DEPARTMENT OF ENVIRONMENTAL AFFAIRS

NOTICE 423 OF 2017

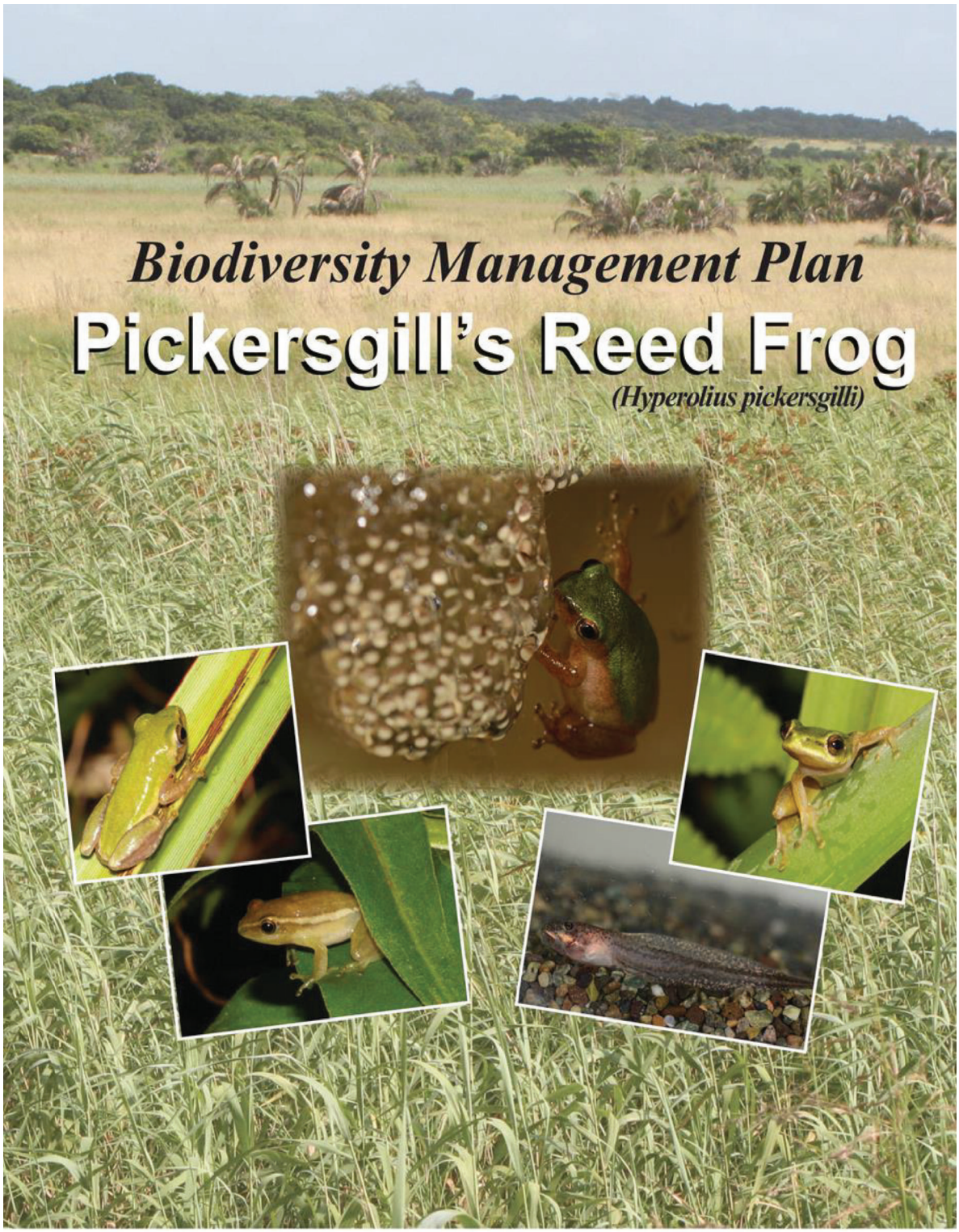
NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT, 2004 (ACT NO. 10 OF 2004)

BIODIVERSITY MANAGEMENT PLAN FOR PICKERSGILL'S REED FROG (*HYPEROLIUS PICKERGILLI*)

I, Bomo Edith Edna Molewa, Minister of Environmental Affairs, hereby, in terms of section 43(3) read with section 43(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), publish the approved Biodiversity Management Plan for Pickersgill's Reed Frog (*Hyperolius Pickergilli)* in the Schedule hereto, for implementation.

BOMO EDITH EDNA MOLEWA
MINISTER OF ENVIRONMENTAL AFFAIRS

SCHEDULE



environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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BIODIVERSITY MANAGEMENT PLAN

FOR

PICKERSGILL'S REED FROG

HYPEROLIUS PICKERSGILLI

A female Pickersgill's Reed Frog, *Hyperolius pickersgilli*

A male Pickersgill's Reed Frog, *Hyperolius pickersgilli*

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Lead Agent: Ezemvelo KZN Wildlife
Supporting Implementing Agent: Endangered Wildlife Trust

FINAL DRAFT: Version 9, 30 January 2017
Photo credits: Nick Evans, Carl Schloms

EXECUTIVE SUMMARY

The integral roles amphibians play is of significant importance in most ecosystems. Despite them often going unnoticed, amphibians comprise the bulk of terrestrial vertebrate biomass in temperate and tropical environments. As prey, amphibians (adults and larvae) are important protein sources for numerous invertebrates, reptiles, birds, mammals, and other amphibian species. Currently, amphibians are globally the most threatened Class of vertebrates, with approximately one third of all known species currently Red Listed by the IUCN. This situation is reflected in South Africa, with 30% of the country's frog species currently listed under a threatened category. South Africa is ranked fourth in terms of number of Threatened amphibian species in the Afrotropical realm. Overall, 43% of South African frog species are endemic to the country. Of these, 35% are in a threatened category and all but one of the threatened species are endemics. Despite this, southern Africa has a rich diversity of amphibians with 160 known species. The highest species richness for frogs occurs in KwaZulu-Natal, an area that has been recognised as being important for both frog endemism and having high levels of human activity, particularly in the coastal regions.

Pickersgill's Reed Frog, *Hyperolius pickersgilli,* is a small frog known only from limited and highly fragmented coastal wetland habitat in the KwaZulu-Natal Province of South Africa. The species has been prioritised for conservation action due to its Red List status, endemism and ongoing deterioration in and loss of habitat. The species was recently down-listed from globally Critically Endangered to Endangered B1ab(ii,iii)+2ab(ii,iii) ver. 3.1[1] by the IUCN.. It is listed as Endangered because its extent of occurrence (EOO) is 4,768 km^2, area of occupancy (AOO) is 12 km^2, its distribution is severely fragmented, and there is continuing decline in its AOO and the extent and quality of habitat. Species assigned to this status are defined as facing a very high risk of extinction in the wild (IUCN 2012).

Section 9 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) provides for the issuing of national norms and standards for the management and conservation of South Africa's biodiversity and its components. To this effect, the Department of Environmental Affairs (DEA) developed the Norms and Standards for the Development of BMP for Species (BMP-S), which were gazetted in March 2009 (Department of Environmental Affairs and Tourism 2009). The purpose of these norms and standards is to provide a national approach and minimum standards for the development of a BMP-S.

Hyperolius pickersgilli is endemic to a narrow and extremely fragmented range within about 16 km of the KwaZulu-Natal coastline, where as of February 2016, it is known from approximately 24 localities. Twenty of these sites (i.e. 90%) are not officially protected and are experiencing ongoing decline in habitat quality and some even face the threat of complete elimination as a result of industrial development. Reported threats include:

- Habitat loss as a result of wetland drainage or destruction for agricultural, urban and industrial development.
- Severe habitat fragmentation and small, isolated sub-populations.
- Alien vegetation and afforestation resulting in drying out of breeding sites.
- Pollution from pesticides and other contaminants.

Without concerted proactive conservation intervention in the near future, it is highly likely that *H. pickersgilli* will become extinct. A BMP-S for *H. pickersgilli* is therefore warranted to formalise urgent, targeted conservation action for the species. Given that the majority of sites occur on privately or commercially-owned land, the participation of all relevant stakeholders in the management of habitat for the long-term protection of *H. pickersgilli* is crucial. There are at least 15 different stakeholder groups that are well placed to influence the long-term future of *H. pickersgilli*.

The BMP-S process so far has included over 40 representatives from these role-player groups, and has prioritised a set of threats and corresponding actions toward achieving the overall aim and objectives of the BMP-S. The overall aim of

[1] http://www.iucnredlist.org/details/10644/0

the BMP-S for *H. pickersgilli* is to improve the conservation status of *Hyperolius pickersgilli* and secure its survival in perpetuity in the wild. The aim will be achieved through the following objectives:

Improve the conservation status of *H. pickersgilli*, ultimately to Least Concern, and improve its protection as part of meeting international biodiversity objectives (i.e. Aichi targets) through applied conservation action.

1. *Create and maintain an enabling environment for relevant stakeholders, including private land-owners, to carry out appropriate management actions required for the survival of subpopulations and maintain or improve necessary ecological processes.*
2. *Prioritise the protection and appropriate management of key habitats for H. pickersgilli in relation to the scale and imminence of potential impact from urban or industrial development, with the additional objectives of:*
    a. *reducing habitat fragmentation and improve gene flow through creation of linkages or corridors,*
    b. *identifying potential sites for offsets involving H. pickersgilli, and*
    c. *researching relocation and habitat rehabilitation or restoration requirements of H. pickersgilli and developing guidelines for the implementation of these processes.*
3. *Implement habitat protection and management activities through land-owner agreements, including but not limited to biodiversity stewardship, to curb habitat degradation caused by agricultural activities and water usage, and to secure sites to mitigate against the potential impacts of climate change.*
4. *Identify and conduct research to generate knowledge and provide information relevant to conservation management requirements, both in situ and ex situ, implement population monitoring protocols, and ensure that these data inform and are applied in the overall conservation process.*
5. *Develop educational and awareness campaigns to improve public knowledge about H. pickersgilli and the importance of its ecosystem.*

The specificity of the operational goals and actions that are captured under the objectives is required to ensure that progress with implementation of the BMP-S can be tracked and those to whom responsibilities have been allocated can hold each other accountable for delivery.

This is the fourth draft of the document produced as a result of the workshop held on 5-6 September 2013 and based on comments received from relevant stakeholders and interested parties thereafter. This BMP-S for *H. pickersgilli* will be subject to iterations brought about through realistic and relevant management dynamics. As such, it is important that those responsible for the implementation of this BMP-S recognise the need for and apply active adaptive management where necessary.

DEFINITIONS

"Breeding site" means the wetland habitat used by *Hyperolius pickersgilli* for breeding activities including calling, mating, egg-laying and tadpole development and metamorphosis.

"Dispersal" means the movement of individuals from one breeding site to another or to non-breeding sites, typically involving the juveniles once they have developed sufficiently to move away from the breeding site.

"*Ex situ"* conservation" means the conservation of wild organisms, in this case *Hyperolius pickersgilli*, and/or its genetic resources off-site or outside of their natural habitats.

"Non-breeding site" means the terrestrial habitat surrounding wetland areas used by frogs during the non-breeding season. This is typically any area within about a 2 km radius of a known breeding site.

"*In-situ* conservation" means the conservation of Pickersgill's Reed Frog in the wild through the conservation of ecosystems and habitats natural to *Hyperolius pickersgilli*, and the maintenance of viable populations or recovery to viability of populations of the species in their natural surroundings.

"IUCN Red Data List" means the global list providing information on a species' risk of extinction (usually by taxonomic group) prepared under the auspices of the International Union for Conservation of Nature.

"Migration" means the movement of frogs to and from breeding sites, usually referring to adults moving to breeding sites from over-wintering sites at the commencement of the breeding season and returning to over-wintering sites after the breeding season.

"Role player" means a natural or juristic person who has a direct role to play in the implementation of the Biodiversity Management Plan for the species and whose role is captured in the Biodiversity Management Plan.

"Stakeholder" means a natural or juristic person that has an interest in, or may be affected by, a particular obligation or decision or activity, relating to or resulting from a management plan, either as individuals or representatives of a group, and include landowners where appropriate.

"Species" means a kind of animal, plant or other organism that does not normally interbreed with individuals of another kind, and includes any sub-species, cultivar, variety, geographic race, strain, and hybrid or geographically separate population.

"Threat" means any action that causes a decline in and compromises the future survival of one or more populations a species or anything that has a detrimental effect on the species, most often human-induced. This BMP-S is focused on mitigating human-induced threats to *H. pickersgilli*.

"Tadpole" means the larval, usually aquatic, phase of frogs, occurring between the egg and adult phases.

"Viable" in relation to a species or population means the ability to survive or persist and develop or multiply over multiple generations or in perpetuity.

ABBREVIATIONS

ACAP	Amphibian Conservation Action Plan
AACRG	African Amphibian Conservation Research Group
ACSA	Airports Company South Africa
AOO	Area of Occupancy
APP	African Preservation Programme of PAAZAB
BGIS	Biodiversity Geographical Information System, SANBI
BMP-S	Biodiversity Management Plan for Species
COGTA	Department of Co-operative Governance and Traditional Affairs
DAEA	Department of Agriculture and Environmental Affairs (Provincial - KZN)
DEA	Department of Environmental Affairs (National)
DDOP	Durban Dig Out Port (Transnet project for new port)
DWA	Department of Water Affairs (National)
EIA	Environmental Impact Assessment
EOO	Extent of Occurrence
EMA	eThekwini Municipal Area
EN	IUCN listing as Endangered
EWT	Endangered Wildlife Trust
EZEMVELO	Ezemvelo KZN Wildlife
Jhb ZOO	Johannesburg City Parks and Zoo
IDP	Integrated Development Plan (Municipal)
IUCN	International Union for Conservation of Nature
KZN	KwaZulu-Natal Province
LUMS	Land Use Management System (Municipal)
Masl	Meters above sea-level
NFEPA	National Freshwater Ecosystem Priority Areas
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEMPAA	National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003)
NRM	Natural Resource Management (DEA)
NWU	North-West University, Potchefstroom Campus
NZG	National Zoological Gardens of South Africa
PAAZA	African Association of Zoos and Aquaria
SANBI	South African National Biodiversity Institute
SASA	South African Sugar Association
SCP	Systematic Conservation Plan
SDF	Spatial Development Framework (Municipal)
SSC	Species Survival Commission of the IUCN
ToPS	Threatened or Protected Species List of NEMBA
WESSA	Wildlife and Environment Society of South Africa

ACKNOWLEDGEMENTS

All representatives listed in section 2.3 and the appendices are thanked for their contribution to the process of compiling this Biodiversity Management Plan for *Hyperolius pickersgilli* by attending the BMP-S development workshop held in September 2013, and for commenting on subsequent draft versions of this BMP-S. All are thanked for their commitment to seeing this plan becoming reality. Pamela Kershaw and Humbu Mafumo of the Conservation Management Department of Environmental Affairs are thanked for their guidance throughout the process; Dr Harriet Davies-Mostert of the Endangered Wildlife Trust seamlessly facilitated the stakeholder workshop held at Simbithi Country Club, Salt Rock, KwaZulu-Natal in September 2013; Mea Trenor and Nick Evans kindly assisted in setting up the workshop, and Mea also took the minutes of the workshop (Appendix B). Presentations at the workshop were given by Adrian Armstrong, the late Ian Visser, Jeanne Tarrant and Pamela Kershaw. Mike O'Donaghue kindly assisted in organising the outing to the Simbithi wetlands during the workshop to search for *H. pickersgilli* and other species. Ian Visser is acknowledged here posthumously for the instrumental role he played in ensuring that this species be the first threatened South African frog to be brought into a captive breeding programme following the outcomes of the Amphibian Arc workshop held at Johannesburg Zoo in April 2008.

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1. INTRODUCTION

1.1 Why *Hyperolius pickersgilli* requires a Biodiversity Management Plan

Pickersgill's Reed Frog, *Hyperolius pickersgilli,* is listed by the IUCN as Endangered due to its limited and severely fragmented distribution. It occurs within a region that has been, and continues to be, heavily impacted by anthropogenic transformation including for urban, agricultural and industrial development. Surveys conducted between 2009 and 2015 have revealed several new localities for the species, but also that at least seven of the historically known sites for the species have been destroyed, bringing the total number of localities at which it is known to occur to 28. However, two of these populations occur in statutory Protected Areas, namely the iSimangaliso Wetland Park World Heritage Site and the Umlalazi Nature Reserve, while the remainder are all experiencing a decline in the quality of habitat or face imminent threat from mining or industrial development. The protected sites themselves are not specifically managed for the frog, and may face some threats, while those occurring on privately owned or communal land receive even less attention in terms of habitat management.

Considering the Endangered status of this species, the relevant legislation for amphibian conservation, and the multiple role players involved with the conservation and management of the species, it is deemed essential that a comprehensive management plan that captures the linkages between the various role players and their responsibilities is compiled to secure the future of *H. pickersgilli in situ*. An important component of the conservation of *H. pickersgilli* needs to take place in the *ex situ* environment and this plan also highlights these requirements.

1.2 The Aim and Objectives of the Biodiversity Management Plan

The BMP-S for *H. pickersgilli* requires the input from representative stakeholder groups to be successful. NEMBA specifies that all BMPs need to be revised after five years. This plan will thus be the first in a series of five-year iterations where the success of the preceding five years will be measured, and adaptations made to ensure that the plan for the following five years is appropriate for the circumstances at the time.

The overall aim of this management plan is:

To improve the conservation status of *Hyperolius pickersgilli* and secure its survival in the wild in perpetuity.

In order to achieve this, a number of objectives have been compiled as follows:

Improve the conservation status of *H. pickersgilli*, ultimately to Least Concern, and improve its protection as part of meeting international biodiversity objectives (i.e. Aichi targets) through applied conservation action.

1. *Create and maintain an enabling environment for relevant stakeholders, including private land-owners, to carry out appropriate management actions required for the survival of subpopulations and maintain or improve necessary ecological processes.*
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3. *Implement habitat protection and management activities through land-owner agreements, including but not limited to biodiversity stewardship, to curb habitat degradation caused by agricultural activities and water usage, and to secure sites to mitigate against the potential impacts of climate change.*

4. *Identify and conduct research to generate knowledge and provide information relevant to conservation management requirements, both in situ and ex situ, implement population monitoring protocols, and ensure that these data inform and are applied in the overall conservation process.*
5. *Develop educational and awareness campaigns to improve public knowledge about H. pickersgilli and the importance of its ecosystem.*

1.3 Biodiversity Justification

Amphibians are the most threatened group of vertebrates on Earth, with 32% of species currently listed as threatened (Critically Endangered, Endangered or Vulnerable) (IUCN 2012). In South Africa, 29% of frog species fall under the IUCN categories Critically Endangered, Endangered or Vulnerable (SA-FRoG 2010; Measey 2011). The KwaZulu-Natal coast hosts the highest species richness for frogs in the country (Measey 2011). Global amphibian declines and those in South Africa are primarily caused by loss of habitat. A decline in populations of *H. pickersgilli* is indicative of a loss of coastal wetlands, which provide important ecosystem services, including provision of habitat for a vast array of species, water purification and flood attenuation. These services will become increasingly important in the face of climate change.

Frogs in general, including *H. pickersgilli*, are important for the following reasons:

- Amphibians are an extremely diverse Class of vertebrates, comprised of three Orders and including over 7,450 species (as of September 2015), of which 6,565 are Anura (frogs and toads), 680 are Caudata (newts and salamanders), and 205 are Gymnophiona (caecilians). The numbers of species have grown rapidly. Since 1985 the total number of recognized species has increased by over 60%.

- Amphibians evolved approximately 310 to 300 million years ago. During the late Carboniferous and early Permian periods amphibians were the dominant land animals on earth. Amphibians (which include frogs, toads, salamanders, newts and caecilians) are believed to have radiated from a common ancestor that lived in the middle Permian or early Triassic periods. The lifecycle of frogs represents the evolution of life from primarily water-based to the invasion of land. Amphibians therefore have considerable evolutionary significance.

- They have important integral roles in most ecosystems because they are often the most abundant wetland and terrestrial vertebrates in terms of biomass in temperate and tropical environments. Such abundance is linked to the role of both adults and larvae as primary predators in both the terrestrial and aquatic environments.

- Tadpoles are usually aquatic and are consumers of primary production in the form of algae (periphyton and phytoplankton), and by doing so, assist in keeping waterways clean.

- Adults consume vast quantities of small invertebrates (mostly insects), many of which are not available to other vertebrate groups. For example, individuals of many species are known to prey on hundreds of flies and mosquitoes in a single night. Accordingly, amphibians are important bio-control agents for insects that cause problems for agriculture and insects such as flies and mosquitoes that may carry diseases that are transmittable to humans.

- They connect the aquatic and terrestrial environments. As prey, both adults and tadpoles are important protein sources and nutrient vectors for numerous species of invertebrates, reptiles, birds, mammals, other amphibians, and some humans.

- They are bio-indicators because they have a number of physiological, ecological and life-history characteristics that make them sensitive to changes in the environment. Most species make use of both the aquatic and

terrestrial environments during their lifecycles, and as a result, are sensitive to changes in both systems caused by intense human activities or use.

- They are considered good indicators of environmental health and the state of the biosphere as a whole due to their biphasic lifestyle and their sensitive semi-permeable skins.

- They are particularly sensitive to habitat fragmentation and are vulnerable to the changes brought about through habitat transformation owing to their limited dispersal distances.

- Based on the proportion of amphibian species currently threatened with extinction, the magnitude of the potential loss of amphibians is significant and will undoubtedly have a multiplier effect, ultimately contributing to declines and extinctions of other species which rely on them.

- They have social, cultural and religious importance in addition to them being an important source of protein for people in many parts of the world. Some cultures have held them in the highest regard as keepers of rain or agents of fertility and good luck. Others have persecuted them, regarding them as evil. Either way, amphibians have featured large in the folklore of many societies. Amphibians have aesthetic value and play an important role in education about biodiversity, especially in increasingly urban environments. Their fascinating life-cycle is an often-used educational tool at school level. The medicinal properties derived from amphibians have also long been recognised by humans and amphibians are used extensively in traditional medicine for treatments of ailments as varied as warts and heart disease.

- The use of amphibian products for western medicine has gained increased attention. One of the first such medical uses was for pregnancy testing, for which the African clawed frog *Xenopus laevis* was used extensively. Amphibian skin secretions (predominantly peptides and alkaloids) harbour a diversity of defensive biological compounds, which provide immunity against infections, viruses and bacteria. Peptides isolated from amphibian skin are showing pharmacological promise as antibiotics and analgesics. Current active fields of research include the investigation of frog skin peptides to block HIV transmission and inhibit growth of chytrid zoospores. Loss of species could thus mean the inadvertent loss of potential cures for important diseases.

- The loss of biodiversity in general does not bode well for human well-being considering our dependence on ecosystem goods and services, such as clean water, pollination, food, medicines and building materials. However, the general public remains largely apathetic to or ignorant of the plight of amphibians and their importance. This is particularly relevant in South Africa where various superstitious beliefs and fears lead some people to see frogs in a negative light. Overcoming this apathy or ignorance through education and raised awareness is necessary for improving the support (and hence effectiveness) of amphibian conservation efforts.

1.4 Benefits of the Biodiversity Management Plan

A major benefit of the BMP-S will be to obtain the support of owners, managers and occupiers of land on which *H. pickersgilli* occurs for the implementation of conservation actions. This should ensure the species does not go extinct and instead becomes less threatened over time, eventually obtaining the status of Least Concern. BMPs allow for conservation management plans to be legally gazetted under South African policy in terms of NEMBA. This will facilitate the attainment of the aims of the plan because the support of the government and the support of the role-players and stakeholders will be ensured. Participation of such a broad range of stakeholders (see 2.3 below) is imperative for ensuring the success of the BMP-S process.

A BMP-S for *H. pickersgilli* is necessary owing to its Endangered Red List status and endemicity to the KwaZulu-Natal Province, the inadequate protection of its wetland habitat, and the necessity for the involvement of multiple stakeholders

to ensure its conservation. Despite the recognised ecological value and services provided by wetlands, coastal wetlands in KwaZulu-Natal remain under tremendous pressure from urban, agricultural and industrial development and are generally not prioritised for concise management plans.

Using *H. pickersgilli* as a flagship species to prioritise such wetland areas, this BMP-S will allow for improved management of this habitat, which itself is Critically Endangered Indian Ocean Coastalbelt Wetland. Many of these wetlands fall within the National Freshwater Ecosystem Priority Areas (NFEPAs), which also made use of occurrences of threatened frog species to prioritise wetlands. As a result of lack of management, most of the sites at which *H. pickersgilli* occurs are in an ongoing state of degradation and require implementation of management practices including:

- removal of alien invasive vegetation;
- the prevention of new pioneer invasions;
- upstream management;
- improved buffer-zone management;
- appropriate management of fire regimes;
- implementation of species monitoring at selected sites; and
- wetland rehabilitation or restoration where necessary.

These wetland areas represent floodplains that provide crucial ecosystem services such as flood attenuation and water filtration. Furthermore, many of the wetland areas concerned are surrounded by high densities of people and are as such impacted by human activity as well as encroachment of alien invasive vegetation.

Hyperolius pickersgilli has also been prioritised for captive (*ex-situ*) breeding, and is the first threatened amphibian species for which such a programme has been initiated in South Africa. This BMP-S will help to ensure that this process is co-ordinated and that communication between the various *ex-situ* partners is facilitated for exchange of learning and success toward the ultimate aim of re-introducing captive-bred individuals back into the wild to secure habitat.

1.5 Anticipated Outcomes

The overall anticipated outcome of the BMP will be the assured persistence of *H. pickersgilli* in perpetuity. This overall outcome can be broken down into the following anticipated outcomes:

1. Clear management goals and time-frames for their achievement.
2. Key role players and stakeholders identified.
3. Acceptance and support of the BMPs by stakeholders.
4. Clarity and acceptance of roles and responsibilities by stakeholders and role players.
5. A plan that comprehensively and concisely covers all aspects related to the conservation requirements of *H. pickersgilli* and provides realistic targets for the five years of this iteration.
6. Identification of key performance indicators that could be used to assess the progress toward defined goals.
7. Improvement of wetland functionality for priority coastal wetlands through implementation of management practices.
8. Improvement in the long-term survival of an Endangered endemic species, *H. pickersgilli*, which is unique to the KwaZulu-Natal coast and is representative of these important habitats.
9. Guidance for *ex-situ* conservation efforts for the species, with the ultimate goal of re-introducing individuals to secure habitat in the wild.
10. All relevant information concerning captive breeding efforts will be accurately recorded in a studbook to ensure that the genetic integrity of the natural populations is not compromised.
11. Opportunities for job creation, capacity building and education for local community members living in the vicinity of these key wetland areas.

2. BACKGROUND

2.1 Conservation status and legislative context

Hyperolius pickersgilli has been listed as Endangered B1ab(ii,iii)+2ab(ii,iii) ver 3.1 (IUCN 2016).) due to:

- its' very small area of occupancy (9km^2 as of the 2009 assessment);
- the severe fragmentation of its habitat, and;
- the continuing decline in the area of occupancy, extent and quality of habitat, and number of locations.

Go to http://www.iucnredlist.org/details/10644/0 for the IUCN account (accessed 30 January 2017). Currently there is no specific legal protection for the species. While *H. pickersgilli* was provisionally listed for the Threatened or Protected Species list in 2014, it was removed because it is primarily threatened by habitat destruction. Due to its Endangered status, the species is increasingly included in the EIA process for proposed developments in KwaZulu-Natal through inclusion of mapped Critical Biodiversity Areas in municipal conservation plans or through provincial conservation legislation. Through this BMP-S, the improved legal protection of *H. pickersgilli* should be achieved.

Although *H. pickersgilli* is a species of importance in KwaZulu-Natal (Goodman 2000), only two populations are known from formally protected areas, and the need to identify and protect remaining breeding *H. pickersgilli* habitats is crucial. The species has been prioritised for conservation research (Measey 2011) and is also the first threatened frog species in South Africa to be used in a captive breeding program (Visser 2011).

Section 43 of NEMBA provides for the drafting of a Biodiversity Management Plan (BMP) for an indigenous species listed in terms of section 56 of the Act or for an indigenous species which is not listed in terms of section 56 but which does warrant special conservation attention. Section 9 of NEMBA provides for national norms and standards for the management and conservation of South Africa's biodiversity and its components. To this effect, the DEA developed the Norms and Standards for the development of a BMP for Species (BMP-S), which were gazetted in March 2009. The purpose of these norms and standards is to provide a national approach and minimum standards for the development of the BMP-S. Without concerted proactive conservation intervention in the near future to it is likely that *H. pickersgilli* will face extinction. A BMP for this species is therefore warranted.

2.2 Information pertinent to the Management of *Hyperolius pickersgilli*

2.2.1 Taxonomic Description

The species was described by Raw in 1982 and is named after the herpetologist Martin Pickersgill, who discovered the species at Mount Edgecombe in 1978. The type locality is Avoca, Durban. Both of these historical sites no longer exist as a result of extensive urban development and wetland drainage.

Taxonomy:

Class: Amphibia
Order: Anura
Family: Hyperoliidae
Genus: Hyperolius
Species: *pickersgilli* (Raw, 1982)

Common Name: Pickersgill's Reed Frog
Synonyms: None

Hyperolius pickersgilli is a small (body length ≤29 mm) reed frog with variable colouration (Raw 1982). Males and juveniles are usually brown in colour and are characterised by having a dark-edged light dorso-lateral band running from the snout to the hind quarters on each side (du Preez & Carruthers 2009). The throat of males is dark yellow. Females are usually more uniform in colour, often bright green, and lack the dorso-lateral stripe. The underside is smooth and pale and the concealed body surfaces (inner thighs, toes and fingers) lack pigmentation. The snout extends only just beyond the nostrils and is slightly pointed. The call of the male is a soft insect-like chirp issued intermittently (Bishop 2004). The behaviour and call of this species are cryptic, often making it difficult to detect even when present.

2.2.2 Distribution and Population Status

Hyperolius pickersgilli is endemic to a narrow strip along the coast of KwaZulu-Natal (Figure 1a). Following extensive surveying between 2008 and 2015 the species is currently (as of February 2016) known from 24 isolated sites between St Lucia in the north and Sezela in the south (Tarrant & Armstrong 2013; Figure 1b; pers. obs.; Ezemvelo Biodiversity Database). Only two of these sites occur within statutory protected areas (iSimangaliso Wetland Park World Heritage Site and Umlalazi Nature Reserve) (Bishop 2004). Known localities for the species are within 16 km of the coast and up to an elevation of 380 m a.s.l.). For the 2010 Red List assessment, the area of occupancy (AOO) for *H. pickersgilli* was estimated at only 9 km^2 and the extent of occurrence (EOO) is 2,303 km^2 (Measey 2011).

The national population trend of *H. pickersgilli* is reported as declining in the most recent IUCN Red List assessment (SA-FRoG 2010). The spatial distribution of this species is considered to be severely fragmented as more than half the number of individuals are thought to occur in small, isolated patches and many of the subpopulations are considered non-viable in the long-term (Measey 2011). The overall population size of *H. pickersgilli* is currently unknown. In this regard, research is still required to determine the total population size in terms of abundance of individuals. A population estimate method based on call surveys has been tested at two sites between 2011 and 2014. A conservative estimate at Froggy Pond, Mount Moreland estimates the number of adults (male and female) at approximately 2000 individuals, and at Prospecton at approximately 2800 individuals across three wetlands. Long-term monitoring protocols for this species are due to be implemented in the summer of 2013-2014 and continued for at least the next twenty years in order to determine trends in population size and extent of occurrence.

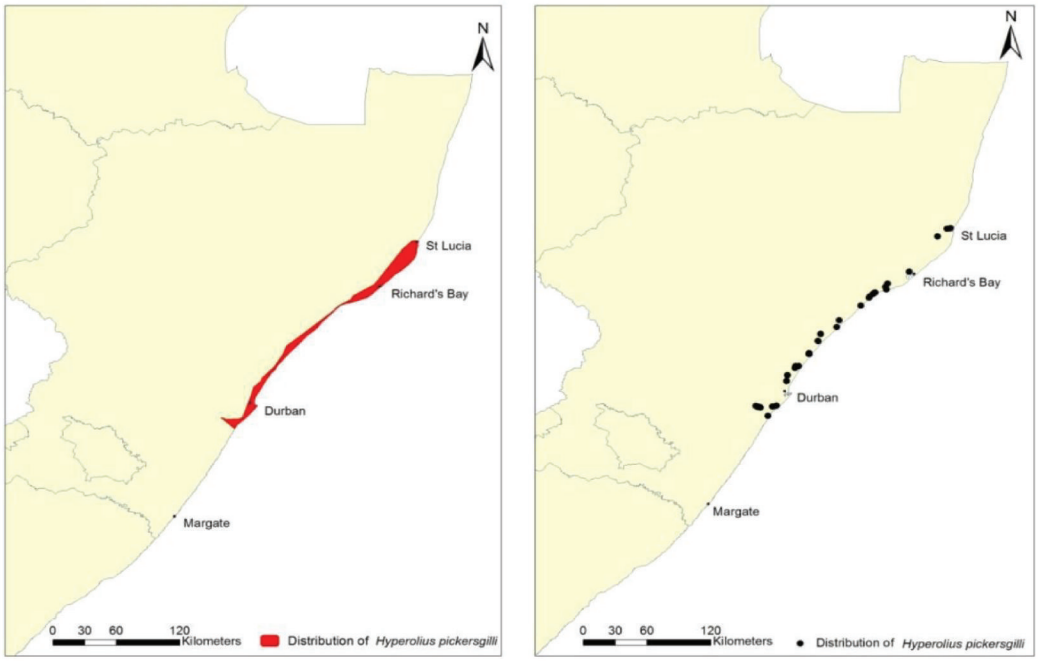

Figure 1 (a): Range of Pickersgill's Reed Frog along the KZN coast, (b) known localities

2.2.3 Life History

Males call from dusk until the early hours of the morning (pers. obs.). The behaviour and call of this species are cryptic, often making it difficult to detect even when present. Breeding takes place in well-concealed vegetation. Out of the breeding season the species can move up to 2 km from breeding sites for foraging and over-wintering (J. Harvey pers. comm., A. Wilken pers. comm.). Additional research is necessary to understand the breeding biology and ecological requirements of this species. It is thought not to occur within the same vicinity as the abundant *Hyperolius marmoratus* (Bishop 2004), although this may be as a result of inability to detect the species' call when other species are chorusing loudly (Tarrant, pers. obs. 2012). The behaviour and call of this species are cryptic, often making it difficult to detect even when present.

2.2.4 Population Genetics

Until recently, little was known about the population genetic structure of *H. pickersgilli*. A study currently being conducted by the EWT, NZG and NWU is investigating the impact of fragmentation on genetic diversity, gene flow and genetic status within and between isolated populations. A total of 54 samples collected from 12 sites between 2011 and 2014 were analysed using mitochondrial DNA sequencing (16S and COI) and microsatellite genotyping. Initial results indicate that there is good gene flow and high genetic diversity between populations, but that additional sampling is required to determine structures within populations (Dalton et. al. 2015). In addition, the genetic variation of the captive population will be monitored to ensure optimal genetic health.

2.2.5 Habitat Requirements

The species is a habitat specialist requiring perennial wetlands comprised of very dense reed beds in Coastal Bushveld-Grassveld (Mucina & Rutherford 2006) at low altitudes (Raw 1982; Armstrong 2001; Bishop 2004). It requires an understudy of thick vegetation, such as Snakeroot (*Persicaria attenuata*), from which males call and taller broad-leaved vegetation, including the Common Reed (*Phragmites australis*), Bulrushes (*Typha capensis*), and sedges (including

Cyperus dives, *C. latifolius* and *C. papyrus*) on which to lay its eggs (Raw 1982; Bowman 2011; Tarrant & Armstrong 2013, pers. obs.). The wetlands inhabited by *H. pickersgilli* should not be regularly burnt so that a layer of moribund vegetation forms over the water surface. The species requires perennial standing water of between about 20 and 60 cm in depth. Additional in-depth research into habitat requirements for *H. pickersgilli* is necessary in the light of proposed biodiversity offsets and potential translocation projects.

2.2.6 Threats

Less than 1% of this species range is currently estimated to fall within protected areas (Armstrong 2001). As such, protection of the species at the remaining unprotected sites is critical. The species is threatened primarily by habitat loss caused by urbanisation, afforestation and drainage for agricultural and urban development (Measey 2011). Many of the historically known sites have been eliminated by either sugar cane or eucalyptus plantations, which directly impact on breeding habitat through wetland drainage and planting within wetland buffers, and which cause a drying out of wetland areas (Johnson & Raw 1987; Bishop 2004b). Pollution of breeding sites by DDT during malaria control seasons and encroachment of alien vegetation have also been identified as threats to the species (SA-FRoG 2010). The remaining subpopulations are small and severely fragmented and are thus subject to loss of genetic diversity through genetic drift and inbreeding, which may be reflected in lowered larval fitness, ultimately resulting in local extinction (Hitchings & Beebee 1997). Fragmentation of habitat may lead to barriers to movement so that metamorphs and adults cannot safely disperse from the breeding wetland to other suitable wetlands and to foraging and over-wintering habitat.

A number of potential threats face *H. pickersgilli* in the two statutory protected areas in which it is known to occur. At Umlalazi Nature Reserve, reeds (*Phragmites australis* and *Juncus kraussii*) are harvested in May from the wetland for use by local communities. This wetland also serves as the outlet and filtration system for sewage from internal infrastructure and the regular sewerage overflow from the Mtunzini sewerage facility. This has been identified as an increasing problem and the BMP-S will assist in addressing the issue. Potential impacts resulting from the rejoining of the Umfolozi River to the St. Lucia estuary in the iSimangaliso Wetland Park are unknown at present and the population there needs to be monitored.

2.2.7 Utilisation

Hyperolius pickersgilli is not known to be utilised directly by humans in any way.

2.2.8 Past and Current Conservation Measures

Following a period in which little research was done on *H. pickersgilli*, recent years have seen increasing research attention being paid to this threatened species. Such research will benefit conservation actions through its application. Recent research projects have included surveys of distribution and development of a predictive model to guide additional surveys (Tarrant & Armstrong 2013), and a study done on the potential impact of noise from airplanes landing at King Shaka International Airport on the Mount Moreland population (Kruger & Du Preez 2016).

At the Amphibian Species Prioritisation Workshop held in Johannesburg in 2008, *H. pickersgilli* was identified as a species requiring *ex situ* rescue and supplementation. An *ex situ* breeding programme was initiated by the Johannesburg Zoo in January 2012 with the collection of 30 individuals from two sites (Mount Moreland and Isipingo) within the eThekwini Municipal Area (EMA). All individuals have survived to date and some initial breeding success occurred during the 2012/2013 summer, with 6 offspring surviving to date (the others only dying because of maintenance catastrophes; I. Visser, pers. comm. 2013). Other *ex situ* facilities were identified for participation in a coordinated APP (African Preservation Programme of PAAZAB). These include the NZG in Pretoria and uShaka Marine World, Durban. The first aim of the *ex situ* breeding programme is to develop correct husbandry practices for the species. Ultimately the

goal is to have the *ex situ* component contributing to the overall conservation of the species through supplementation and establishing viable populations in the wild.

In situ research initiated by NWU in 2008 on *H. pickersgilli* coincided with the prioritisation of the species for *ex situ* work. Through collaboration between NWU, Ezemvelo, Jhb Zoo, NZG, PAAZAB and uShaka, the process of bringing the species into captivity was realised in 2012 (initially at Jhb Zoo and followed thereafter by NZG and most recently at uShaka). As a continuation of the NWU research, The Endangered Wildlife Trust's Threatened Amphibian Programme (EWT-TAP) was initiated and the programme has included *H. pickersgilli* as a priority species for conservation action. In 2016, the EWT-TAP commenced implementation of a Natural Resources Management Project through funding from DEA at four wetland areas for *H. pickersgilli* in the Greater Durban area, namely Widenham (Umkomaas), Adam's Mission, Isipingo and Mount Moreland. The project is primarily aimed at removal of alien invasive vegetation from these sites as well as restoration by replanting indigenous vegetation. In collaboration with the above organisations, the EWT-TAP Pickersgill's Reed Frog Recovery Project is currently working toward the following overall objectives:

Table 1: Conservation objectives of the Endangered Wildlife Trust's Threatened Amphibian Programme

Objective	Key Outputs	Progress to date (July 2016)
1. Develop a Biodiversity Management Plan (BMP-S) for *H. pickersgilli* to guide management plans by the end of 2015	A gazetted BMP-S by the end of 2016.	Gazettal is on track for end of 2016, Ezemvelo, EWT and DEA.
2. Develop and implement a standardized long-term monitoring protocol at selected sites to ascertain population demographics, and improve understanding of threats to populations and responses of populations to management interventions by 2014.	Monitoring and surveillance protocols for KZN's threatened frog species are in place by the end of 2014. Data is captured in the EWT Biodiversity Database as well as the Ezemvelo KZN Wildlife Biodiversity Database.	On track – the protocol was initiated in 2013 and has been tested at several sites during the breeding seasons of 2013/14, 2014/15 and 2015/16. An ongoing study through NWU using automated recorders is also on track at three sites for which baseline data has been collected in 2015/16 to gauge responses against management interventions (alien clearing).
3. Secure at least 30% of the total known range for *H. pickersgilli* in the next 3 years through land-owner agreements and habitat management including, but not limited to, Biodiversity Stewardship over the next 5 years (2013 – 2018)	Priority sites for protection and management are identified. Land-owner agreements or acquisitions are in place.	Steady progress - one site, Widenham, has been acquired by eThekwini Municipality (2015) and is currently under active management by the EWT and eThekwini. This and three other sites in Durban are undergoing active management for alien plant control and rehabilitation through a DEA-funded Natural Resources (NRM) grant.
4. Identify restoration needs and possibilities at all existing and historical sites and facilitating restoration with relevant partners where appropriate.	• Management plans are implemented at four sites within eThekwini between 2015 and 2018. • Improved management practices, including water usage, of agricultural operations in the vicinity of *H. pickersgilli* habitat. • Restoration/Rehabilitation of suitable habitat to achieve target of down-listing. • Improved wetland functionality for	Implementation of a three-year NRM programme started in February 2016 at four sites in the eThekwini Municipal Area. Species and wetland health are being monitored in response to this intervention.

	4 priority coastal wetlands within the eThekwini Municipal Area through control of alien clearing, implementing upstream management practices and wetland and buffer-zone restoration. • Municipal and regional conservation planning and development processes are appropriately informed by relevant conservation plans.	
Provide support to ex situ programs to determine whether captive breeding can be used to supplement wild populations.	• Develop guidelines for translocation of PRF and habitat rehabilitation or restoration. • Conduct genetic assessment of overall population to assess population dynamics and determine the impact of habitat fragmentation on the species. • Undertake research on the habitat requirements, breeding biology and general husbandry of *H. pickersgilli*, both in situ and ex situ.	• On track - A genetic study has been conducted jointly by the EWT, NZG and NWU. Initial results indicate that there is good gene flow and high genetic diversity between populations, but that additional sampling is required to determine structures within populations (Dalton et. al. 2015). • Slow progress - Some initial breeding successes have been had by NZG and uShaka contributing to knowledge on basic biology between 2012 and 2015.
Improve the level of awareness of *H. pickersgilli* amongst the general public through multiple channels (ongoing).	• Educational resources to raise awareness are developed • An awareness campaign about *H. pickersgilli* to be communicated through various media channels • Provide opportunities for job creation, capacity building and education for local community members living in the vicinity of these key wetland areas.	On track – the project has been featured on several national and online documentaries, educational materials have been developed and distributed. Signage for priority sites will be erected in 2016.

2.2.9 Research Inventory and Summary

Research targeting *H. pickersgilli* has been relatively limited and studies on the following topics have been published to date:

1. Conservation status (Armstrong 2001; Minter 2004; Measey 2011). A Red List re-assessment workshop was held in November 2015, results of which will be available in 2017.
2. Distribution modelling (Tarrant & Armstrong 2013).
3. Disease prevalence and infection (Tarrant et al. 2013).
4. Impact of sugarcane (Johnson & Raw 1987).
5. Captive breeding (Visser 2011).
6. Monitoring (Bowman 2011; Trenor 2015).
7. The effect of aeroplane noise on calling dynamics at Mount Moreland (Kruger & Du Preez 2016).

Active conservation research is currently underway on the following topics pertaining to the species:

1. Implementation of monitoring protocols and population estimates (EWT, Ezemvelo and NWU), including through the use of automated recording equipment.
2. Population genetic structure (EWT, NWU, NZG). Unpublished report 2015.
3. Husbandry and *ex-situ* techniques (uShaka, NZG, Jhb Zoo).
4. Translocations (EWT, Ezemvelo, NWU).

2.3 The Role Players

The role players are those who have a legal mandate and responsibility to carry out the conservation actions necessary to achieve the aim of this BMP-S, i.e. improve the conservation status of *H. pickersgilli* and secure its survival in perpetuity in the wild through the implementation of this management plan. This includes land-owners on whose property *H. pickersgilli* occurs, as well as institutions involved in the ex-situ plans for the species. These role players have indicated a willingness to be involved. Table 1 below lists the major role players and the rationale for their inclusion. Appendix A provides further details of key personnel at these organisations at the time of development of this BMP-S, and their contact details.

Table 2: A list of role players required for the implementation of this management plan together with the rationale for their inclusion

ORGANISATION	ROLE/RESPONSIBILITY
Ezemvelo KZN Wildlife	Joint lead agency for development and implementation of the BMP-S and its implementation; co-ordination of conservation efforts and research; facilitation of site visits; development and implementation of monitoring programme.
Endangered Wildlife Trust (Threatened Amphibian Programme)	Joint lead agency for the development of the BMP-S and its implementation. Guide and carry out relevant *in situ* research; co-ordination and implementation of conservation management plans; facilitate communication between the various role-players; development of monitoring programme.
ACSA	Management of Mt Moreland site (Froggy Pond) and involvement in the awareness campaign.
EPCPD, eThekwini Municipality (Environmental Planning & Climate Protection Department)	Inclusion of *H. pickersgilli* sites into conservation planning in the eThekwini Municipal Area; purchase or zonation of sites for conservation; support for NRM programme implemented by EWT at *H. pickersgilli* sites in eThekwini (2015-2017).
Department of Environmental Affairs (National)	Provision of guidance for and facilitation of BMP-S development and implementation; provision of funds for and the gazetting of the BMP; provision of funds for Natural Resource Management at priority sites.
Dube Tradeport	Funding for and management of the Mt Moreland site.
iSimangaliso Wetlands Park World Heritage Site Authority	Facilitation of research and of site visits.
JHB Zoo	*Ex-situ* breeding programme and awareness.
Mondi	Funding for and management of the Port Durnford site.
National Zoological Gardens	*Ex-situ* facility and funding for the captive breeding of *H. pickersgilli* and interdisciplinary research, and the undertaking of and co-operation with other institutions in the interdisciplinary research (population genetics; reproduction biology; molecular diagnostics; biomaterial banking).
North-West University	Funding for and undertaking of relevant conservation research.
SAAMBR/uShaka	Co-ordination of and funding for the uShaka *ex-situ* breeding programme; assistance in the field; co-operation with other institutions in the interdisciplinary research.

Simbithi Eco-Estate	Data collection and facilitation of access to the wetland sites on the estate; funding for and undertaking the management of the *H. pickersgilli* habitat on the estate.
Transnet	Funding for the acquisition and management of offset sites for the *H. pickersgilli* population on the DDOP site; funding for the translocation and re-introduction of H. pickersgilli to the offset sites; facilitation of access to and research on the *H. pickersgilli* populations on the DDOP site and the offset sites.
Umkomaas Conservancy	Implementation of the BMP at, and management of, the Widenham site.

3. LEGISLATIVE FRAMEWORK

This is discussed under section 2.1 above

4. SUMMARY OF PLANNING METHODOLOGY

The Norms & Standards for BMP-S (DEAT 2009, currently under review) requires the following steps for the planning process:

- Appropriate stakeholders should be invited to participate in the development of the BMP-S.
- Stakeholders may be identified according to:
    - The stakeholder group to which they belong, or;
    - Their interests and mission.
- Background information on the species may be compiled and circulated to all appropriate stakeholders prior to development of the BMP-S. The background information should include:
    - Criteria used to select the species;
    - Information on the current status of the species;
    - Information on known threats to the species;
- Compilation of the first draft of the BMP-S can be done by either:
    - A consultant;
    - An expert on the species;
    - A panel of experts on the species; or
    - During a stakeholder workshop.

- The first draft of the BMP-S should be made available to the stakeholders for comment;
- The comment period should be at least 30 days;
    - Relevant comments received should be included in a final draft of the BMP-S.
    - The final draft of the plan should be sent to all implementers of identified actions for validation within 60 days of date of notice.
    - The final draft of the plan should be compiled and submitted, within 90 days of receipt of comments, to the Minister for approval.

The process for that has been followed for the management plan for *H. pickersgilli* has been as follows:

- 24 June 2013 – An invitation was sent to approximately 60 potential participants to attend the Biodiversity Management Plan development workshop.
- 26 August 2013 – A background document was sent to the invitation list

- 5 – 6 September 2013 – A workshop attended by approximately 40 delegates representing 15 organisations attended the BMP-S development workshop at Simbithi Eco-Estate, Shaka's Rock, KZN. The proceedings of this workshop and list of attendees are included in Table 1 and the appendices to this document.
- 22 October 2013 – The first draft of the BMP for *H. pickersgilli* was compiled by Dr. Jeanne Tarrant of the EWT and circulated to all workshop attendees and other interested parties for comments to be returned by 15 November 2013.
- Comments were included and the second draft of the BMP-S was circulated in May 2014.
- Internal comments from EWT and Ezemvelo were incorporated in September 2015 and submitted to DEA.
- The document was made available for public comment from 10 June 2016 to 10 July 2016. Comments were collated and addressed and returned to DEA on 25 July 2016 (see Appendix B).

4.1 Agreements Required for Implementation

In taking the implementation of this BMP-S forward, the key role players have all accepted their various roles and responsibilities and consider the plan to be a document binding them to these. As such additional agreements are not required, although it will be necessary to monitor implementation very carefully and introduce relevant agreements where these are deemed necessary. Provisional agreements currently exist between some of the parties in terms of data collection and usage as well as the *ex-situ* component of the project, namely:

- Data-sharing agreement between EWT, Ezemvelo, NWU and NZG (to be finalised and signed)
- Memorandum of Understanding between EWT, Ezemvelo, PAAZA, NWU, NZG and uShaka (as of 25 July 2016 this has been finalised and signed by EWT, Ezemvelo, PAAZA and NWU).

4.2 Relevant Documents, Agreements and Policies

In addition to the literate cited in the references below (section 9), the following are also relevant:

- NEMBA
- Norms and Standards for BMP-S (March 2009)

4.3 Verification of the Integrity of the Content of the BMP-S

The compilation of this BMP-S has been overseen by Dr. Jeanne Tarrant of the EWT Threatened Amphibian Programme and Dr. Adrian Armstrong, Scientific Services, Ezemvelo, both of whom are experts on *H. pickersgilli.*

SCHEDULE

Table 3: Major threats adversely affecting *Hyperolius pickersgilli* as identified at the stakeholder workshop 5-6 September 2013 (not necessarily in order of importance).

Threat	Description
1. Habitat loss caused by urbanisation and industrial development	The destruction of breeding sites and terrestrial habitat and corridors caused by wetland drainage, complete destruction of habitat as a result of development, and degradation of habitat quality as a result of lack of management.
2. Habitat fragmentation and genetic isolation	Severe habitat fragmentation between the limited number of known sites and very little connectivity between key habitats remains. Risk of insufficient gene flow and genetic diversity
3. Pollution and infectious disease	Contaminants entering key habitat including pollution, sedimentation, fertilizers, effluent and other runoff from agricultural, urban and industrial activities in the surrounding landscape. Also includes encroachment and loss of habitat as a result of alien invasive plants. Novel strains of infectious disease such as *Batrachochytrium dendrobatidis* and ranavirus may pose a risk to isolated populations.
4. Inadequate habitat protection as a result of lack of suitable legislation, relevant policy and uninformed management practices	Only 2 of the 21 known sites known for *H. pickersgilli* occur in Protected Areas. The remainder of sites occur on privately or commercially-owned property or communal land and have been largely overlooked in terms of management. As such, the habitat is in a gradual state of decline, in particular with regard to alien vegetation invasion, siltation of wetlands and inadequate buffer zones.
5. Habitat loss as a result of agricultural activities and possible effects of climate change	Many of the known sites have been affected, and in some instances, destroyed as a result of sugarcane farming. In particular, wetlands have been drained through herring bone drainage, and very little, or no buffer zones have been kept intact surrounding wetlands. The effects of climate change on the species are unknown, but the wetlands they inhabit provide important ecosystem services, including flood attenuation, which will become increasingly important in the face of climate change.
6. Lack of knowledge and lack of awareness	Ecological information about the species is incomplete. Some of this information will be determined through the long-term data collection, for example, through implementation of monitoring and gauging the effectiveness of conservation interventions. Lack of public awareness about the species and the importance of its coastal wetland habitat is also detrimental to the long-term survival of the species.

SCHEDULE

5. ACTION PLAN

High-level objectives toward achieving the aim of the plan were discussed with the role players during the stakeholder workshop using the SMART approach (Specific, Measurable, Achievable, Relevant and Time-bound), in order to break down the objectives into a series of operational goals. Each of these are then broken down into the actions which specifically address the identified threats and include the nature of the action, responsibilities, resource requirements, time frames and indicators of the achievement. The latter will be used for monitoring and evaluation to track implementation.

The actions are broadly designed to address the following threat groups as identified above:

1. Habitat loss caused by urbanisation and industrial development.
2. Habitat degradation or loss caused by agricultural activities and water usage (wetland drainage, abstraction etc), and the potential impacts of climate change.
3. Habitat fragmentation and consequences for genetic management.
4. Pollution, disease and alien vegetation.
5. Lack of appropriate legislation, policy and institutional process (capacity management, protection of sites).
6. Lack of scientific knowledge and public awareness.

The overarching aim and objectives are:

AIM

To improve the conservation status of *Hyperolius pickersgilli* and secure its long-term survival in the wild

GOAL

Improve the conservation status of *H. pickersgilli*, ultimately to Least Concern, and improve its protection as part of meeting international biodiversity objectives (i.e. Aichi targets) through applied conservation action.

OBJECTIVES

1. *Create and maintain an enabling environment for relevant stakeholders, including private land-owners, to carry out appropriate management actions required for the survival of subpopulations and maintain or improve necessary ecological processes.*
2. *Prioritise the protection and appropriate management of key habitats for H. pickersgilli in relation to the scale and imminence of potential impact from urban or industrial development, with the additional objectives of:*
    a. *reducing habitat fragmentation and improve gene flow through creation of linkages or corridors,*
    b. *identifying potential sites for offsets involving H. pickersgilli, and*
    c. *researching relocation and habitat rehabilitation or restoration requirements of H. pickersgilli and developing guidelines for the implementation of these processes.*
3. *Implement habitat protection and management activities through land-owner agreements, including but not limited to biodiversity stewardship, to curb habitat degradation caused by agricultural activities and water usage, and to secure sites to mitigate against the potential impacts of climate change.*
4. *Identify and conduct research to generate knowledge and provide information relevant to conservation management requirements, both in situ and ex situ, implement population monitoring protocols, and ensure that these data inform and are applied in the overall conservation process.*

5. *Develop educational and awareness campaigns to improve public knowledge about H. pickersgilli and the importance of its ecosystem.*

5.1 Over-arching principles

Given the Endangered status of *H. pickersgilli* and the numerous role players that will be involved in the implementation of this BMP-S, it is important to list the over-arching principles that will be used to govern implementation and provide context within which the planning components have been derived. These include:

- Iterative: This BMP-S is the first version of an iterative planning process that will continue to evolve throughout its implementation. It is not necessarily an exhaustive list of all the actions that may be required to achieve the aim and objectives. The PRFF (see Action 1.1.1) will need to manage an adaptive process as implementation proceeds and generates information on the conservation management actions required.
- A focus on in situ conservation: The primary focus of this BMP-S is an action plan to secure the future of *H. pickersgilli* in the wild within its natural range (including a projected "natural range" under climate change). Some captive breeding programmes will necessitate activities with the species outside of this range, with the ultimate goal of re-introducing individuals to secure habitat back to the natural range.
- Partnerships: Certain agreements such as MoUs may be necessary between some role-players in order to facilitate relevant actions so that they can be carried out within the stipulated time-frame and by the designated implementers.

5.2 Goal

Improve the conservation status of H. pickersgilli, ultimately to Least Concern, and improve its protection as part of meeting international biodiversity objectives (i.e. Aichi targets) through applied conservation action.

This overarching goal will be met through all of the actions detailed in this BMP-S. The objectives outlined in this BMP-S are aligned with meeting Aichi targets. The Aichi targets for the period 2011-2020 fall under five strategic goals, of which the following is of most relevance to this BMP-S:

- Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity.

The most important Aichi target relating to this BMP-S is Target 12 under Strategic Goal C:

- By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.

Objective 1

Create and maintain an enabling environment for relevant stakeholders, including land-owners, to carry out appropriate management actions required to ensure the survival of the relevant sub-population and maintain or improve necessary ecological processes.

Operational Goal 1.1

Establish the Pickersgill's Reed Frog Forum (PRFF) by March 2016 to monitor, track implementation of, and report on progress of implementation of the BMP-S, and facilitate interactions between responsible parties and provide decision support.

Action 1.1.1: Formally invite representatives from each sector of the key role players identified in 2.3 (i.e. academia, NGO's, conservancies, conservation authority, local government, commercial, private and, ex-situ facilities) to accept membership on the PRFF to share and communicate conservation priority information for *H. pickersgilli* with authorities and regulators. Draw up constitution and *modis operandi*.	
Lead Parties	Ezemvelo KZN Wildlife, EWT
Implementing Agents	Forum members
Time Frame	1 year Annually revised to conform to government planning cycles
Resources needed	Internal -
Incentives	Coordination of effort and implementation of the plan Monitoring of implementation of the plan
Measurable Indicators	Copies of invites sent Pickersgill's Reed Frog Forum mailing list Meeting minutes Annual report of BMP-S implementation progress

Action 1.1.2: Convene meetings of the PRFF	
Lead Parties	Ezemvelo KZN Wildlife, EWT
Implementing Agents	Forum members
Time Frame	Annual or more frequently if needed
Resources needed	Internal
Measurable Indicators	Meeting minutes

Operational Goal 1.2

Promote the inclusion of the objectives of the BMP-S into formal conservation and land-use processes so that the conservation of *H. pickersgilli* is prioritised.

Action 1.2.1: Inform corporate and civic responsibility groups via the PRFF in order to get priority areas included in district and municipal systematic planning processes (e.g. SCPs, SDFs/IDPs/LUMSs etc.).	
Lead Parties	Ezemvelo KZN Wildlife, EWT
Implementing Agents	Corporate and civic responsibility groups Local Municipalities
Time Frame	Ongoing
Resources needed	Time, Spatial data
Incentives	Protection of ecosystem services, therefore saving on "hard engineering" and clean-up alternatives
Measurable Indicators	Meeting records Relevant information is made available to appropriate groups via the PRFF Number of programs implemented across different levels

Objective 2

Prioritise key habitats for H. pickersgilli with regard to potential impact, especially with regard to urban and industrial development, and depending on land-owner circumstances and ability to implement management interventions.

Operational Goal 2.1

Prioritise known sites in terms of long-term viability

Action 2.1.1: Rank known localities in terms of conservation importance for the long-term viability of *H. pickersgilli*, based on selection criteria such as area size, population size, connectivity, threats and ecosystem integrity etc. Identify unique threats and risks for all existing sites and use as a decision-making tool for conservation actions.	
Lead Parties	Ezemvelo KZN Wildlife, EWT
Implementing Agents	Municipalities, DAEA, universities, and consultants
Time Frame	3 years
Resources needed	Student bursary, travel, knowledge
Impacts/ Consequences	Site rankings to provide starting point for on-the-ground conservation
Incentives	Focus resources on priority sites to streamline resources Partnerships – project Awareness of relative importance of each site
Measurable Indicators	Ranking of sites

Action 2.1.2: Overlay GIS layers that depict a) known and predicted distribution of the species, b) ecosystem integrity, c) SDFs, d) IDPs, e) Biodiversity Plans, f) development plans to highlight priority areas, including for climate change adaptation.	
Lead Parties	Ezemvelo KZN Wildlife, EWT
Implementing Agents	Conservancies, Municipalities, COGTA, SANBI – BGIS, NZG, DWA, Ezemvelo KZN Wildlife, EWT, corporate groups and private land owners
Time Frame	6 months & annual updates

Resources needed	Workshops to share and collate available data and discuss quality
Incentives	Opportunities for companies to share offset responsibilities Positive publicity for landowners and corporates ("green stamp" of social responsibility)
Measurable Indicators	List of identified sites that are suitable or potentially suitable Revised BGIS product

Operational Goal 2.2

Identify key habitats for potential offset sites / "offset banks" from which offset sites can be drawn from by potential developments affecting *H. pickersgilli* habitat.

Action 2.2.1: Identify sites that have been ear-marked for development and which may not be able to be adequately protected (as per the mitigation hierarchy).	
Lead Parties	Ezemvelo KZN Wildlife, EWT
Implementing Agents	Ezemvelo KZN Wildlife, DEA, Universities, corporates specialist consultants
Time Frame	2 years to identify sites currently threatened Ongoing for threat assessment and monitoring
Resources needed	Financial resources, workshop
Impacts/ Consequences	Proactive planning to accommodate development while protecting populations of *H. pickersgilli* Positive impact of additional knowledge Application of knowledge Environmentally sustainable development
Incentives	Gaining knowledge for application Increased awareness of challenges and opportunities Green image of stakeholders
Measurable Indicators	Reports upon completion of surveys GIS layer of doomed localities

Action 2.2.2: Identify potential offset sites suitable for expansion, rehabilitation and improved linkage and prioritise conservation actions accordingly.	
Lead Parties	Ezemvelo KZN Wildlife, EWT
Implementing Agents	Ezemvelo KZN Wildlife, Universities, DEA (Environmental Programmes Unit), DAEA, corporates, Working for Wetlands/Working for Ecosystems, municipalities, specialist consultants
Time Frame	1 year to ID sites Ongoing for threat assessment and monitoring
Resources needed	Financial, workshop, advisory capacity, technical expertise
Impacts/ Consequences	Proactive identification of receiving areas for translocation from doomed localities. Reduce authorization process time Environmentally sustainable development No net loss of populations of *H. pickersgilli* Downgrade the threat status of *H. pickersgilli*
Incentives	Possible student project Improved knowledge Improved conservation status

	Fulfilment of international contractual obligations through implementation (meeting AICHI targets under NEMBA) Green image of stakeholders of new identified sites
Measurable Indicators	Reports upon completion of surveys GIS layer of potential offset sites Increased commitment from landowners of sites

Operational Goal 2.3

Reduce population isolation and allow sufficient gene flow between populations and reduce the barriers to movement of *H. pickersgilli* between suitable habitats

Action 2.3.1: Using the site ranking and GIS layers generated in 2.1.1 and 2.1.2, identify localities with corridors that could be improved through rehabilitation or restoration and possibly used for re-introduction	
Lead Parties	Ezemvelo KZN Wildlife
Implementing Agents	Ezemvelo KZN Wildlife & EWT
Time Frame	1 year to identify sites based on predictive model
Resources needed	Manpower, equipment, funding
Impacts/Consequences	Could impact development scheduled for such areas; Positively impact on protected area targets if proclaimed under NEMPAA
Incentives	Improved management plans
Measurable Indicators	New GIS layers List of sites with supporting information

Objective 3

Implement habitat management activities through land-owner agreements to curb habitat degradation caused by agricultural activities and associated impacts on water availability and quality, and to secure sites to mitigate against the potential impacts of climate change.

Operational Goal 3.1

Improve management practices, including water usage, of development operations (including agriculture, mining and urban development) in the vicinity of *H. pickersgilli* habitat.

Action 3.1.1: Implement appropriate site-specific management activities, i.e., control of invasive alien vegetation, rehabilitation activities, structural hydrological remediation, etc., where applicable, at sites prioritised in 2.1.1	
Lead Parties	DEA (Environmental Programmes Unit) , DWA
Implementing Agents	Ezemvelo KZN Wildlife, EWT, local municipalities, DEA Working for Ecosystem programmes, DWA, land owners, Mondi Wetlands Programme, SASA, local conservancies
Time Frame	3-5 years to commence implementation
Resources needed	Stewardship capacity, operational expenses
Incentives	Job creation, improved wetland management, tax rebates, healthy biodiversity
Measurable Indicators	Site-specific management plans developed Management practices in place Alien plants cleared Establishment of certification programme, for example, “Frog Friendly Sugar”

Action 3.1.2: Commence restoration/rehabilitation, as appropriate, of both existing and potential *H. pickersgilli* habitat (as identified in 2.1.1.)	
Lead Parties	DEA (Environmental Programmes Unit), EWT, appropriate municipalities
Implementing Agents	Landowners Working for Wetlands (and other DEA programmes) EWT Local government
Time Frame	To be initiated within 24 months 3 years for first 4 sites
Resources needed	Rehabilitation protocols and plans (from above) Expert wetland knowledge Manpower, equipment, funding, meetings
Impacts/Consequences	Establishing management plans for such areas Improved ecosystem services Meeting conservation planning targets (as per systematic plans) Meeting Aichi target of improving conservation status
Incentives	Partnerships formed Leverage co-funding Local communities will benefit from improved ecosystem services Job creation
Measurable Indicators	Restoration/rehabilitation of suitable habitat to achieve target of down-listing. Number of areas of habitat rehabilitated successfully in accordance with *H. pickersgilli* requirements. Successful reintroduction or increase in population size and number.

Operational Goal 3.2

Improve the ecological status of *H. pickersgilli* habitat though improved management practices to mitigate potential impacts of climate change.

Action 3.2.1: Model potential impacts of climate change on *H. pickersgilli*. Links to 2.1.1.	
Lead Parties	Ezemvelo KZN Wildlife, EWT
Implementing Agents	Ezemvelo KZN Wildlife, EWT, universities, local municipalities, land owners and users
Time Frame	2 Years
Resources needed	Relevant specialists and resources
Incentives	Improved understanding of climate change impacts on *H. pickersgilli.* Use results toward establishment of new populations of *H. pickersgilli* Improved ecological function. Meeting climate change adaption requirements.
Measurable Indicators	Model of climate change potential impacts on *H. pickersgilli.* Improvement in ecological status of *H. pickersgilli* habitat towards the benchmark status. Guidance on targets for rehabilitation and reintroductions.

Objective 4

Identify and conduct relevant research to provide information relevant to conservation management requirements, both in situ and ex situ, implement population monitoring protocols, determine relocation and rehabilitation requirements, and ensure that these data are fed back into and inform the overall conservation process.

Operational Goal 4.1

Improve the understanding of the biology, population genetics, habitat requirements and husbandry of *H. pickersgilli.*

Action 4.1.1: Conduct genetic assessment of overall population to assess population dynamics and determine the impact of habitat fragmentation on the species.	
Lead Parties	NZG
Implementing Agents	NZG, EWT, NWU, Ezemvelo KZN Wildlife
Time Frame	1 – 2 years
Resources needed	Financial, Laboratories and equipment (NZG), Students
Incentives	Graduate research possibilities Improved management of meta-population Contributing to sound genetic principals for *ex situ* breeding programs and relocations and re-introductions
Measurable Indicators	Publication of results and input into relevant databases Phylogenetic trees and genetic map of *H. pickersgilli* across its range. Results of genetic study are incorporated into plans for potential translocations and improved habitat linkages.

Action 4.1.2: Undertake research on the habitat requirements, breeding biology and general husbandry of *H. pickersgilli*, both *in situ* and *ex situ*.	
Lead Parties	PAAZAB, Ezemvelo KZN Wildlife, EWT,
Implementing Agents	Jhb Zoo, EWT, Ezemvelo, NWU, NZG, SAAMBR
Time Frame	1 – 2 years. Ongoing
Resources needed	Financial, facilities, human resources (students, staff)
Incentives	Capacity building Increase knowledge Association with endangered species conservation Local and international recognition Inter-departmental incentives and co-operation (i.e. promotion of wetland and human health) Graduate research possibilities.
Measurable Indicators	Increased knowledge of life-history, breeding biology and husbandry of *H. pickersgilli* Publication of results Incorporate findings into conservation actions and translocation guidelines

Action 4.1.3: Implement population monitoring at selected priority sites.	
Lead Parties	Ezemvelo KZN Wildlife, EWT
Implementing Agents	EWT, Ezemvelo KZN Wildlife NWU
Time Frame	1 – 2 years. Ongoing
Resources needed	Financial, facilities, human resources (students, staff)
Incentives	Baseline data Increase knowledge Graduate research possibilities.
Measurable Indicators	Increased knowledge of life-history, breeding biology and requirements of *H. pickersgilli* Publication of results

Operational Goal 4.2

Establish best-practice guidelines for conservation translocations of *H. pickersgilli*

Action 4.2.1 Establish protocols under the IUCN guidelines for potential translocations and reintroductions of *H. pickersgilli* Ties in with 1.4 and 3.1.2	
Lead Parties	Ezemvelo KZN Wildlife, EWT, PAAZAB (NZG), IUCN
Implementing Agents	Ezemvelo KZN Wildlife, EWT, NZG, NWU
Time Frame	2-3 years to develop guidelines 3 - 5 years for initial testing
Resources needed	Expertise, research, testing sites, funding
Incentives	Maximise the probability of success of translocations and reintroductions
Measurable Indicators	Guidelines produced Guidelines are tested, made available to translocation implementing agencies

	and mainstreamed

Operational Goal 4.3

Develop and maintain an appropriate database for curation of data obtained through research to assist with implementation of the BMP-S on an ongoing basis.

Action 4.3.1: Collate all relevant information in appropriate databases and make it publicly available to influence and guide decision making.	
Lead Parties	Ezemvelo KZN Wildlife, EWT
Implementing Agents	EWT, NZG, Ezemvelo KZN Wildlife
Time Frame	2-3 years
Resources needed	IT skills, time, financial
Incentives	Efficient storage and accessibility of data
Measurable Indicators	Data are captured and available

Objective 5

Develop educational and awareness campaigns to improve public knowledge about H. pickersgilli and the importance of its habitats.

Operational Goal 5.1

Improve the level of awareness of *H. pickersgilli* amongst the general public through multiple channels.

Action 5.1.1 Develop an awareness campaign and education programme about *H. pickersgilli* to be communicated through various environmental education programmes and media, including television, radio, print, billboards, social media and displays.	
Lead Parties	EWT
Implementing Agents	EWT, Ezemvelo KZN Wildlife, JHB Zoo, NZG, uShaka, NGOs, media, commercial partners, *ex-situ* facilities, social responsibility groups within corporates
Time Frame	To be developed after 1 year. Ongoing
Resources needed	Marketing/education budget, internal, financial (corporate sponsorship)
Incentives	Reach a wide audience Add impetus to future funding applications. Positive company image, reaching a wide audience ("green stamp"/environmental responsibility) Social change **Positive publicity for landowners (e.g. farmers) and corporates**
Measurable Indicators	Inclusion in environmental education programmes Participation in awareness events Surveys of, and feedback from, people exposed to educational and awareness programmes Media tracking records Indices of "reach" e.g. distribution, number of posts, shares and "likes"

	Number of records uploaded in the form of photos

6. MONITORING

The actions covered in section 6 above indicate applicable and measurable outcomes where relevant. From these it will be possible to derive an overall understanding of performance as will be determined by the Pickersgill's Reed Frog Forum (PRFF) who will be responsible for the implementation, monitoring and reporting of this BMP-S.
An annual report will be generated for circulation to all stakeholders and submission to DEA, to reflect progress made according to the following over-arching outcomes:

- Sustained and enhanced co-operation between all stakeholders through the PRFF.
- Clarity and acceptance of roles and responsibilities by relevant stakeholders.
- Clear management goals and relevant time-frames for their achievement.
- Identification of key performance indicators that can be used to assess the progress toward defined goals.
- A plan that comprehensively and concisely covers all aspects related to the conservation requirements of *H. pickersgilli* and provides realistic targets for the five years of this iteration.
- A summary of up-to-date research pertaining to *H. pickersgilli.*
- Improved management and conservation status of the priority sites for *H. pickersgilli* and of relevant habitat linkages.
- Progress towards an improved Red List conservation status for the species.
- Identification of potential sites for offsets and translocations involving *H. pickersgilli*, including in terms of predicted climate change impacts, identified.
- Development of guidelines for the rehabilitation or restoration of *H. pickersgilli* habitat and the translocation of *H. pickersgilli*.
- Implementation of an educational and awareness campaign to improve public knowledge about *H. pickersgilli* and the importance of its ecosystem.

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APPENDIX A: Proof of Compliance

Table 4: Participants that attended the stakeholder meeting in September 2013

NAME	ORGANISATION	ROLE/RESPONSIBILITY
Dr. Jeanne Tarrant	Endangered Wildlife Trust	Research, Co-ordination of conservation efforts
Dr. Harriet Davies-Mostert	Endangered Wildlife Trust	Co-ordination of conservation efforts
Dr. Adrian Armstrong	Ezemvelo KZN Wildlife	Research, Co-ordination of conservation efforts
Sharon Louw	Ezemvelo KZN Wildlife	Research and facilitation of site visits
Prof. Louis du Preez	North-West University	Research
Prof. Che Weldon	North-West University	Research
Mea Trenor	North-West University	Research, Field assistant, Collection of samples for genetic analysis
Prof. Antoinette Kotze	National Zoological Gardens	Interdisciplinary research (population genetics; reproduction biology; molecular diagnostics; biomaterial banking)
Judy Mann	SAAMBR/uShaka	Co-ordination of uShaka *ex-situ* programme
Carl Scholms	SAAMBR/uShaka	*Ex-situ* breeding programme
Nick Evans	SAAMBR/uShaka	Field assistant, *Ex-situ* breeding programme
Mike Jordan	National Zoological Gardens	*Ex-situ* breeding programme, Re-introductions
Mike Adams	National Zoological Gardens	*Ex-situ* breeding programme
Chris de Beer	National Zoological Gardens	*Ex-situ* breeding programme
Ian Visser	JHB Zoo	*Ex-situ* breeding programme
Joseph McMahon	Transnet	Prospecton site facilitation and potential offset opportunities for DDOP
Hermano Taute	Transnet	Prospecton site facilitation and potential offset opportunities for DDOP
Tarik Bodasing	iSimangaliso / Ezemvelo KZN Wildlife	Research and facilitation of site visits
Christopher Jones	ACSA	Management of Mt Moreland site, awareness campaign
Nokuthula Mcinga	ACSA	Management of Mt Moreland site, awareness campaign
Mike O'Donaghue	Simbithi	Data collection and facilitation of access to site
Margi Lilienfield	Simbithi	Data collection and facilitation of access to site
Dudley Wang	Simbithi	Data collection and facilitation of access to site
Pamela Kershaw	DEA (Conservation)	BMP facilitation
Garth Green	Forest Lodge, Mtunzini	Site facilitation
Lyle Ground	EPCPD, eThekweni Municipality	Inclusion of EMA *H. pickersgilli* sites into conservation planning
Warren Botes	EPCPD, eThekweni	Inclusion of EMA *H. pickersgilli* sites

NAME	ORGANISATION	ROLE/RESPONSIBILITY
	Municipality	into conservation planning
Nonhlanhla Khoza	Tongaat-Hullett	Management of Mt Moreland site, awareness campaign
Pat Jennings	Tronox	Environmental Manager for Fairbreeze site
Marius Vlok	Tronox	Environmental Manager for Fairbreeze site
Derek & Sue Weightman	Umkomaas Conservancy	Widenham site
Zama Dlamini	Dube Tradeport	Environmental Manager for Mt Moreland site
Daniel Smith	Dube Tradeport	Environmental Manager for Mt Moreland site
Theresia Ott	Richards Bay Minerals	
Lize Shaw	Mondi	Rehabilitation and management of Port Durnford site
Jacqui Shuttleworth	Mondi	Rehabilitation and management of Port Durnford site

Table 5: Interested and Affected Parties who did not attend the initial stakeholder development meeting in September 2013.

NAME	ORGANISATION	EMAIL
Angie Wilken	Mt Moreland Conservancy	angie@barnswallow.co.za
Barbara Kewley	Mtunzini Conservancy	bwkewley@telkomsa.net
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Dr Steven van der Spuy	NZG	stephen@nzg.ac.za
Timothy Netsianda	Jhb Zoo	
Cameron McLean	EPCPD, eThekwini Municipality	Cameron.McLean@durban.gov.za
Natasha Govender	EPCPD, eThekwini Municipality	Natasha.Govender@durban.gov.za
Doug Macfarlane	Eco-Pulse Consulting	dmacfarlane@eco-pulse.co.za
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Nicolene Lotter	Widenham	lizelleg@mweb.co.za
Dudley Wang	Simbithi Eco-Estate	dwangbt@gmail.com
Judy Mann	UShaka Marine World	jmann@seaworld.org.za
Michelle Boshoff	Richards Bay Minerals	
Adam Teixeira-Leite	Eco-Pulse Consulting	ateixeira@eco-pulse.co.za
Brian Molefe	Eskom	
Ryan Brudvig	DEA, Natural Resource Management Programmes- KZN	RBrudvig@environment.gov.za
South African Frog Re-assessment Group (SA-FRoG)	IUCN SSC Amphibian Specialist Group for Red List reassessments	jeannet@ewt.org.za john@measey.com
SANBI	South African National Biodiversity Institute	D.Pillay@sanbi.org.za k.tolley@sanbi.org.za