately be educated about frogs and be motivated to visit the frogging destinations by educating visitors via fully interpreted tours, involving exploring the park and explaining the concept of frogging and the contribution to conservation, guided walks for tourists and also daily outings for local school children (Burlo, 2015).

4.4.2 Types of frog-related activities that can be held at tourism destinations

In order to provide the visitor with an interesting frogging experience, the frog-related ecotourism activities should take place in an environment with charismatic frogs species, a high species richness, frogs with different conservation statuses, different biomes and habitats within the biomes, a safe environment where tourists can walk around and climb out of vehicles to view frogs and accessibility to get to frogs (marked pathways, infrastructure build like walkways to minimise the distress on the frogs). These attributes will sustain the frogging ecotourism operations in the long-term.

- **Night Drives:** In parks where people go out on night drives to view wildlife, the guide can stop at ponds and wetlands and educate the tourists about the calls that frogs make and its value in identifying species. They can then also take part in finding frogs if the park doesn't have dangerous animals.

- **Night/day walks:** If tourists go out on guided walks it makes the possibility of finding frogs easier due to no vehicle sound disturbing the frogs. By being in amphibian habitat, the tourist will directly encounter frog species and observe calling behaviour. Even though a smaller area is covered by walking, more frogs are likely to be found by being in closer proximity to them.
- **Frogging excursions:** During these excursions, guides can take tourists to a frog site and then everyone participates in searching for frogs. If the tourists are educated on how to catch frogs without injuring them they can help to catch frogs, otherwise they can help to find the frogs and acquire assistance from the guide. After a frog has been caught the guide can then teach the tourists about all the external features of the frog and point out diagnostic features of the particular species. Various frog identification guides are available that tourists can use to identify the species. During the frogging excursion it is very important that the guide educates the tourists about the health and ethic regulations regarding frogs. Also, to educate them about frog diseases and to not relocate frogs from one habitat to another without the help of a frog expert.
- **Photography excursions:** For tourists that are interested in taking photos a short course on the photography of frogs can be held. During this course the tourists can be shown which lighting equipment and lenses to use when taking pictures of frogs and which angles of the subject are most effective.
- **Frog identification and ecology courses:** This can be held before the guide takes the tourists out on the frog walks, drives or excursion. A basic identification presentation can be given on which main features of frog are used in identifying species.
- **Entertainment for children:** When tourists with children attend the frogging events, the children can either also participate in the frogging excursions or alternative activities can be held for them. These activities include colouring in competitions, identification of frogs and their calls on an age level suitable for them, an interactive frog display area where the children can touch objects made from materials that feel like frogs and animated educational films.
- **Educational activities and films:** For tourists that would still like to be educated about frogs, but don't particularly want to go out on frogging excursions, educational films can be shown. Another concept that parks can incorporate is a virtual frog museum where tourists can walk around and have a look at the different aspect of a frog's life cycle, their different habitats and then also examples of different species.
- **Citizen science:** Tourists can help scientists with frog-related research by taking part in citizen science. Tourists can create a profile on the Animal Demography Unit's webpage (http://vmus.adu.org.za/vm_view_db.php?sp=FrogMap-490) and add frog photos to the virtual museum. The information required by the site is a photo of the frog, the location

and the species name. Scientists then use this information to update the distribution maps of frogs in South Africa. Another way to contribute is by downloading the Frogs of Southern Africa mobile application authored by zoology professor Louis du Preez and environmental consultant Vincent Carruthers (du Preez & Carruthers, 2017). The app is a definitive guide to frog identification in southern Africa and is suitable for nature lovers of all experience levels. The app introduces the user to all the frog species in South Africa and gives information about the tadpole stages, conservation statuses, calls, distribution maps, habits, habitats and key ID points of the frogs. Full-colour photographs and high-definition videos showing behaviour, mating, habitat and calls are also available. The app also gives the opportunity for tourists to log frog species that they find during their frogging trips. This information is then also send through to the Animal Demography Unit to help them with their research. The Young Explorer App Series includes one for frogs based on “My First Book of Frog” (J. Tarrant pers. comm.), available for children that includes species descriptions, calls and games.

4.4.3 How to educate staff from the destinations that may offer frog-related activities to tourists

Management of the park should also be educated about frogs to ensure that they provide the right information about frogs to the tourists. An effective way to do this is by encouraging employees to become frogging guides. The guides can do a FGASA Level 1 course that introduces them to frogs. As this course does not give an in-depth description of how to be a frogging guide, how to educate tourists about frogs and how to catch and handle frogs when going on a frogging excursion, additional training is required. Many frog experts in South Africa can be approached to improve the knowledge and expertise of frogging guides and to ensure that a standard of guiding is maintained throughout the industry. Dr. Jeanne Tarrant at the EWT is currently updating an in-depth training guide for frogging guides (J. Tarrant pers. comm.).

We recommend that the following should be included in a frog guide training manual: basic background about frogs (ecology, classification, anatomy and morphology, how to be a frogging guide, how to entertain the tourists with regards to frogs, how to catch frogs and what type of activities to incorporate into a frogging event. The guide should be educated about the frog species that occurs in the area, know a few calls and be able to identify them quickly without a book, if a guide struggles to identify a lot of species he will lose the interest of the tourists.

When the guide meets the tourists, he should analyse their demographic profiles to make sure that the activities are suitable for the type of tourists. He can do this by asking them a few personal questions like; why they are here, how they feel about frogs, have they ever taken part in frogging activities and so on. Before the guide takes the tourists out on the frogging excursion he first needs to give them information about what to do and what not to do of frogging, the safety and ethics of frogging and the suitable clothes they need to wear. It is important that tourists should follow the rules of nature reserves when going on frogging trips to ensure that tourists exercise proper care and control of the environment and fauna and flora within it. This should be done to ensure that the following risks don't occur (Breiter, 2011); spread of diseases, vehicle/footprint damage, public nuisance, unsanitary conditions, digging in frogging areas, chasing/killing/injuring of frogs and other animals and the removal of fauna and flora from the environment. During this information session he can also give them a quick session on how to identify and catch the frogs.

During the frogging trip it is always important that the guide is aware of his surroundings and takes the safety of his clients into account. When a frog is approached the guide can catch the frog and put it in a container for the tourists to study it and take photos. The important thing about taking people out on field trips is to keep the group small, make everyone part of the excursion, give them enough information, answer all their questions thoroughly and make the event interesting and fun. The concept of how the tourists can conserve frogs on their own should also be talked about and tourists should be informed that they can't just go into field and do frogging excursions on their own. Permits is needed and that is way tourism destinations will benefit by offering these types of activities. Brochures on the topic can also be handed out to tourists and these brochures can be written in different languages to make it appealing for the tourists.

Through this study we aim to introduce nature-based tourists to frogging activities and thereby promoting it as a growing tourism activity in South Africa. The data gathered by tourists during frogging excursions can be used by conservationists and scientists for species research and management purposes. Ultimately, tourism activities can contribute towards the conservation of frogs in South Africa and help to highlight the plight of declining frogs.

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APPENDIX A – FROGS OF SOUTH AFRICA SPECIES LIST

Appendix A is the full species lists that were created for Chapter 2. Species were listed alphabetically only up to genus level. The common names are written in brackets.

Criteria	Free State	Gauteng	Western Cape	Northern Cape	Mpumalanga	Eastern Cape	Limpopo	KwaZulu-Natal	North-West
CRITICALLY ENDANGERED			*Arthroleptella rugosa* (Rough Moss Frog) *Arthroleptella subvoce* (Northern Moss Frog) *Capensibufo rosei* (Rose's Mountain Toad) *Heleophryne rosei* (Table Mountain Ghost Frog) *Microbatrachella capensis* (Micro Frog)			*Vandijkophrynus amatolicus* (Amathole Toad)			
ENDANGERED			*Afrixalus knysnae* (Knysna Leaf-folding Frog) *Sclerophrys pantherinus* (Western Leopard Toad) *Xenopus gilli* (Cape Platanna)			*Afrixalus knysnae* (Knysna Leaf-folding Frog) *Heleophryne hewitti* (Hewitt's Ghost Frog) *Natalobatrachus bonebergi* (Kloof Frog)		*Anhydrophryne ngongoniensis* (Mistbelt Chirping Frog) *Hyperolius pickersgilli* (Pickersgill's Reed Frog) *Leptopelis xenodactylus* (Long-toed Tree Frog) *Natalobatrachus bonebergi* (Kloof Frog)	

	Free State	Gauteng	Western Cape	Northern Cape	Mpumalanga	Eastern Cape	Limpopo	KwaZulu-Natal	North-West
VULNERABLE				*Breviceps macrops* (Desert Rain Frog)	*Hemisus guttatus* (Spotted Shovel-nosed Frog)	*Anhydrophryne rattrayi* (Hogsback Frog)		*Hemisus guttatus* (Spotted Shovel-nosed Frog)	
								Breviceps bagginsi (Bilbo's Rain Frog)	
NEAR THREATENED			*Arthroleptella drewsii* (Drew's Moss Frog) *Arthroleptella lightfooti* (Cape Peninsula Moss Frog) *Breviceps gibbosus* (Cape Rain Frog) *Cacosternum capense* (Cape Caco) *Poyntonia paludicola* (Montane Marsh Frog)				*Breviceps sylvestris* (Northern Forest Rain Frog)	*Amietia hymenopus (Phofung River Frog)*	
LEAST CONCERN	*Amietia delalandii* (Common River Frog) *Amietia poyntoni* (Poynton's River Frog)	*Amietia delalandii* (Common River Frog) *Amietia poyntoni* (Poynton's River Frog)	*Amietia delalandii* (Common River Frog) *Amietia fuscigula* (Cape River Frog)	*Amietia delalandii* (Common River Frog) *Amietia poyntoni* (Poynton's River Frog)	*Afrixalus aureus* (Golden Leaf-folding Frog) *Afrixalus fornasinii* (Greater Leaf-folding Frog)	*Afrixalus spinifrons* (Natal Leaf-Folding Frog) *Amietia delalandii* (Common River Frog)	*Afrixalus aureus* (Golden Leaf-folding Frog) *Amietia delalandii* (Common River Frog)	*Afrixalus aureus* (Golden Leaf-folding Frog) *Afrixalus delicatus* (Delicate Leaf-folding Frog)	*Amietia delalandii* (Common River Frog) *Amietia poyntoni* (Poynton's River Frog)

	Amietia umbraculata (Maluti River Frog)	*Breviceps adspersus* (Bushveld Rain Frog)	*Amietia poyntoni* (Poynton's River Frog)	*Breviceps adspersus* (Bushveld Rain Frog)	*Amietia delalandii* (Common River Frog)	*Amietia fuscigula* (Cape River Frog)	*Arthroleptis stenodactylus* (Shovel-footed Squeaker)	*Afrixalus fornasinii* (Greater Leaf-folding Frog)	*Breviceps adspersus* (Bushveld Rain Frog)
	Free State	**Gauteng**	**Western Cape**	**Northern Cape**	**Mpumalanga**	**Eastern Cape**	**Limpopo**	**KwaZulu-Natal**	**North-West**
	Anhydrophryne hewitti (Natal Chirping Frog)	*Cacosternum boettgeri* (Boettger's Caco)	*Amietia vandijki* (Van Dijk's River Frog)	*Breviceps branchi* (Branch's Rain Frog)	*Amietia poyntoni* (Poynton's River Frog)	*Amietia hymenopus* (Phofung River Frog)	*Breviceps adspersus* (Bushveld Rain Frog)	*Afrixalus spinifrons* (Natal Leaf-Folding Frog)	*Cacosternum boettgeri* (Boettger's Caco)
	Breviceps adspersus (Bushveld Rain Frog)	*Kassina senegalensis* (Bubbling Kassina)	*Arthroleptella bicolor* (Bainskloof Moss Frog)	*Breviceps namaquensis* (Namaqua Rain Frog)	*Breviceps adspersus* (Bushveld Rain Frog)	*Amietia poyntoni* (Poynton's River Frog)	*Breviceps mossambicus* (Mozambique Rain Frog)	*Amietia delalandii* (Common River Frog)	*Chiromantis xerampelina* (Southern Foam Nest Frog)
	Breviceps mossambicus (Mozambique Rain Frog)	*Phrynomantis bifasciatus* (Banded Rubber Frog)	*Arthroleptella landdrosia* (Landdroskop Moss Frog)	*Cacosternum boettgeri* (Boettger's Caco)	*Breviceps mossambicus* (Mozambique Rain Frog)	*Amietia vertebralis* (Maluti River Frog)	*Cacosternum boettgeri* (Boettger's Caco)	*Amietia poyntoni* (Poynton's River Frog)	*Hemisus marmoratus* (Mottled Shovel-nosed Frog)
	Cacosternum boettgeri (Boettger's Caco)	*Poyntonophrynus fenoulheti* (Northern Pygme Toad)	*Arthroleptella rugosa* (Rough Moss Frog)	*Cacosternum namaquense* (Namaqua Caco)	*Breviceps sopranus* (Whistling Rain Frog)	*Arthroleptis wahlbergi* (Bush Squeaker)	*Chiromantis xerampelina* (Southern Foam Nest Frog)	*Amietia umbraculata* (Maluti River Frog)	*Hildebrandtia ornata* (Southern Ornata Frog)
	Cacosternum nanum (Bronze Caco)	*Ptychadena anchietae* (Plain Grass Frog)	*Arthroleptella subvoce* (Northern Moss Frog)	*Kassina senegalensis* (Bubbling Kassina)	*Breviceps verrucosus* (Plaintive Rain Frog)	*Breviceps adspersus* (Bushveld Rain Frog)	*Hadromophryne natalensis* (Natal Cascade Frog)	*Anhydrophryne hewitti* (Natal Chirping Frog)	*Kassina senegalensis* (Bubbling Kassina)
	Hadromophryne natalensis (Natal Cascade Frog)	*Ptychadena mossambica* (Broad-banded Grass Frog)	*Arthroleptella villiersi* (De Villiers' Moss Frog)	*Phrynomantis annectens* (Marbled Rubber Frog)	*Cacosternum boettgeri* (Boettger's Caco)	*Breviceps fuscus* (Plain Rain Frog)	*Hemisus guineesis* (Guinea Shovel-nosed Frog)	*Arthroleptis stenodactylus* (Shovel-footed Squeaker)	*Phrynobatrachus natalensis* (Snoring Puddle Frog)
	Kassina senegalensis (Bubbling Kassina)	*Ptychadena porosissima* (Striped Grass Frog)	*Breviceps acutirostris* (Strawberry Rain Frog)	*Poyntonophrynus vertebralis* (Southern Pygme Toad)	*Cacosternum nanum* (Bronze Caco)	*Breviceps mossambicus* (Mozambique Rain Frog)	*Hemisus marmoratus* (Mottled Shovel-nosed Frog)	*Arthroleptis wahlbergi* (Bush Squeaker)	*Poyntonophrynus fenoulheti* (Northern Pygme Toad)

	Phrynobatrachus natalensis (Snoring Puddle Frog)	*Pyxicephalus adspersus* (Giant Bullfrog)	*Breviceps fuscus* (Plain Rain Frog)	*Pyxicephalus adspersus* (Giant Bullfrog)	*Cacosternum parvum* (Mountain Caco)	*Breviceps verrucosus* (Plaintive Rain Frog)	*Hildebrandtia ornata* (Southern Ornata Frog)	*Breviceps adspersus* (Bushveld Rain Frog)	*Poyntonophrynus vertebralis* (Southern Pygme Toad)
	Free State	**Gauteng**	**Western Cape**	**Northern Cape**	**Mpumalanga**	**Eastern Cape**	**Limpopo**	**KwaZulu-Natal**	**North-West**
	Poyntonophrynus vertebralis (Southern Pygme Toad)	*Schismaderma carens* (Red Toad)	*Breviceps montanus* (Cape Mountain Rain Frog)	*Sclerophrys capensis (Rauccos Toad)*	*Chiromantis xerampelina* (Southern Foam Nest Frog)	*Cacosternum boettgeri* (Boettger's Caco)	*Hyperolius marmoratus* (Painted Reed Frog)	*Breviceps mossambicus* (Mozambique Rain Frog)	*Ptychadena anchietae* (Plain Grass Frog)
	Pyxicephalus adspersus (Giant Bullfrog)	*Sclerophrys gutturalis* (Guttaral Toad)	*Breviceps namaquensis* (Namaqua Rain Frog)	*Sclerophrys gutturalis* (Guttaral Toad)	*Hadromophryne natalensis* (Natal Cascade Frog)	*Cacosternum nanum* (Bronze Caco)	*Hyperolius pusillus* (Water Lily Frog)	*Breviceps sopranus* (Whistling Rain Frog)	*Ptychadena mossambica*(Broad-banded Grass Frog)
	Schismaderma carens (Red Toad)	*Sclerophrys poweri* (Western Olive Toad)	*Breviceps rosei vansoni* (Rose's Rain Frog)	*Sclerophrys poweri* (Western Olive Toad)	*Hemisus marmoratus* (Mottled Shovel-nosed Frog)	*Cacosternum parvum* (Mountain Caco)	*Kassina maculata* (Red-legged Kassina)	*Breviceps verrucosus* (Plaintive Rain Frog)	*Pyxicephalus adspersus* (Giant Bullfrog)
	Sclerophrys capensis (Rauccos Toad)	*Sclerophrys capensis (Rauccos Toad)*	*Cacosternum aggestum* (Klipheuwel Caco)	*Strongylopus grayii* (Clicking Stream Frog)	*Hildebrandtia ornata* (Southern Ornata Frog)	*Cacosternum thorini* (Hogsback Caco)	*Kassina senegalensis* (Bubbling Kassina)	*Cacosternum boettgeri* (Boettger's Caco)	*Pyxicephalus edulis* (Edible Bullfrog)
	Sclerophrys gutturalis (Guttaral Toad)	*Semnodactylus wealii* (Rattling Frog)	*Cacosternum australis* (Southern Caco)	*Strongylopus springbokensis* (Namaqua Stream Frog)	*Hyperolius marmoratus* (Painted Reed Frog)	*Hadromophryne natalensis* (Natal Cascade Frog)	*Leptopelis mossambicus* (Brown-backed Tree Frog)	*Cacosternum nanogularum* (KwaZulu Caco)	*Schismaderma carens* (Red Toad)
	Sclerophrys poweri (Western Olive Toad)	*Strongylopus fasciatus* (Striped Stream Frog)	*Cacosternum boettgeri* (Boettger's Caco)	*Tomopterna cryptotis* (Tremolo Sand Frog)	*Hyperolius pusillus* (Water Lily Frog)	*Heleophryne regis* (Southern Ghost frog)	*Phrynobatrachus mababiensis* (Dwarf Puddle Frog)	*Cacosternum nanum* (Bronze Caco)	*Sclerophrys capensis (Rauccos Toad)*
	Semnodactylus wealii (Rattling Frog)	*Tomopterna cryptotis* (Tremolo Sand Frog)	*Cacosternum karooicum* (Karoo Caco)	*Tomopterna delalandii* (Cape Sand Frog)	*Hyperolius semidiscus* (Yellow-striped Reed Frog)	*Hyperolius horstockii* (Arum Lily Frog)	*Phrynobatrachus natalensis* (Snoring Puddle Frog)	*Cacosternum parvum* (Mountain Caco)	*Sclerophrys garmani* (Eastern Olive Toad)

	Strongylopus fasciatus (Striped Stream Frog)	*Tomopterna natalensis* (Natal Sand Frog)	*Cacosternum namaquense* (Namaqua Caco)	*Tomopterna tandyi* (Tandy's Sand Frog)	*Hyperolius tuberilinguis* (Tinker Reed Frog)	*Hyperolius marmoratus* (Painted Reed Frog)	*Phrynomantis bifasciatus* (Banded Rubber Frog)	*Cacosternum rhythmum* (Rhythmic Caco)	*Sclerophrys gutturalis* (Guttaral Toad)
	Free State	**Gauteng**	**Western Cape**	**Northern Cape**	**Mpumalanga**	**Eastern Cape**	**Limpopo**	**KwaZulu-Natal**	**North-West**
	Strongylopus grayii (Clicking Stream Frog)	*Xenopus laevis* (Common Platanna)	*Cacosternum nanum* (Bronze Caco)	*Vandijkophrynus angusticeps* (Cape Sand Toad)	*Kassina maculata* (Red-legged Kassina)	*Hyperolius pusillus* (Water Lily Frog)	*Poyntonophrynus fenoulheti* (Northern Pygmy Toad)	*Cacosternum striatum* (Striped Caco)	*Strongylopus fasciatus* (Striped Stream Frog)
	Strongylopus wageri (Plain stream Frog)		*Cacosternum platys* (Flat Caco)	*Vandijkophrynus gariepensis* (Karoo Skurwepadda)	*Kassina senegalensis* (Bubbling Kassina)	*Hyperolius semidiscus* (Yellow-striped Reed Frog)	*Ptychadena anchietae* (Plain Grass Frog)	*Chiromantis xerampelina* (Southern Foam Nest Frog)	*Tomopterna cryptotis* (Tremolo Sand Frog)
	Tomopterna cryptotis (Tremolo Sand Frog)		*Capensibufo deceptus* (Deception Peak Mountain Toadlet)	*Vandijkophrynus robinsoni* (Paradise Toad)	*Leptopelis mossambicus* (Brown-backed Tree Frog)	*Kassina senegalensis* (Bubbling Kassina)	*Ptychadena mossambica* (Broad-banded Grass Frog)	*Hadromophryne natalensis* (Natal Cascade Frog)	*Tomopterna krugerensis* (Knocking Sand Frog)
	Tomopterna natalensis (Natal Sand Frog)		*Capensibufo magistratus* (Landdroskop Mountain Toadlet)	*Xenopus laevis* (Common Platanna)	*Phrynobatrachus mababiensis* (Dwarf Puddle Frog)	*Leptopelis natalensis* (Natal Tree Frog)	*Ptychadena oxyrhynchus* (Sharp-nosed Grass Frog)	*Hemisus marmoratus* (Mottled Shovel-nosed Frog)	*Tomopterna natalensis* (Natal Sand Frog)
	Tomopterna tandyi (Tandy's Sand Frog)		*Capensibufo selenophos* (Moonlight Mountain Toadlet)		*Phrynobatrachus natalensis* (Snoring Puddle Frog)	*Phrynobatrachus natalensis* (Snoring Puddle Frog)	*Ptychadena uzungwensis* (Udzungwa Grass Frog)	*Hildebrandtia ornata* (Southern Ornata Frog)	*Xenopus laevis* (Common Platanna)
	Vandijkophrynus gariepensis (Karoo Skurwepadda)		*Capensibufo tradouwi* (Tradouw Mountain Toad)		*Phrynomantis bifasciatus* (Banded Rubber Frog)	*Poyntonophrynus vertebralis* (Southern Pygme Toad)	*Pyxicephalus adspersus* (Giant Bullfrog)	*Hyperolius argus* (Argus Reed Frog)	

	Xenopus laevis (Common Platanna)		*Heleophryne depressa* (Cederberg Ghost Frog)		*Poyntonophrynus fenoulheti* (Northern Pygme Toad)	*Ptychadena oxyrhynchus* (Sharp-nosed Grass Frog)	*Pyxicephalus edulis* (Edible Bullfrog)	*Hyperolius marmoratus* (Painted Reed Frog)	
	Free State	**Gauteng**	**Western Cape**	**Northern Cape**	**Mpumalanga**	**Eastern Cape**	**Limpopo**	**KwaZulu-Natal**	**North-West**
			Heleophryne orientalis (Eastern Ghost Frog) *Heleophryne purcelli* (Cape Ghost Frog) *Heleophryne regis* (Southern Ghost frog) *Hyperolius horstockii* (Arum Lily Frog) *Hyperolius marmoratus* (Painted Reed Frog) *Kassina senegalensis* (Bubbling Kassina) *Poyntonophrynus vertebralis* (Southern Pygme Toad)		*Ptychadena anchietae* (Plain Grass Frog) *Ptychadena mossambica* (Broad-banded Grass Frog) *Ptychadena nilotica (Mascarene Grass Frog)* *Ptychadena oxyrhynchus* (Sharp-nosed Grass Frog) *Ptychadena porosissima* (Striped Grass Frog) *Pyxicephalus adspersus* (Giant Bullfrog) *Pyxicephalus edulis* (Edible Bullfrog)	*Ptychadena porosissima* (Striped Grass Frog) *Pyxicephalus adspersus* (Giant Bullfrog) *Sclerophrys capensis (Rauccos Toad)* *Sclerophrys gutturalis* (Guttaral Toad) *Sclerophrys pardalis* (Eastern leopard Toad) *Semnodactylus wealii* (Rattling Frog) *Strongylopus fasciatus* (Striped Stream Frog)	*Schismaderma carens* (Red Toad) *Sclerophrys capensis (Rauccos Toad)* *Sclerophrys garmani* (Eastern Olive Toad) *Sclerophrys gutturalis* (Guttaral Toad) *Sclerophrys poweri* (Western Olive Toad) *Sclerophrys pusilla* (Flat-backed Toad) *Strongylopus grayii* (Clicking Stream Frog)	*Hyperolius poweri* (Power's Reed Frog) *Hyperolius pusillus* (Water Lily Frog) *Hyperolius semidiscus* (Yellow-striped Reed Frog) *Hyperolius tuberilinguis* (Tinker Reed Frog) *Kassina maculata* (Red-legged Kassina) *Kassina senegalensis* (Bubbling Kassina) *Leptopelis mossambicus* (Brown-backed Tree Frog)	

			Sclerophrys capensis (Rauccos Toad)		*Schismaderma carens* (Red Toad)	*Strongylopus grayii* (Clicking Stream Frog)	*Tomopterna cryptotis* (Tremolo Sand Frog)	*Leptopelis natalensis* (Natal Tree Frog)	
Free State	**Gauteng**	**Western Cape**	**Northern Cape**	**Mpumalanga**	**Eastern Cape**	**Limpopo**	**KwaZulu-Natal**	**North-West**	
		Sclerophrys garmani (Eastern Olive Toad) *Sclerophrys pardalis* (Eastern leopard Toad)		*Sclerophrys capensis (Rauccos Toad)* *Sclerophrys garmani* (Eastern Olive Toad) *Sclerophrys gutturalis* (Guttaral Toad) *Sclerophrys poweri* (Western Olive Toad) *Sclerophrys pusilla* (Flat-backed Toad)	*Tomopterna cryptotis* (Tremolo Sand Frog) *Tomopterna delalandii* (Cape Sand Frog) *Tomopterna natalensis* (Natal Sand Frog) *Tomopterna tandyi* (Tandy's Sand Frog) *Vandijkophrynus angusticeps* (Cape Sand Toad)	*Tomopterna krugerensis* (Knocking Sand Frog) *Tomopterna marmorata* (Russer-backed Sand frog) *Tomopterna natalensis* (Natal Sand Frog) *Xenopus laevis* (Common Platanna) *Xenopus muelleri (*Müller's Platanna)	*Phrynobatrachus acridoides* (East African Puddle Frog) *Phrynobatrachus mababiensis* (Dwarf Puddle Frog) *Phrynobatrachus natalensis* (Snoring Puddle Frog) *Phrynomantis bifasciatus* (Banded Rubber Frog) *Poyntonophrynus fenoulheti* (Northern Pygme Toad)	
		Semnodactylus wealii (Rattling Frog)		*Semnodactylus wealii* (Rattling Frog)	*Vandijkophrynus gariepensis* (Karoo Skurwepadda)		*Ptychadena anchietae* (Plain Grass Frog) *Ptychadena mossambica* (Broad-banded Grass Frog)		
		Strongylopus bonaespei (Banded Stream Frog) *Strongylopus fasciatus* (Striped Stream Frog) *Strongylopus grayii* (Clicking Stream Frog)		*Strongylopus fasciatus* (Striped Stream Frog)	*Xenopus laevis* (Common Platanna)				
		Tomopterna delalandii (Cape Sand Frog)							

			Tomopterna tandyi (Tandy's Sand Frog)		*Strongylopus grayii* (Clicking Stream Frog)			*Ptychadena nilotica (Mascarene Grass Frog)*	
	Free State	**Gauteng**	**Western Cape**	**Northern Cape**	**Mpumalanga**	**Eastern Cape**	**Limpopo**	**KwaZulu-Natal**	**North-West**
			Vandijkophrynus angusticeps (Cape Sand Toad) *Vandijkophrynus gariepensis* (Karoo Skurwepadda) *Vandijkophrynus robinsoni* (Paradise Toad)		*Strongylopus wageri* (Plain stream Frog) *Tomopterna cryptotis* (Tremolo Sand Frog) *Tomopterna marmorata* (Russer-backed Sand frog) *Tomopterna natalensis* (Natal Sand Frog) *Tomopterna tandyi* (Tandy's Sand Frog) *Xenopus laevis* (Common Platanna) *Xenopus muelleri (*Müller's Platanna)			*Ptychadena oxyrhynchus* (Sharp-nosed Grass Frog) *Ptychadena porosissima* (Striped Grass Frog) *Ptychadena taenioscelis* (Dwarf Grass Frog) *Pyxicephalus edulis* (Edible Bullfrog) *Schismaderma carens* (Red Toad) *Sclerophrys capensis (Rauccos Toad)* *Sclerophrys garmani* (Eastern Olive Toad)	

								Sclerophrys gutturalis (Guttaral Toad)	
	Free State	**Gauteng**	**Western Cape**	**Northern Cape**	**Mpumalanga**	**Eastern Cape**	**Limpopo**	**KwaZulu-Natal**	**North-West**
								Sclerophrys pusilla (Flat-backed Toad)	
								Semnodactylus wealii (Rattling Frog)	
								Strongylopus fasciatus (Striped Stream Frog) *Strongylopus grayii* (Clicking Stream Frog) *Strongylopus wageri* (Plain stream Frog)	
								Tomopterna cryptotis (Tremolo Sand Frog) *Tomopterna krugerensis* (Knocking Sand Frog)	

								Tomopterna natalensis (Natal Sand Frog)	
	Free State	**Gauteng**	**Western Cape**	**Northern Cape**	**Mpumalanga**	**Eastern Cape**	**Limpopo**	**KwaZulu-Natal**	**North-West**
								Tomopterna tandyi (Tandy's Sand Frog)	
								Vandijkophrynus gariepensis (Karoo Skurwepadda)	
								Xenopus laevis (Common Platanna) *Xenopus muelleri (*Müller's Platanna)	

APPENDIX B – INTERVIEW QUESTIONS

TOURISM POTENTIAL OF FROGS IN SOUTH AFRICA
INTERVIEW

Goal of this study:

South Africa hosts a high diversity of frogs, especially in the eastern regions, and contains numerous endemic frog species. Almost a third of the nearly 7,000 known amphibian species worldwide are listed as threatened by the IUCN. Furthermore, in comparison to say the 'Big 5', little has been done to promote awareness and value of some of South Africa's smaller fauna, which form an important part of our natural heritage. "Frogging" is a well-known term amongst wildlife enthusiasts, describing the activity of searching for frogs in their natural habitats. Through this study, we aim to determine the ecotourism potential of frogs in South Africa. By doing so, the project will introduce the wonders and excitement of frogging to the South African community, thereby promoting it as a growing tourism activity in South Africa. In the long run, data gathered by tourists during frogging expeditions can be used by scientists and conservationists for species research and management purposes. Ultimately, tourism activities can contribute towards the conservation of frogs in South Africa and help to highlight the plight of declining amphibians.

Your role in this study:

It came to our attention that you already offer some form of amphibian-related ecotourism activities, and maybe still do. We would like to hear from your past frogging ecotourism experiences. This will help us to come up with plans to help promote this kind of activity and to make it effective. The answers of the questions will only be used for the project and will be referenced.

Name of park/company/attraction:

Name of amphibian/frog activity:

Start and end year of the activity:

What was the scope of the activity?

Successes of the project:

Failures of the project:

Why did the activity stop? OR. Why are you still running it?

Your recommendations to grow "frogging" as a tourism activity:

Was any additional infrastructure or equipment needed to run these activities?

Did any damage of nature occur as a result of these activities?

Where any third parties involved in promoting this activity? If so, who?

Would you like to be part of this M.Sc. project and use its outcomes to enhance ecotourism at your facility?

Are you aware of any other similar activities? If so, please indicate which and where?

APPENDIX C – ONLINE QUESTIONNAIRE

TOURISM POTENTIAL OF FROGS IN SOUTH AFRICA

SURVEY 2016

South Africa hosts a high diversity of frogs, especially in the eastern regions, and contains numerous endemic frog species. Almost a third of the nearly 7,000 known amphibian species are listed as threatened by the IUCN. Therefore, it is imperative to protect our high frog diversity as they are part of South Africa's natural heritage. "Frogging" is a well-known term amongst wildlife enthusiasts, describing the activity of searching for frogs in the wild. We aim to determine the ecotourism potential of frogs in South Africa. By doing so, the project will introduce the wonders and excitement of frogging to the South African community, thereby promoting it as a growing tourism activity in South Africa. In the long run, data gathered by tourists during frogging expeditions can be used by scientists and conservationists for species research and management purposes. Ultimately, tourism activities can contribute towards the conservation of frogs in South Africa and help to highlight the plight of declining amphibians.

Please answer all the questions. An * next to "Reason" indicates that a reason for your answer is only optional.

Unit for Environmental Sciences and Management, North-West University, Potchefstroom, 2520, South Africa.
Zoëgné du Preez (dupreezzoegne@gmail.com)

SECTION A: SOCIO-DEMOGRAPHIC INFORMATION

1. Gender:

M	
F	

2. Year of birth:

13-17 Year/Teenager	
18-24 Year/Young Adult	
25-40 Year/Adult	
41-64 Year/Adult	
65+/Elderly	

3. Home language:

English	
Afrikaans	
Other	

4. Maritial status:

Single	
Married	
Partnership	
Divorced	

5a. Province of residence:

North-West	
Gauteng	

KwaZulu-Natal	
Western Cape	
Eastern Cape	
Limpopo	
Northern Cape	
Mpumalanga	
Free State	
International	

6. Employment status:

Student	
Salaried employment	
Retired	
Self-employed	
Unable to work	
Currently looking for work	
Other	
Volunteer	

8. What is your gross annual household income?

< R20 000	
R20 001 - R140 000	
R140 001 - R221 000	
R221 001 - R305 000	
R305 001 - R431 000	
R431 001 - R552 000	
> R552 001	

Widow(er)	

5b. Outside RSA, please specify your country of origin:

7. Highest level of education:

Grade 10	
Matric	
Diploma, degree	
Post-graduate	
Doctors	

9a. At which age were you first exposed to nature-based or ecotourism?

0-1 Year/Infant	
1-3 Year/Toddler	
3-13 Year/Child	
13-18 Year/Teenager	
18-24 Year/Young Adult	
24-65 Year/Adult	
65+/Elderly	

9b. Do you remember your first encounter with frogs? (Please ellaborate)

9c. How did you experience your first encounter with frogs?

Stressful	
Terrifying	
Exciting	
Boring	
Calm	

11. What type of holiday activities do you most enjoy? (Choose multiple)

Being in nature (e.g. bird/game viewing)		
Shopping (e.g. malls, local markets)		
Adventure (e.g. river rafting)		
Sport (e.g. cycling, fishing, hiking)		
Cultural (e.g. museums, monuments)		
Relaxation (e.g. spa's, reading, sleeping)		

10. What type of nature-based destinations do you like to visit? (Choose multiple)

Wildlife reserves	
Botanical gardens	
Bird & small animal reserves	
Scenic areas (e.g. mountains)	

TOURISM POTENTIAL OF FROGS IN SOUTH AFRICA
SURVEY 2016

SECTION B: FROG-RELATED QUESTIONS

1. Please indicate to what extent you agree with the following statements:

	Not at all 1	A little bit 2	Somewhat 3	Quite a bit 4	A great deal 5
1. Are you aware that frogs are one of the most threatened groups of species on earth?					
2. Do you find frogs interesting?					
3. Have you ever been educated about frogs?					
4. Do you have a broad knowledge about the frogs of South Africa?					
5. Do you think tourism, especially nature-based or ecotourism, can help with the conservation of frogs?					
6. Would you like to become more educated regarding frogs?					
7. Have you ever taken part in any frog-related activities?					
8. Would you be interested in taking part in any frog-related activities?					
9. If you have children or younger sibilings, would you like to expose them to frog-related activities?					
10. Do you think frogging activities should be offered at nature reserves and national parks?					

1. **Please indicate your level of agreement with the following statements:**

	Strongly disagree					Strongly agree
		Disagree		Neither agree nor disagree	Agree	
	1	2	3	4	5	
1. Frogs play an important role in nature.						
2. We must protect frogs and conserve their habitat.						
3. People should be encouraged to interact with frogs.						
4. People need to be educacted about frogs.						
5. Frogs need alternative conservation methods, such as ecotourism, to protect them.						
6. Future generations/your children will benefit if frogs are protected.						

2. **Please tick the appropriate answer:**

1. Do you own a frog identification guide(s)?	**YES**	**NO**	**Maybe**
2. Do you have any type of frog call or identification application on your mobile device?	**YES**	**NO**	**Maybe**
3. Can you identify any specific frog calls?	**YES**	**NO**	**Maybe**

TOURISM POTENTIAL OF FROGS IN SOUTH AFRICA
SURVEY 2016

SECTION C: FROGS & NATURE-BASED TOURISM

1. How important are the following reasons for visiting a nature-based tourism destination:

	Not at all important 1	Slightly important 2	Important 3	Very important 4	Extremely important 5
To escape from everyday routine					
To rest and relax in nature					
To find relief from everyday tension					
To experience peace and tranquility					
To explore a new, exotic destination					
To contribute towards fauna (animal) conservation					
To contribute towards flora (plant) conservation					
To enhance my knowledge as a nature-based tourist (learn something new)					
To socialize with other nature enthusiasts					
To spend time with friends and family					
To meet new people					
For the benefit of my children					
To photograph animals and plants					

For spiritual experiences					
To make use of appealing accomodation facilities					
Value for money					
For a cultural and historical experience					
To see the Big 5					
For birdwatching					
To look at smaller animals (e.g. reptiles, amphibians)					
The unique location of the natue-based destination					
The unique experience that the destination offers					

2. Which of the following frog-related ecotourism activities would you be interested in doing at a nature-based destination?

	Not at all	Very Little	Somewhat	Quite a bit	A great deal
	1	2	3	4	5
1. Night drives to look for frogs and listen to their calls (frog & sound identification)					
2. Night walks to look for frogs and listen to their calls (frog & sound identification)					
3. Day walks to look for frogs					
4. Frogging activities (look for and catch frogs)					
6. Photography					
7. Frog identification course (species & sound)					
8. Frog-related entertainment for children					
9. Educational activities/films					

10. Citizen science *(i.e. The collection and analysis of data, by the general public, related to the natural environment. Usually as part of a project with professional scientists.)*					

3. If you were more informed about frogs, would you travel to a destination to specifically take part in frogging activities?

Yes	
No	
May be	

4. How far are you prepared to travel to visit a specific frog-related tourism destination?

0 km	
< 50 km (Locally)	
50-150 km (Regionally)	
150-400 km (Neighbouring provinces)	
400-700 km	
700+ km	
Internationally	

5. To what extent will the following factors influence your decision to partake in frog-related activities?

	Not at all (will still take part)	**Very Little**	**I don't know**	**Quite a bit**	**A great deal (will not take part)**
	1	**2**	**3**	**4**	**5**
Finances					

Travel distance					
Weather					
Outdoor as opposed to indoor					
Accessibility (e.g. dirt roads)					
Knowledge about frogs					
Availability of entertainment					
Shared interest by my travel partners					
Time spent at the destination					
Effort required (e.g. type of vehicle, gear needed)					
Availability of interpretation services					
Availability of activities that would accommodate kids					
Type of accomodation offered					
Availability of information sessions about frogs at the park					

6. Would you be interested in buying the following?

				Not at all
			Regardless of participating in frogging activities	
			After Participating in frogging activities	
		Before participating in frogging activities		
	1	**2**	**3**	**4**
Frog identification books				
Frog identification mobile application (including calls)				
Frog curios (e.g. shirts, caps, toys)				
Map of South African frogging hotspots				
Frogging manual (to educate tourists on how to do frogging on their own)				

TOURISM POTENTIAL OF FROGS IN SOUTH AFRICA
SURVEY 2016

SECTION D: OPTIONAL QUESTIONS

1. **Are you aware of any past, present or future frog-related, nature based tourism destinations? If so please provide names and descriptions.**

2. **Would you like to be personally contacted about the project to either give more input, help with information or to receive updates? Please provide an email address.**

3. **Any recommendations or comments?**

APPENDIX D – ETHICAL CLEARANCE

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15 October 2016

ETHICAL CLEARANCE

This letter serves to confirm that the research project of, Du Preez, Z (22934014) with the title *" TOURISM POTENTIAL OF FROGS IN SOUTH AFRICA"* has undergone ethical review. The proposal was presented at a Faculty Research Meeting and accepted. The Faculty Research Meeting assigned the project number EMS2016/11/04-0213 & EMS2016/11/04-0214 (online). This acceptance deems the proposed research as being of minimal risk, granted that all requirements of anonymity, confidentiality and informed consent are met. This letter should form part or your dissertation manuscript submitted for examination purposes.

Yours
sincerely

Prof M Saayman
Director: TREES