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DEPARTMENT OF ENVIRONMENTAL AFFAIRS

NO. 1328 **18 OCTOBER 2019**

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

DRAFT BIODIVERSITY MANAGEMENT PLAN FOR THE AFRICAN PENGUIN

I, Barbara Dallas Creecy, Minister of Environment, Forestry and Fisheries, hereby invite members of the public to comment on the draft Biodiversity Management Plan (BMP) for the African Penguin in terms of section 99, read with section 100, of the National Environmental Management: Biodiversity Act, 2004 (No. 10 of 2004). Copies of the draft BMP can be downloaded from the website of the national Department of Environment, Forestry and Fisheries: www.environment.gov.za or can be obtained electronically upon request by email to marinespecies@environment.gov.za.

The BMP's vision is to halt the decline of the African Penguin in South Africa within its 5-year timeframe and therefore sets out a draft plan for doing so.

Members of the public are invited to submit written representations on, or objections to, the draft BMP within 30 (thirty) days after the publication of this notice in the *Gazette.* Written representations or objections received after this time may not be considered. All representations and comments must be submitted in writing to the Deputy Director–General of the national Department of Environment, Forestry and Fisheries: Branch Oceans and Coasts:

By hand: The Deputy Director-General
Attention: Ms M M Makoala
Department of Environment,
Forestry and Fisheries
Branch: Oceans & Coasts
1 East Pier Building, East Pier Road
V&A Waterfront, Cape Town
By e-mail: marinespecies@environment.gov.za

By post to: The Deputy Director-General
Attention: Ms M M Makoala
Department of Environment, Forestry and Fisheries
Branch: Oceans & Coasts
P.O. Box / Private Bag X4390
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BARBARA DALLAS CREECY
MINISTER OF ENVIRONMENT, FORESTRY AND FISHERIES

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DRAFT 2nd BIODIVERSITY MANAGEMENT PLAN FOR THE AFRICAN PENGUIN (*Spheniscus demersus*)

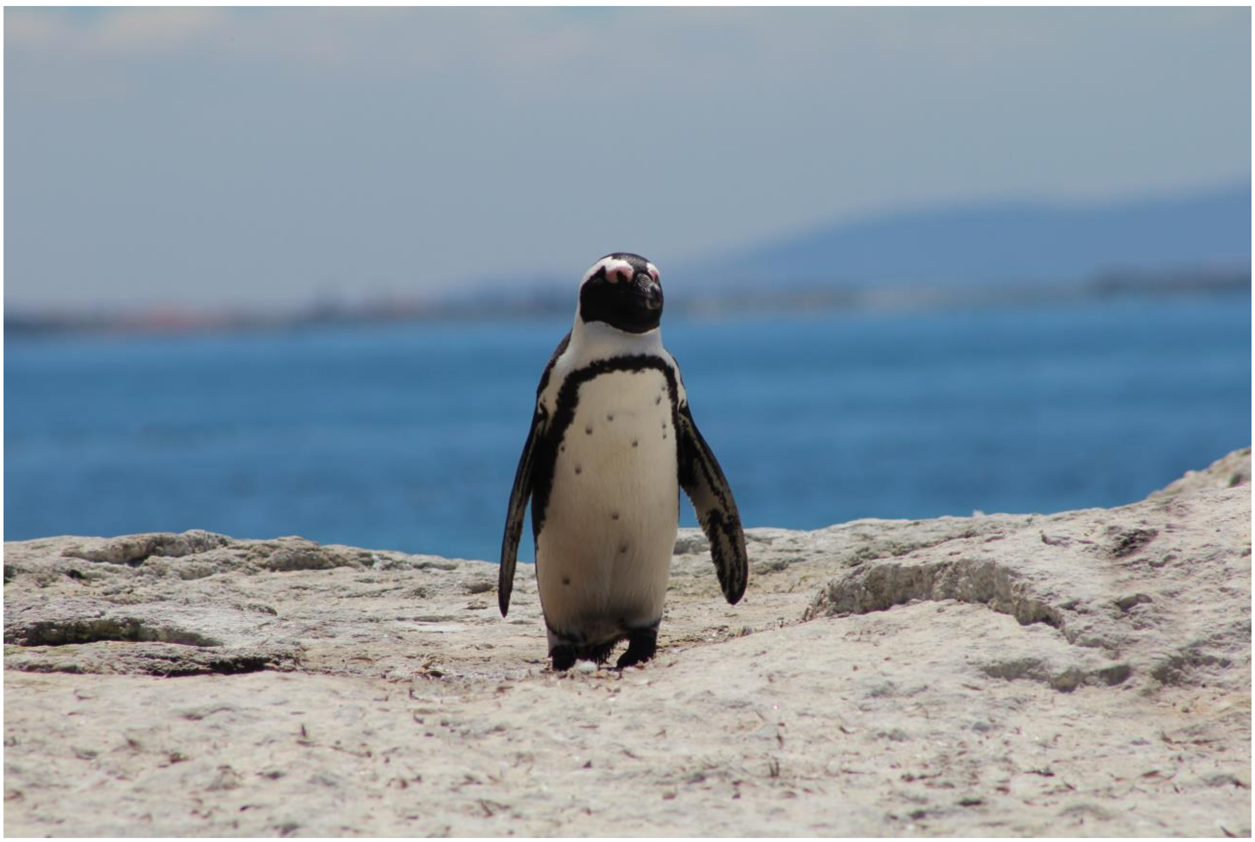

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

The African Penguin *Spheniscus demersus*, Africa's only extant penguin, is endemic to Namibia and South Africa. It was formerly the most abundant seabird of the Benguela upwelling ecosystem but, following large declines of the species in the 20th century and a collapse of the South African population in the present century, is now classified as Endangered. In addition to biodiversity concerns, African Penguins (and other seabirds) are important in regional economies (e.g. through attracting tourism) and in the healthy functioning of ecosystems.

A Biodiversity Management Plan for the African Penguin was gazetted in 2013, with aims: *To halt the decline of the African Penguin population in South Africa within two years of the implementation of the management plan and thereafter achieve a population growth which will result in a downlisting of the species in terms of its status in the IUCN Red List of Threatened Species*. Despite the successful implementation of many of the actions listed in the plan, these aims were not attained and African Penguins in South Africa have continued to decline. Therefore, it is necessary that the plan be revised and extended to operate over a second five-year period, from mid-2019–2024. The main reason for the ongoing decline of African Penguins in South Africa is a scarcity of prey, which has led to mortality of birds. If the second plan of the management plan is to succeed, it is crucial that this matter be addressed. For that, fishing of its main prey items should be precluded around all prioritized colonies and seasonally at feeding grounds while fattening before and after a moult. Further, colonies along the south coast should be maintained and, if shown to be safe and viable, bolstered through the release of hand-reared abandoned chicks and captive-bred penguins. In addition, the risk of oil spills must be strictly minimised through, for example, the zoning of shipping and bunkering. Given the present small size of the population, colony-specific interventions, such as the management of predation on African penguins, are likely to play a major role.

2. DEFINITIONS

“Biodiversity Management Plan - Species” means a species management plan in terms of section 43 of the National Environmental Management: Biodiversity Act (No 10 of 2004).

“Collaborators” mean those individuals and/or organisations that will be approached/included in the process to participate and complete the relevant actions.

“**Catastrophic event**” means any event that affects or has the potential to negatively impact a colony and can include oil spills, disease outbreaks, fire and inclement weather (flooding, wind chills, heat stress, etc.).

“Conservation Authorities” mean those organisations mandated in terms of legislation with the conservation of South Africa’s biota.

“**Conservation Translocation**” means the intentional movement and release of a living organism where the primary objective is a conservation benefit: this will usually comprise improving the conservation status of the focal species locally or globally, and/or restoring natural ecosystem functions or processes.

“Management Authorities” mean those organisations or individuals managing the land either for themselves where they are the owners or on behalf of the owners through an agreement.

“Permitted Rehabilitation Centres” refer to those centres that have permission from Provincial Conservation Authorities (by means of a permit) to rehabilitate animal species as specified on the permit.

“Protected Area Management Plans” mean those management plans developed for protected areas as set out in section 39 of the National Environmental Management: Protected Areas Act (No 57 of 2003).

“Rehabilitation” means the re-establishment of part of the productivity, structure, function and processes of the original ecosystem.

“Responsible Party” means the organisation or body that has the delegated authority to carry out an action either through legislation or through delegation of that authority.

“Restoration” means that all of the key ecological processes and functions are re-established and all of the original biodiversity is re-established.

"Special Management Areas" are areas wholly or partially in the coastal zone that may be declared by the Minister of Environmental Affairs to prohibit certain activities from taking place within such areas (National Environmental Management: Integrated Coastal Management Act No 24 of 2008).

"Stakeholder" means any group or individual who can affect or is affected by any of the actions in the Biodiversity Management Plan.

"Steering Committee" means a group of individuals appointed by this Department to oversee the implementation of the management plan in accordance with the determined terms of reference for the Committee.

"Working Group" means a number of individuals invited to form a group in order to complete an action or actions set out in the Biodiversity Management Plan. The tenure of such a group may be until the completion of the action or for the duration of the Management Plan.

3. ABBREVIATIONS

APBMP:	African Penguin Biodiversity Management Plan
CITES:	Convention on International Trade in Endangered Species of Wild Fauna and Flora
IUCN:	International Union for Conservation of Nature
NEM: BA:	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEM: PAA:	National Environment Management: Protected Areas Act, 2003 (Act No. 57 of 2003)
TOPMS:	Threatened or Protected Marine Species as listed in terms of section 56 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)

4. INTRODUCTION

4.1 Why the African Penguin requires a Biodiversity Management Plan

A Biodiversity Management Plan for the African Penguin (APBMP) was gazetted in 2013 on account of a rapid decrease of the species at the start of the present century. More than 50,000 pairs of African Penguins bred in South Africa in 2004 but this fell to c. 19,000 pairs in 2013. Conservation efforts were required from stakeholders to assist in mitigating and reversing this trend. However, despite the unified approach to the conservation of the African penguin and successful attainment of several actions listed in the APBMP, numbers continued to decrease. In 2016, the status of the African Penguin was re-assessed according to criteria of the International Union for Conservation of Nature (IUCN) and its classification as endangered was maintained (IUCN 2016), and a record low of c. 15,000 pairs bred in South Africa in 2018.

Given that no further interventions are implemented, it is predicted that the future population along the West Coast of South Africa will continue to undergo rapid reduction and could be functionally extinct by 2035 (Sherley *et al*. 2018). Food scarcity, which was shown to be the main driver of the loss of about 35,000 breeding pairs of African Penguins in South Africa between 2001 and 2009 (Figure 1, Crawford *et al.* 2011, 2018), is still considered the main cause of the predicted future declines (Sherley *et al.* (2018).

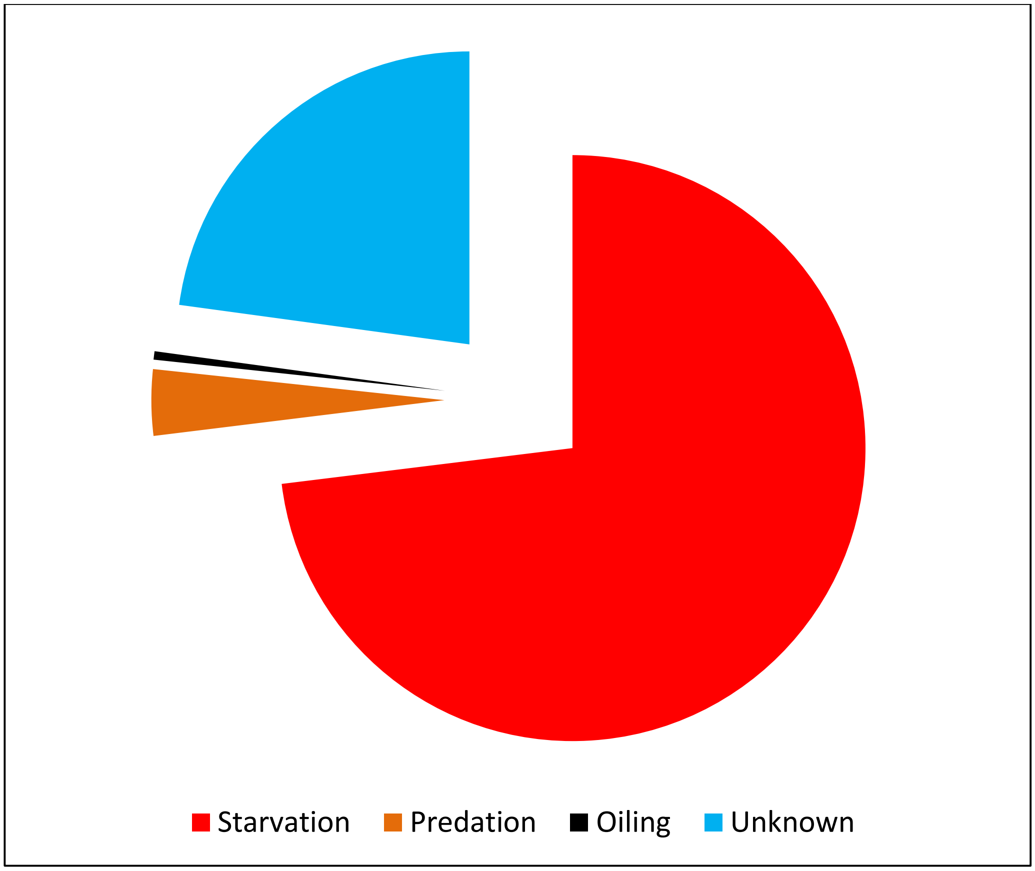

Figure 1: The proportional contributions of different factors to the loss of about 35,000 breeding pairs of African Penguins in South Africa between 2001 and 2009 (for further details see Section 5.3)

4.2 Aims of the Biodiversity Management Plan

The aims of APBMP are:

1. To take steps towards downlisting the African Penguin from IUCN's list of species having an endangered conservation status; and thereby
2. To ensure the survival of the species in South Africa in a healthy environment for South Africans and visitors to experience, and hence maintain (with possible expansion) the socio-economic benefit (jobs and revenue) that African Penguins generate for the country (see Figure 2).

4.3 Objectives of the Biodiversity Management Plan

The objectives by the end of the period covered by the APBMP are:

1. Through addressing the threats to African Penguins, to have increased their number in South Africa, as measured by the number of pairs breeding in the wild[1], by at least 5% from that estimated for 2018[2]; and
2. Within objective 1 to strive to ensure that:
   a) No extant colonies become extinct and that the populations in each of three regions in South Africa (Orange River to Cape Point, Cape Point to Cape Agulhas, east of Cape Agulhas) are stable or increasing;
   b) Economic and employment benefits related to penguin tourism are sustainably managed, with possible expansion,
   c) Further degradation of marine ecosystems and increases of detrimental activities near breeding colonies are prevented; and
   d) Intergovernmental and regional collaboration and decision-making (between relevant departments) are facilitated.

Figure 2: African Penguins are important generators of income (see Lewis *et al*. 2012, van Zyl and Kinghorn 2018)

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[1] The number of breeding pairs is used as a measurable proxy for the overall abundance of penguins. The size of the breeding population depends on adult mortality and recruitment. Recruitment is affected by breeding participation, breeding success and immature survival.

[2] The objective of increasing the population by 1% per annum will not achieve the long-term aim of removing the African Penguin from the IUCN list of threatened species. Similar or greater increases will be needed in future revisions of the APBMP.

4.4 Rationale and Benefits of the 2nd Biodiversity Management Plan

The 2nd African Penguin Biodiversity Management Plan will continue to coordinate and implement the various conservation initiatives of South African agencies aimed at recovery of the species. It will also facilitate South Africa's contribution to international efforts to improve the conservation status of African Penguins, e.g. through the African Eurasian Waterbird Agreement (AEWA), a treaty to which South Africa is a signatory party. It is expected that other agencies (including non-governmental organisations, academic institutions and overseas competences) will continue to contribute substantially to efforts to improve the conservation status of the species through research, rehabilitation and other activities.

The South African population of African Penguins are geographically divided into three sub-populations according to regions, as described in the first APBMP (viz. north of Cape Point on the West Coast; between Cape Point and Cape Agulhas, and east of Cape Agulhas on the South Coast – Crawford *et al*. 2011; Crawford *et al*. 2013). It is well known that there is substantial movement of immature penguins between colonies, a trait that should enable the species to adjust to altered environmental conditions, albeit with some delay (Sherley *et al*. 2014). Furthermore, population genetic studies using DNA evidence show that the three sub-populations are not genetically distinct on a broad scale (Nupen 2014). Thus, the conclusion from results obtained in the 1st APBMP supports African Penguins at different colonies as contributing to a single meta-population and to be managed as such accordingly. African Penguin colonies presumed extant in 2017 are shown in Figure 3 and the authorities that manage the various colonies are indicated in Table 1.

A major achievement of the 1st APBMP is that all the managing authorities are now working together to prioritise and implement best practice across the entire population. Additionally, stakeholder involvement has been very successful through outputs from a number of coordinated working groups. Examples include harmonisation of research projects, standardisation of research and monitoring methods, a compilation of research reports, and standardisation of rehabilitation methods. In this 2nd APBMP, it is expected that this close cooperation will continue and grow. The development of a strategy for identifying and prioritising research needs, fostering closer ties between the research and conservation communities and maintaining (with possible expansion) of socio-economic initiatives.

Penguins are considered as sentinels of ecosystem health (Boersma 2008) playing an important role in the functioning of marine ecosystems (see Section 4.6). Therefore, thriving African Penguin colonies will indicate that South Africa's marine ecosystems are in good shape, or vice versa.

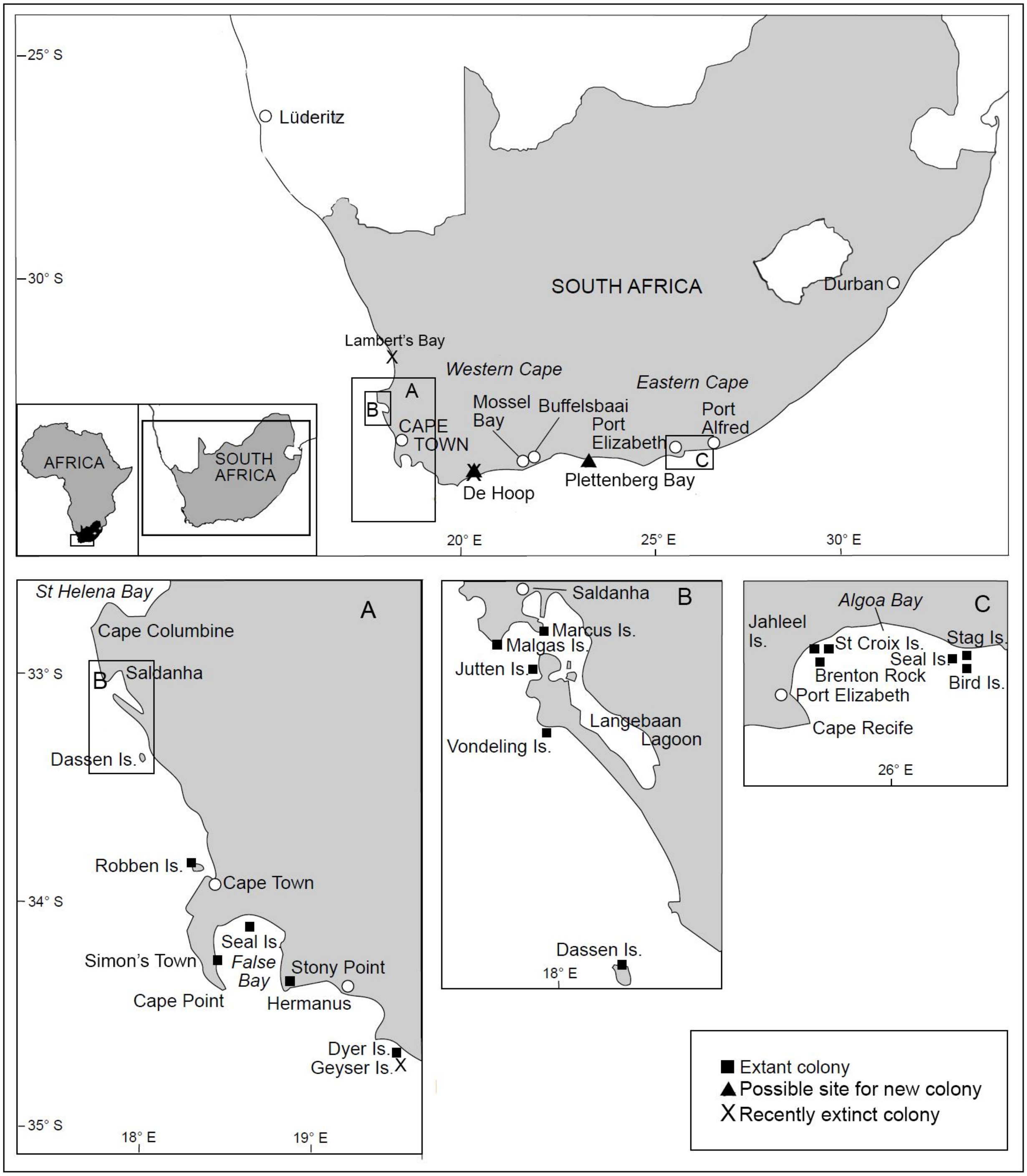

Figure 3: The localities of African Penguin breeding colonies in South Africa that were extant in 2018 or recently extinct and of sites under consideration for the establishment of new colonies

Table 1: List of managing authorities responsible for extant African Penguin colonies or those that became recently extinct, in South Africa

COLONY	MANAGING AUTHORITY
Bird Island (Lambert's Bay)*	CapeNature
Malgas Island	SANParks
Marcus Island	SANParks
Jutten Island	SANParks
Vondeling Island	CapeNature
Dassen Island	CapeNature
Robben Island	Robben Island Museum
Simon's Town (Seaforth, Windmill, Boulders, Burgher's Walk)	SANParks and City of Cape Town
Seal Island (False Bay)	CapeNature
Stony Point	CapeNature
Dyer Island	CapeNature
Geyser Island*	CapeNature
De Hoop Marine Reserve*	CapeNature
Jahleel Island	SANParks
Brenton Island	SANParks
St Croix Island	SANParks
Seal Island (Algoa Bay)	SANParks
Stag Island	SANParks
Bird Island (Algoa Bay)	SANParks

** became extinct in the present century*

4.5 Anticipated Outcomes of the 2nd Biodiversity Management Plan

The anticipated outcomes of the 2nd management plan are:

a) To see an increase in the number of African Penguins breeding in South Africa, with a long-term objective of delisting the species as threatened under the IUCN;

b) To maintain economic growth and employment opportunities derived from penguin-related tourism;

c) To make a contribution to healthy marine ecosystems in South Africa;

d) To make available a mechanism to prioritise and stimulate research on African Penguins to provide sound scientific information to management authorities;

e) To offer a mechanism to coordinate and prioritise means to conserve the African Penguin in South Africa and to promote its persistence around Southern Africa;

f) To continue development and innovation of interventions and mitigation measures aimed at improved conservation of African Penguins, with a regional and global impact for similar species.

4.6 The role of seabirds in the functioning of marine ecosystems

Seabirds are central-place foragers when breeding (Orians and Pearson 1979) that bring large amounts of nutrients from the ocean to their colonies. This influences the functioning of island ecosystems and their adjacent marine areas, e.g. through increasing algal growth and changing the structure of intertidal communities, which in turn increases the population sizes of some shorebird species (Bosman and Hockey 1988). Inputs by seabirds of nitrogen, N, and phosphorus, P, are of similar magnitude to other inputs of these nutrients considered in global N and P cycles, with concentrations per unit of surface area in seabird colonies among the highest measured on the Earth's surface. Moreover, an important fraction of the total excreted N (72.5×10^6 kg.a^{-1}) and P (21.8×10^6 kg.a^{-1}) can be readily solubilized, hence increasing the short-term bioavailability of these nutrients in continental and coastal waters that are located near the seabird colonies (Otero *et al*. 2018). Not only do seabirds have such beneficial bottom-up impacts but they also exert valuable top-down control. For example, they may select prey that is small and in poor body condition and by removing these substandard individuals ensure the long-term survival of prey populations (Tucker *et al*. 2016). Accordingly, large decreases in seabird populations, as have been observed for African Penguins and other seabird species in South Africa (e.g. Crawford *et al*. 2015), will have detrimental consequences for ecosystem functioning.

African Penguins facilitate prey capture by volant seabird species, such as Cape Cormorants (*Phalacrocorax capensis)*, Swift Terns (*Sterna bergii*) and Sooty Shearwaters (*Puffinus griseus*), by herding prey from depths > 33 m to the surface where they are more accessible to these species (McInnes *et al*. in press). This form of symbiosis is likely to play an important role in the foraging efficiency of volant seabird species whose distributions overlap those of African penguins.

Since seabirds are near-apex predators and are sensitive to ecosystem change (Croxall 1992), they have the potential to provide an index of the health of marine ecosystems (Underhill and Crawford 2005). They are ocean samplers and can be used as indicators of the location and variability of marine resources, including those exploited by commercial fisheries (Berruti *et al*. 1993, Cherel and Weimerskirch 1995, Weimerskirch *et al*. 2008, Mullers and Navarro 2010), and of ecosystem changes (Crawford *et al*. 2002, 2014, Boersma 2008). Dietary data from top predators such as penguins are relatively inexpensive and easily obtained and are often able to be collected more frequently and at a broader spatial scale than ship-based surveys of fish abundance (Imber and Berruti 1981, Cherel and Weimerskirch 1995). Phenological data which are also relatively simple to collect can provide useful indicators of food availability (Sherley *et al* 2018). Hence, the study of top predators such as the African Penguin is a potentially useful source of information for management of prey resources and their ecosystems (Benguela Current Large Marine Ecosystem Top Predators Project Steering Committee 2007, Roux *et al*. 2013).

5. INFORMATION PERTINENT TO THE MANAGEMENT OF THE AFRICAN PENGUIN

5.1 Taxonomic Description

The species is one of four in the genus *Spheniscus*. The current classification of *S. demersus* is as follows (Hockey *et al*. 2005):

Order: Sphenisciformes
Family: Spheniscidae
Genus: *Spheniscus*
Species: *demersus* (Linnaeus 1758)
No subspecies are recognised.

5.2 Distribution

The African Penguin is endemic to the greater Benguela upwelling ecosystem off south-western Africa (Crawford *et al.* 2011). It breeds at 27 localities (Kemper *et al.* 2007a) from Hollams Bird Island, central Namibia, to Bird Island in South Africa's Eastern Cape Province (Hockey *et al.* 2005). However, the majority of the population resides in South Africa, which supports c. 77% of the overall breeding population of the species (BirdLife International 2017).

In South Africa, African Penguins breed in three recognized regions, where recent trends in their numbers have been quite different: north of Cape Town, between Cape Point and Cape Agulhas (both in the Western Cape) and in Algoa Bay (Eastern Cape). Colonies in the Western Cape Province are separated by c. 600 km from those in Namibia and in

Algoa Bay (Crawford *et al.* 2008). The distance between some localities increased due to extinctions of, for example, the colonies at Lambert's Bay in 2006 (Crawford *et al.* 2008) and at Mossel Bay around 1926 (Shelton *et al.* 1984).

The usual non-breeding range of the species extends along c. 3,200 km of coast, between c. 18°S on the Namibian coast and c. 29°S on the coast of KwaZulu-Natal. Vagrant birds have been recorded north to Sette Cama (2°32'S), Gabon on the West African coast (Malbrant and Maclatchy 1958) and to the Limpopo River mouth (25°S), as well as in Mozambique on the east coast (Shelton *et al*. 1984). African Penguins have been recorded up to 100 km offshore (Rand 1960). Most occur within 40 km of the coast (Wilson *et al*. 1988, Heath and Randall 1989, Petersen *et al*. 2006, Ludynia *et al.* 2012, Pichegru *et al*. 2010, Waller 2011, Grigg 2016, Robinson 2016), except on the Agulhas Bank where the distribution of their prey extends farther offshore (Shelton *et al*. 1984).

The northern extent of the range of African Penguins off west Africa is predicted to contract southwards in future with no eastward expansion expected (BirdLife International 2017).

5.3 Population Trends

The overall (Namibian and South African) population numbers in the 1920s were probably of the order of millions, with reports of around one million pairs on Dassen Island alone (Crawford *et al*. 2007). By 1956/57 numbers decreased to about 141,000 pairs (Kemper *et al*. 2007a). It further declined to about 69,000 pairs in 1979/80, c. 63,000 pairs in 2001, c. 57,000 pairs in 2004/05, c. 36,000 pairs in 2006/07 (Kemper *et al*. 2007a) and c. 25,000 pairs in 2015 (BirdLife International 2017). The decline in the numbers breeding in South Africa this century is shown in Figure 4.

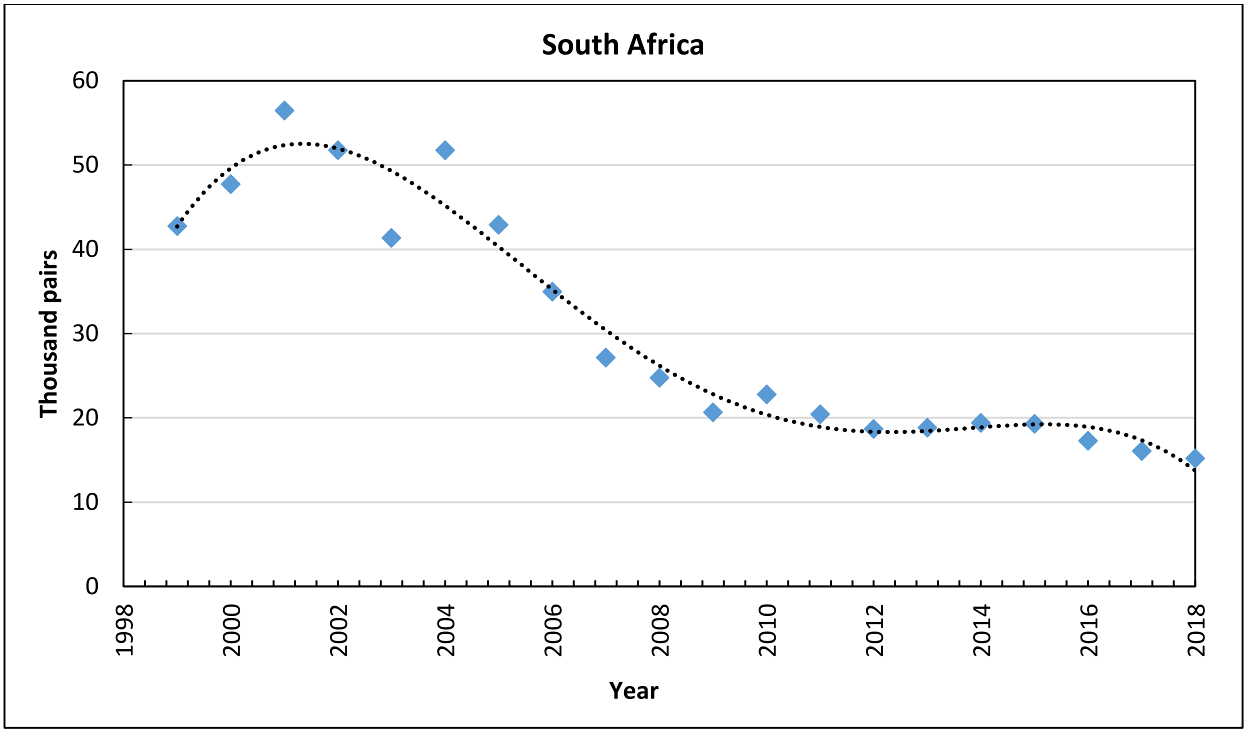

Figure 4: Trends in numbers of African Penguins breeding in South Africa, 1999–2018

The decrease of c. 35,000 pairs in African Penguins breeding in South Africa between 2001 and 2009 was investigated in detail to ascertain the probable causes of mortality (Crawford *et al*. 2011, Crawford *et al*. 2017a). The loss of 24,000 pairs (48,000 breeding birds) west of Cape Agulhas was mainly attributable to a decreased abundance of sardine *Sardinops sagax*, which led to increased annual mortalities of adult penguins north of Cape Town after 2004 from c. 15% when sardine was plentiful to as much as 50% when it was scarce (Crawford *et al*. 2011, 2014, Sherley *et al*. 2014, Robinson *et al*. 2015). Therefore, except for mortalities due to other known causes, all losses of birds breeding west of Cape Agulhas were considered to have resulted from food scarcity.

5.4 Habitat

African Penguin colonies occupy various habitats that range from islands with little or no cover to well-vegetated environments on the mainland. Originally, nests were mainly burrows in guano, but the large-scale collection of guano deposits along the coasts of southern Africa since the mid-nineteenth century destroyed much of this breeding habitat. This resulted in African Penguins breeding in a variety of suboptimal habitats (Frost *et al.* 1976b, Wilson and Wilson 1989, Lei *et al.* 2014). More recently, nests are built in burrows in guano or sand, but more often in clefts between rocks, in the open, under available vegetation, in disused buildings and in provided artificial nests (Sherley *et al.* 2012a, Pichegru 2013, Shelton *et al.* 1984, Crawford *et al.* 1995). Nesting material includes seaweed, pieces of vegetation, rocks, shells, bones and feathers with some nests having no lining. Burrows have a more constant microclimate than the surface and some artificial nests (Lei *et al.* 2014, Tol 2015). African Penguins breed more successfully in nest sites where there is cover rather than in the open (e.g. Frost *et al.* 1976a, Seddon and van Heezik 1991, Pichegru 2013). On Robben Island, breeding success was found to be higher using artificial nests and those in disused buildings (Sherley *et al.* 2012a).

5.5 Breeding

African Penguins usually breed for the first time at between four and six years of age (Whittington *et al*. 2005a). Once they have bred, adults show strong fidelity to colonies and mates, as well as some nest-sites (e.g. Randall *et al.* 1987, La Cock and Hänel 1987, La Cock and Cooper 1988, Crawford *et al.* 1995, Whittington *et al.* 2005b, Barham 2017, Traisnel and Pichegru 2018). First-time breeders have the flexibility to emigrate to non-natal colonies and hence to take advantage of long-term changes in the distribution of food (Crawford 1998). Breeding is monogamous in the wild (Randall 1983, Crawford *et al.* 1995).

The clutch is usually two eggs, sometimes one, rarely three (Crawford *et al.* 1999). Eggs are rounded oval and white, becoming stained as incubation proceeds. The laying interval is c. 3 days (Williams 1981, Williams and Cooper 1984). Double clutching in one season is not unusual; both clutches may fail, or one or both succeed (Randall and Randall 1981, La Cock and Cooper 1988, Crawford *et al.* 1999, Barham 2017). Incubation usually starts with the first-laid egg, lasts 38–41 days (c. 37–38 d/egg) and is shared by both sexes (Rand 1960, Williams and Cooper 1984, Randall 1989).

Chicks generally hatch asynchronously, usually about two days apart (Williams and Cooper 1984, Seddon and van Heezik 1991). Chicks are closely attended by adults until about 26–30 days old when they are mostly left unguarded and may form crèches of up to 25 chicks, although today crèches rarely exceed 12 chicks in size (Seddon and Van Heezik 1993, Erasmus and Smith 1974). Chicks fledge when between 55 and 130 days old (Seddon and Van Heezik 1993, Kemper 2006). Often both chicks will fledge from two chick broods but survival from hatching to fledging is variable and influenced by a multitude of factors such as burrow collapse, drowning, predation by Kelp Gulls *Larus dominicanus*, starvation or heat stress (Seddon and Van Heezik 1991, Barham *et al.* 2007, Kemper *et al.* 2007b, Sherley 2010, Pichegru 2013).

5.6 Moult

In penguins, moult is unique, since they replace all their feathers in a relatively short period of time (13–40 days) in contrast to other birds that continuously replace a few feathers at a time (Stonehouse 1967). Full moult in penguins is essential to remain waterproof and thus insulated in cold waters while foraging (Stonehouse 1967, Payne 1972). The process of growing a complete set of feathers at once comes at a great energy expense. As penguins are unable to forage at sea while their plumage is compromised (Groscolas and Cherel 1991), the moult period is a key life stage, during which penguins use up most of their body reserves placing them at an increased risk of mortality during the immediate post moult period (Cooper 1978, Johannesen *et al*. 2002).

A fasting African Penguin loses about 40% of its pre-moult mass (Cooper 1978). Moult can be abandoned before it is complete (Cooper 1978), but this drastic measure is likely to result in the bird's death. Optimal foraging success for African Penguins during the pre-moult fattening period and the post-moult recovery period is thus crucial for adult survival (Wolfaardt *et al*. 2008b, 2009a, Waller 2011). It can also influence parent condition and breeding success over the next breeding season (Sherley *et al*. 2013).

In South Africa, the timing of moult is somewhat synchronous, with birds of all ages undergoing the moulting process during early summer, from September to January (Crawford *et al*. 2006b; Kemper *et al*. 2008; Wolfaardt *et al*. 2009a). However, colony-specific variability in synchrony and seasonality during this period has been shown (Underhill and Crawford 1999, Crawford *et al*. 2006b, Kemper 2006, Wolfaardt *et al*. 2009a), which may be attributed to variation in available food resources around the colonies or in alternative survival strategies. For African Penguins, the full moulting process, including pre- and post-moult foraging lasts about 100 days (Crawford *et al*. 2006b). Substantial variation exists in the lengths of both pre- and post-moult foraging periods (Wolfaardt *et al*. 2009a) but on average they are approximately 40 days each (Roberts 2016), while the actual moult usually takes 21 days (Randall *et al*. 1986).

Adult African Penguins are generally thought to return to their breeding colony after their pre-moult foraging period to undergo moult, sometimes even to the same nest in which they bred (Wolfaardt *et al*. 2009a). Recent studies, however, have indicated a change in this behaviour with large numbers of west coast penguins moulting at south coast colonies, particularly at Stony Point (Roberts 2016, Morris in preparation). This may indicate poorer foraging conditions during pre-moult periods on the west coast. In addition, evidence exists that different dispersal patterns during pre-moult periods have distinct survival implications since tracking-device signals were lost for a higher proportion of tracked penguins dispersing to the north rather than to the south from Dassen Island, which may indicate increased mortality in the north (Roberts 2016). A greater understanding of the timing of moult, including when and where pre-moult fattening, moult and post-moult recovery takes place is of importance for penguin conservation management.

5.7 Population Genetics

Molecular markers including full mitochondrial genomes, microsatellites and single nucleotide polymorphisms (SNPs) have been developed and validated for the African Penguin (Labuschagne *et al*., 2012; Labuschagne *et al*., 2013; Labuschagne *et al*., 2014) by the National Zoological Gardens, South African Biodiversity Institute (NZG SANBI). These markers are now used for individual identification, to determine genetic diversity, population structure, inbreeding and parentage determination to monitor African Penguin captive and wild populations as well as trade (Labuschagne *et al*., 2015).

Genetic analysis of wild African Penguins, which included samples from 12 of the largest breeding colonies, provided evidence of weak regional population structure but high genetic connectivity between breeding colonies. Genetic diversity was found to be moderate to high (Nupen et al., unpublished data). However, low genetic diversity in the innate immune region of African Penguins, similar to that observed in the New Zealand robin that has undergone several severe population bottlenecks, has been confirmed (Dalton *et al*., 2016). Thus the African Penguin may display lowered resistance to disease and adaptation to changing environments and stress.

Genetic analysis of captive African Penguin populations showed comparable and presumably adequate, levels of genetic variability to wild populations (Labuschagne *et al*., 2016). In addition, the observed genetic diversity was found to be similar to levels reported for other penguin species. Genetic variability in terms of a number of alleles between founders in the populations and their offspring were found to be similar. However, the offspring generation displayed a marginally higher inbreeding coefficient in comparison to the founder generation, most likely due to an increase in relatedness. Currently, the captive African Penguin populations are not at risk of the deleterious effects of inbreeding. However, management of these populations should be directed to maintain the low inbreeding levels. The baseline assessment of genetic diversity and population structure is an important first step for the establishment of a genetic-monitoring program for the African Penguin. However, sampling and genetic analyses should be a continuous process, to measure the extent and effect of processes such as genetic drift on diversity in the captive African Penguin populations. It will also be important to ensure the genetic health of captive penguins to be released into new colonies or when supplementing existing colonies.

5.8 Prey and Foraging

African Penguins in the wild, feed mainly on active, free-swimming prey, usually schooling pelagic fish, which they may locate visually, from their olfactory sense (Wright *et al*. 2011) or using cues from the environment (van Eeden *et al*. 2016). Especially important are anchovy *Engraulis encrasicolus*, sardine and, in Namibia, bearded goby *Sufflogobius bibarbatus* (Hockey *et al.* 2005, Crawford *et al.* 2011, Ludynia *et al.* 2010). Other prey includes cephalopods (e.g. Randall and Randall 1986, Connan *et al.* 2016), horse mackerel *Trachurus capensis* and juvenile hakes *Merluccius* spp. (Hockey *et al.* 2005).

African Penguins feed either solitarily or in small to large groups (up to 150 birds; Rand 1960; Wilson and Wilson 1990, Ryan *et al*. 2012). They may dive to 130 m but usually forage at depths < 80 m, with dives lasting 1–2 minutes on average (Pichegru *et al*. 2012). They may hunt co-operatively, corralling fish located in deep waters and driving them to the surface (Wilson 1985b, Wilson and Wilson 1990, Ryan *et al*. 2012) and this improves their catch per unit effort

(McInnes *et al*. 2017). African penguins are generally diurnal foragers and rely on ambient light to catch prey, with a lull in feeding activity around midday (Wilson and Wilson 1995, Petersen *et al*. 2006, Ludynia 2007, Waller 2011). Birds seldom feed at night (Wilson 1985a). Adult penguins at many localities generally feed within 40 km of colonies, but may around some colonies travel farther to forage (Heath and Randall 1989, Petersen *et al*. 2006, Ludynia 2007, Pichegru *et al*. 2010, Waller 2011, Grigg 2016, Robinson 2016). Adult African Penguins perform between 200 and 400 dives in a foraging trip (Ryan *et al*. 2007).

When breeding, most foraging trips last < 24 h. Foraging effort increases as chicks grow, and parents brooding large chicks can forage for 3–5 days (Ludynia, 2007 Waller 2011, DEA unpubl. data). Outside the breeding season, birds may travel as far as 540 km away from their colony (Waller 2011, Roberts 2016). During pre- and post-moult foraging periods, penguins spend c. 30–50 days foraging out at sea and can travel total distances of c. 600–1000 km (Roberts 2016). Pre- and post-moult penguins from west coast colonies travelled further from their colony and spent longer out at sea than birds from south coast colonies (Morris in preparation). Recent studies on foraging behaviour have important implications for African Penguin management in this BMP. In a study that tracked dispersing African Penguins fledgelings from eight sites, it was found that these birds travelled hundreds of kilometres to areas of low sea surface temperatures and high chlorophyll-a (Sherley *et al*. 2017). Climate change and industrial fishing have depleted forage fish stocks in these regions so that these cues are no longer a reliable indicator of fish availability. This study further reported that juvenile penguin survival is low in populations selecting degraded areas with estimates of breeding numbers ~50% lower than non-impacted regions. This marine ecological trap is of significant concern to an endangered species that continues to decline. The results of this study support suspending fishing when prey drops below critical thresholds; that mitigating these ecological traps requires matching conservation action to the scale of these ecological processes (Sherley *et al*. 2017), and thus needs to be addressed in this BMP.

Further studies provide evidence of the positive effects of experimental fishery closures on some African Penguin demographic parameters over an 8-year period (Pichegru *et al*. 2010, Sherley *et al*. 2018). While effects were not consistent across sites and years, results were obtained at the threshold considered to be biologically meaningful by fisheries management in South Arica and the study recommended that these closures continue (Sherley *et al*. 2018). In addition, fishing exclusion around St Croix Island, the largest remaining colony, has been shown to effectively reduce foraging effort of breeding African Penguins (Pichegru *et al.* 2010), if fishing pressure was not increased at the border of the exclusion zone (Pichegru *et al*. 2012). The reduction in energy spent foraging while breeding was consistently associated with fishing exclusion around that colony (Pichegru *et al*. 2012).

5.9 South African *Ex Situ* Populations and their Status

Currently, African penguin populations are being kept in *ex-situ* facilities throughout South Africa. As part of the management plan for this species, a National studbook (as stated in TOPMSP) is maintained by the Pan-African Association of Zoos and Aquaria (PAAZA). The studbook for the African Penguin uses the Zoological Information Management System (ZIMS) for Studbooks' developed by Species360 and the Species Conservation Toolkit Initiative (SCTI) tools for population analysis and management. Each bird is uniquely identified through inserting of microchips. In addition, an effort to genetically monitor captive birds and to regulate legal trade, a total of 448 African Penguin biological samples was collected following a chain of custody protocol from 13 *ex-situ* facilities (Table 2) during the first round of sampling in 2016/2017. A bi-annual sampling and genetic analyses programme is now in place to ensure compliance within the ex-*situ* populations.

Blood on FTA paper is used to determine gender and genetic diversity (neutral and adaptive). Blood, as well as swabs and feather samples, are currently being stored in the NZG National Biobank for future research. In addition, phenotypic measurements and photographic evidence of each bird are taken and stored in the national African Penguin database. The National Biobank and National Studbook databases are cross-referenced to form the Animal Passport which is unique to each captive penguin.

Table 2: *Ex situ* penguin facilities in South Africa in 2018

No.	FACILITY NAME	PAAZA FACILITIES	TOTAL PENGUINS HELD	MALES	FEMALES	UNDETERMINED
1	Bayworld	PAAZA	49	21	21	7
2	Bester Birds and Animals Zoo Park		3			3
3	East London Aquarium	PAAZA	118	44	44	30
4	National Zoological Gardens of South Africa	PAAZA	51	22	29	-
5	Mystic Monkeys and Feathers Wildlife Park		35	13	22	-
6	South African Association for Marine Biological Research	PAAZA	56	23	33	-
7	Tenikwa Wildlife Awareness Centre		2	1	1	-

8	Two Oceans Aquarium	PAAZA	21	11	10	-
9	World of Birds Wildlife Sanctuary and Monkey Park	PAAZA	19	9	9	1
10	African Penguin and Seabird Sanctuary	PAAZA	11		4	7
11	Southern African Foundation for the Conservation of Coastal Birds (Eastern Cape)		65	27	38	-
12	Southern African Foundation for the Conservation of Coastal Birds (Western Cape)		39	17	21	1
	TOTAL		**469**	**188**	**232**	**49**

The rehabilitation facilities listed in Table 2 accommodate non-releasable African Penguins that are recorded in the PAAZA studbook. There is a total of 469 African Penguins distributed between the various facilities and these populations are managed to prevent inbreeding and to maintain a healthy level of genetic diversity. Many of these non-releasable penguins could be utilised for a future captive-breeding programme.

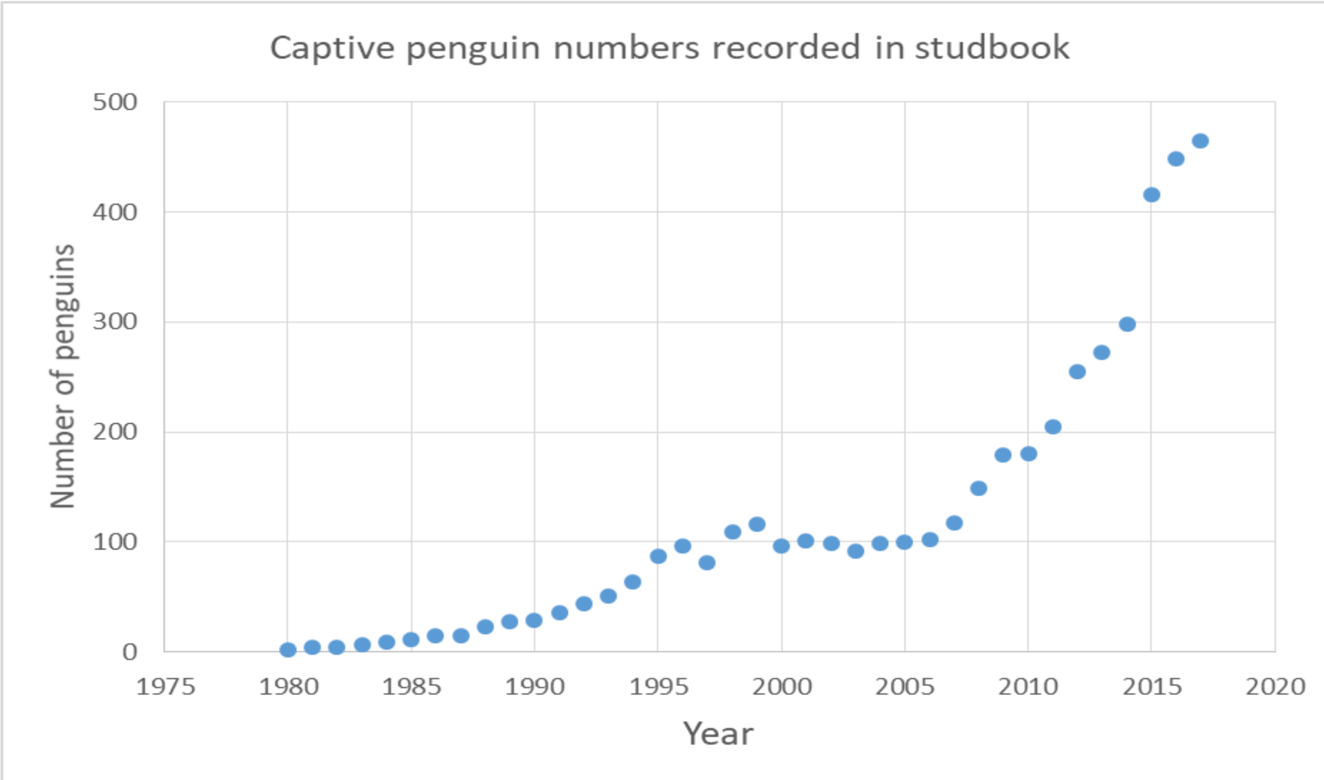

Figure 5: Numbers of captive African Penguins recorded in the studbook for South African institutions since its inception in 1980 until 2017

Studbook records (Figure 5) show that African Penguins have been held in captivity since 1980 and there has been a steady increase in the numbers of birds recorded in the studbook since that time. African Penguins that are deemed non-releasable but still have the ability to enjoy a good quality of life are kept at several captive institutions throughout South Africa where they are exhibited to educate and provide awareness to the general public. During recent years the breeding of penguins in captivity proved very successful and this now creates limitations with regards to space and capacity at several facilities. Several facilities actively manage their populations by pricking eggs as they have reached optimal capacity. There is an option to bolster current colonies and establish new colonies from captive-bred individuals, however, a risk assessment must first be completed.

5.10 Conservation Translocation

Conservation translocation is defined as *the intentional movement and release of a living organism where the primary objective is a conservation benefit: this will usually comprise improving the conservation status of the focal species locally or globally, and/or restoring natural ecosystem functions or processes* (IUCN/SSC 2013). The rescue, rehabilitation and release of oiled, diseased or injured African Penguins, as well as the rescue, raising and release of orphaned chicks has been undertaken with success in South Africa for many years. These activities are considered as conservation translocations since combined they aim to improve the conservation status of African Penguins in the wild.

The rehabilitation and release of de-oiled birds, or those translocated to prevent oiling (e.g. after the *Treasure* oil spill in 2000), have been shown to be effective conservation interventions, with many of the birds subsequently recorded breeding at colonies (Crawford *et al.* 1995a, Whittington *et al.* 2005b, Barham *et al.* 2008, Wolfaardt *et al*. 2009b). However, long-term survival and breeding of some of the birds were impaired (Underhill *et al.* 1999, Crawford *et al.* 2000, Crawford *et al*. 2006a, Barham *et al*. 2007, Wolfaardt *et al.* 2008a, 2009b), thus necessitating efforts to reduce the frequency and scale of oiling events. In addition, evaluation and standardization of rehabilitation protocols are necessary.

Results from hand-reared, wild-origin chicks returned to the wild have shown that post-release juvenile (0.32, s.e. = 0.08) and adult (0.76, s.e. = 0.10) survival rates were similar to those for African Penguin chicks reared after oil spills and to recent survival rates recorded for naturally-reared birds (Barham *et al.* 2007). This is an ongoing conservation translocation activity that takes place each year. More than 3,500 hand-reared wild-origin chicks were released in the five-year period 2013–2017.

6. THREATS

6.1 Food scarcity

Many of the recent population declines of African Penguins have resulted from food shortages caused by shifts in the distributions of prey species and competition with commercial purse-seine fisheries for food (e.g. Crawford *et al.* 2011, 2018). There was an eastward shift in the distribution of sardine and anchovy, with the mature biomass of these species near the breeding islands north of Cape Town decreasing in the early 2000s (Coetzee *et al*. 2008). The abundance of these prey species is known to influence breeding success (Crawford *et al.* 2006a, Sherley *et al.* 2013), adult survival (Sherley *et al.* 2013, Robinson *et al*. 2015) and juvenile survival (Weller *et al.* 2016) of African Penguins, all of which may often be too low off South Africa's west coast to maintain population equilibrium (Weller *et al.* 2014, 2016). In Namibia, where sardine and anchovy are virtually absent from the foraging ranges of breeding penguins, breeding birds feed predominantly on the energy-poor bearded goby S*ufflogobius bibarbatus* (Ludynia *et al.* 2010).

The observed decrease in foraging effort at St Croix Island (Pichegru *et al.* 2010) and increase in chick survival and chick condition at Robben Island (Sherley *et al.* 2015, 2018), which followed the establishment of 20 km no-take zones around these colonies, demonstrates that it is possible to implement interventions that reduce the threats associated with resource competition.

In order to ensure sufficient provisioning of food, it will be necessary to preclude fishing of the penguins' main prey items around all their important breeding colonies and during the non-breeding season at feeding grounds that are used for fattening before and after a moult.

6.2 Exploitation and human disturbance

Penguins have in the past been exploited through harvesting of their eggs for food and by the removal of guano for use as fertiliser. Egg-collecting, now no longer legal, was probably the primary driver of the decrease of the species in the early 20th century (Frost *et al.* 1976b, Shannon and Crawford 1999). Guano collection was historically a major cause of disturbance at many colonies as the removal of guano deprived penguins of nest-burrowing sites. This led to birds nesting on open ground where they are more vulnerable to heat stress (often resulting in the abandonment of nests), flooding of nests by rain and predation (Frost *et al.* 1976b, Shannon and Crawford 1999, Pichegru 2013, Kemper 2015).

African Penguins are regularly injured or killed by entanglement in discarded fishing lines (Crawford *et al.* 2017). Efforts to reduce marine litter are clearly called for. African Penguins are occasionally caught in fishing nets and such mortality is likely to increase if gill-nets are set near colonies (Ellis *et al.* 1998).

Humans and penguins often come into direct contact at some colonies. Tourists visiting Stony Point and Simon's Town colonies frequently interact with African Penguins, and some fail to observe rules, often leaning over or even crossing barriers to photograph penguins or attempting to touch them. Researchers and management staff at most colonies also interact with African Penguins to gather necessary data and to implement conservation actions.

The impact of the potential disturbance caused by these penguin-human interactions is not yet fully understood. It is known that impacts of human disturbance vary widely across species. For example, Humboldt *Spheniscus humboldtii* and Yellow-eyed *Megadyptes antipodes* penguins appear to be particularly sensitive to disturbance (Ellenberg *et al*. 2006, 2007), while other species, e.g. Gentoo *Pygoscelis papua* (Holmes *et al*. 2006), Adélie *P. adeliae* (Carlini *et al*. 2007) and Magellanic Penguins *S. magellanicus (*Villanueva *et al*. 2012), show no detrimental effects caused by human presence.

Research that has been carried out on African Penguins suggests that they can and do habituate to regular human approaches to nests (Pichegru *et al*. 2016) and beach groups (van Heezik and Seddon 1990) and regular nest visits (Barham and Sherley 2013). Chicks of birds that are disturbed at erratic intervals appear to show reduced body condition (Barham and Sherley 2013).

6.3 Catastrophic events

Past mortality from oil spills has been substantial (Wolfaardt *et al.* 2009b) and may increase if the proposed development of harbours close to colonies proceeds. Most of the population is confined to areas that are near existing or planned major shipping routes or ports. There has been a dramatic increase in the number of birds oiled since 1990: 30,000 individuals were oiled in two individual oil spills (in 1994 and 2000). Long-term survival and breeding of these birds have been impaired despite successful rehabilitation programmes (Underhill *et al.* 1999, Crawford *et al.* 2000, Wolfaardt *et al.* 2008a, 2009b). For example, breeding success on Robben island fell to 0.23 chicks per pair following the spill in 2000, compared with an average of 0.62 ± 0.19 over the other 15 years from 1989 to 2004 (Crawford *et al.* 2006a). Rehabilitation of oiled birds does not necessarily ensure good subsequent reproduction by such birds. During 2001–2005, pairs involving at least one bird rehabilitated from the oil spill in 2000 showed a reduced breeding success of 0.66 chicks per pair per year compared to 1.02 chicks per pair per year in unaffected pairs. This was largely attributable to lower fledging success (43%), mostly owing to higher mortality in older chicks, compared to unaffected pairs (61%) and those involving at least one bird affected by a previous oil spill (71%) (Barham *et al.* 2007). This may indicate physiological or behavioural problems that reduce the parents' ability to meet the food requirements of older chicks, perhaps on account of the toxicity of the heavy oil in the 2000 spill or prolonged captivity and time between oiling and washing of birds in that spill (Barham *et al.* 2007).

6.4 Predation

At-sea predation includes that by Cape fur seals *Arctocephalus pusillus*, which impose significant mortality at some colonies (Makhado 2009, Makhado *et al*. 2013, Weller *et al*. 2016), and sharks (Randall *et al*. 1988).

Kelp Gulls *Larus dominicanus* scavenge deserted and unguarded clutches and small chicks especially at surface nests (Cooper 1974). Culling of Kelp Gulls at Bird Island in Algoa Bay led to improved penguin breeding success (Pichegru 2013).

Feral cats prey on eggs and chicks at some colonies (Weller *et al.* 2014, 2016). At mainland colonies, predation by domestic animals (including feral dogs) remains a problem. Predation by natural predators including mongooses, Leopards *Panthera pardus* and Caracals *Caracal caracal* also may severely affect mainland colonies (e.g. Underhill *et al.* 2006, Vanstreels *et al*. unpublished data, CCT, SANParks and CN, unpublished data). Occasional predation of eggs and small chicks by mole snakes *Pseudaspis cana* at Robben Island (Dyer 1996) is not considered a major threat at present.

6.5 Interspecies Competition and Displacement (for food and habitat)

Cape Fur Seals *Arctocephalus pusillus pusillus* and Cape Gannets *Morus capensis* compete with African Penguins for food and habitat at some breeding localities, e.g. Lambert's Bay and Bird Island in Algoa Bay (Crawford *et al*. 1989, David *et al*. 2003, Kirkman 2009).

6.6 Climate change

It is likely that environmental change has resulted in a mismatch in the distributions of breeding colonies and prey resources of African Penguins, leading to food scarcity and large decreases in penguin numbers off South Africa's west coast (Crawford *et al.* 2015). It is thought that changes in sea surface temperatures, atmospheric surface pressure and winds have affected spawning conditions for sardine and anchovy stocks and resulted in a shift in the distribution of these species towards the east of the Agulhas Bank (Roy *et al*. 2007; Coetzee *et al*. 2008). This may have been exacerbated by intensive fishing of sardine in the west (Coetzee *et al*. 2008).

In the longer term, climate change may decrease the extent of habitat suitable for the species at the northern extent of its historical range (BirdLife International 2017). As is the case for Bank Cormorants *Phalacrocorax neglectus* (Sherley *et al.* 2012b), an increase in the frequency and intensity of storms and in ambient temperatures may reduce the breeding success of birds at low-elevation or unshaded nest sites.

Recent observations from the Simon's Town and Robben Island colonies suggest that the increase in the frequency of long periods of high temperatures early in the breeding season may have resulted in an increase in the rate of nest abandonment.

6.7 Known diseases of African Penguins

There are a number of viruses, bacteria, fungi, protozoa and parasites that are known to causes diseases in African Penguins – these are summarised in Table 3. While many can be of a serious nature for captive birds (including those in rehabilitation centres), most of these diseases are not known to hugely compromise the wild population except for small chicks and otherwise compromised birds. However, the recent outbreak of Avian Influenza (H5N8) is known to have caused a number of deaths of adult African Penguins in the wild (Khomenko *et al*. 2018).

Table 3: Diseases known to affect African Penguins

Organism	Pathogenicity	References
Viruses		
Avian influenza	H5N8 caused several deaths of wild adult African penguins in 2018	Hurt *et al*. 2014; Barriga *et al*. 2016; Khomenko *et al*. 2018
Avian paramyxoviruses, including Newcastle Disease	Not significantly pathogenic in wild penguins Captive penguins have died from highly pathogenic strains	Stannard *et al.* 1998; Kane *et al*. 2012, Pierson and Pfow 1975
Avian pox (Avipoxvirus)	Occasionally infects Penguin chicks usually self-limiting	Stannard *et al.* 1988 Kane *et al*. 2012
Herpesvirus-like particles	Can cause airsacculitis and pneumonia in chicks	Parsons *et al*. 2015
Spheniscid Alphaherpesvirus	Can cause diphtheroid oropharyngitis, laryngotracheitis or necrotizing enteritis in captive penguins	Pfaff *et al*. 2017
Bacteria		
Avian cholera: pasteurellosis (*Pasteurella multocida*)	Has been recorded as a cause of death. Penguins are less susceptible to outbreaks of this disease than other seabirds	Crawford *et al*. 1992; SANCCOB, unpubl. data
Relapsing fever (*Borrelia* sp.)	Can significantly reduce the survival of African Penguin chicks and juveniles in rehabilitation; prevalence appears to be very low in wild individuals	Yabsley *et al*. 2012; Coles 1941; Parsons *et al*. 2016;
Mycoplasma gallisepticum and *M. synoviae*	Antibodies against similar organisms have been detected in wild penguins. No cases of clinical disease have been recorded.	Parsons *et al*. 2016
Opportunistic Gram-positive bacteria	Pododermatitis is a problem for captive penguins. Air sacculitis, pneumonia, gastroenteritis and septicaemia are common causes of mortality of Penguins in the wild and during rehabilitation	Erlacher-Reid *et al*. 2012, SANCCOB unpubl. Data, Osório *et al*. 2013
Fungi		
Aspergillosis (*Aspergillus fumigatus* and less frequently *A. flavus*)	A common and potentially lethal respiratory disease of penguins, infections occur almost exclusively in individuals that are otherwise compromised	Burco *et al*. 2014; Silva-Filho *et al*. 2015

Candidiasis (*Candida albicans*)	Oral and gastrointestinal lesions are occasionally seen in otherwise compromised hand-reared African Penguin chicks	SANCCOB, unpubl. data
Protozoa		
Avian malaria (*Plasmodium relictum and P. elongatum*)	A mosquito-borne disease to which penguins are particularly susceptible; prevalence is low in wild individuals (<1%) but can be as high as 10 to 20% at rehabilitation centres during summer months, leading to high levels of mortality unless preventative methods are employed	Vanstreels *et al*. 2016. Fantham and Porter 1944, Brossy 1992; Brossy *et al*. 1999; Parsons *et al*. 2016, Parsons and Underhill 2005; Botes 2004
Babesiosis (*Babesia peircei*)	Relatively common tick-borne disease; prevalence 1.5 to 3.0% in wild individuals and c. 20% in individuals admitted for rehabilitation; infections are relatively mild	Parsons *et al*. 2017; SANCCOB, unpubl. data
Leucocytozoon tawaki	The fly-borne blood parasite occurs at very low prevalence (<0.1% of individuals admitted for rehabilitation). Its health effects are not known	Earlé *et al*. 1992; SANCCOB, unpubl. data
Cryptosporidiosis (*Cryptosporidium* sp.) and Intestinal coccidiosis (*Eimeria* sp. and *Isospora* sp.)	Transmitted through the ingestion of materials contaminated with faeces or secretions of other birds. Both diseases have been occasionally recorded as a cause of death in hand-reared African Penguin chicks; prevalence and impacts on wild populations of this species are not known	SANCCOB, unpubl. data
Toxoplasmosis (*Toxoplasma gondii*)	Transmitted through the ingestion of materials contaminated with faeces of domestic cats and wild felids. Found only in some captive African Penguins from Europe which died with neurological signs	Ploeg *et al*. 2011
Metazoan parasites		
Trematodes *Cardiocephaloides physalis*	Although all of these parasites can potentially produce significant health effects in cases of hyper-infection, thus far only the trematode *C. physalis* has been identified as a cause of mortality of chicks and recently-fledged juveniles in captivity	Randall and Bray 1983
Hematodes *Contracaecum variegatum*, *Cyathostoma phenisci*		Borges *et al*. 2014
Digeneans *Metorchis coeruleus*, *M. orientalis*, *M.*		Brandão *et al*. 2014

pinguinicola, *M. tener*, *M. xanthosomus, Renicola sloanei*		
Soft ticks (*Ornithodoros capensis*)		Aldhoun and Horne 2015
Fleas (*Parapsyllus longicornis humboldti*)		Beaucoumu and Rodhain 1990; Von Keler 1952; Zumpt 1959; Brandão *et al*. 2013
Lice (*Austrogoniodes demersus*)		

6.7.1 Viruses in other wild penguins

A number of other viruses (e.g. Flavivirus, Bunyavirus, Orbivirus, Papillomavirus, Polyomavirus and an unclassified RNA virus) are known to occur asymptomatically in other species of penguins (Doherty *et al*. 1975; St George *et al*. 1985; Major *et al*. 2009; Varsani *et al*. 2014, 2015), but these have not yet been recorded in African Penguins. Eastern Equine *Encephalitis* Virus has been found in some captive penguins in the Americas but is not known to occur in Africa (Brault *et al*. 1999; Tuttle *et al*. 2005).

6.7.2 Bacteria in other wild penguins

Chlamydiosis (*Chlamydia psittaci*) has not yet been recorded in African Penguins, although it is known to occur in pet birds in South Africa (Chahota *et al*. 2006) and has been recorded in captive Magellanic Penguins in North America (Jencek *et al*. 2012).

6.8 SEISMIC SURVEYS

Seismic surveys taking place within < 100 km of African Penguin breeding colonies have been shown to induce a behavioural response so that the penguins use foraging areas further away from the location of the seismic activities (Pichegru *et al*. 2017). As a result, energy expenditure while foraging significantly increases. Due to rapidly increasing seismic activities planned by the government, this disturbance of and possible detrimental effects on penguins at sea should be managed.

7. SOCIO-ECONOMIC ISSUES AND UTILISATION

Simon's Town (which includes the areas of Boulders, Seaforth, Burgher's Walk and Windmill Beach), Stony Point and Robben Island, provide opportunities for the public to observe the species in its natural habitat and have become popular tourist destinations (e.g. Lewis *et al*. 2012). The economic benefits of these colonies include income generated through entrance fees, provision of jobs and associated tourism benefits to the surrounding areas (Lewis *et al*. 2012). For example, the colony at Boulders is one of the world's most-visited penguin colonies with 885 jobs associated with it (van Zyl and Kinghorn 2018). In 2018, the likely income generation directly associated with this colony over the next 30 years was estimated at approximately ZAR 6.87 billion (van Zyl and Kinghorn 2018). Given that people are able to see African Penguins at these sites and the present poor conservation status of the species, any expansion of tourism to other island colonies would need to be carefully considered before implementation. However, it is hoped that a recovery of South Africa's penguins would enable growth of this industry and in line with the National Development Goals.

The scarcity of food for African Penguins makes it likely that the attainment of several of the APBMP's objectives will necessitate the effective management of local competition with the purse-seine fishing industry for sardine and anchovy, through exclusion of fishing in areas that surround South Africa's important penguin colonies and any proposed new breeding locality for the species (See Section 5.9). Although such closures would not affect allowable catches, it has been argued that they would have a cost to the purse-seine fishery (Berg *et al.* 2016). However, in addition to the high socio-economic value of penguins and its potential for growth, it should be borne in mind that other predators of epipelagic forage resources (e.g. gannets, cormorants, seals, cetaceans, predatory fish) also support marine ecotourism or alternative fisheries and failure to apply an ecosystem approach to fisheries may result in severe losses in ecosystem services (e.g. Roux *et al.* 2013, section 5.10 above).

8. ENVIRONMENTAL EDUCATION AND PUBLIC AWARENESS

Most people find penguins highly charismatic, many zoos and aquaria note that the penguins they keep are one of their most popular attractions. As a result, by engaging members of the public using penguins as a hook, it is possible to raise their individual awareness of environmental and conservation issues and even modify their future behaviour. Most, if not all, institutions that keep African Penguins both within and outside South Africa, offer regular talks at penguin exhibits and provide plenty of signage all of which draws the attention of the many visitors to a range of environmental and conservation issues. Such regular talks to all visitors are backed up at most zoos and rehab centres with a range of educational projects both in the house and as outreach in schools, etc. Furthermore, researchers and conservationists working in the field with the wild penguins also regularly provide talks about their work and the conservation of the birds to local interest groups as well in schools and at other public events. Overall, it is notable that very large audiences whose environmental behaviour can be influenced are reached every year, through the medium of the African Penguin. One example of a successful such campaign is 'Penguin Promises' which encourages people to make pledges to change their own behaviour in ways that will improve the overall environment, for example by reducing their use of plastics or by changing their diets, etc. The campaign which originated at uShaka Sea World in 2011 now has partners throughout South Africa and has even started work in South America.

9. ACTIONS

ACTION 9.1: IDENTIFY CRITICAL AT-SEA HABITATS	
Responsible Party	DEA
Collaborators	Colony managing authorities, other relevant authorities; NGOs, Academic Institutions
Timeline	a) Within six months of the gazetting of the APBMP b) Within one year of the gazetting of the APBMP
Resources Needed	Internal and external funding
Indicator	a) Collation of all existing tracking information for African Penguins and their storage on the BirdLife Global Seabird Tracking database by the end of December 2019. b) A report identifying critical at-sea habitats from an analysis of tracking information and containing recommendations for their protection by the end of June 2020. The report should be suitable for submission to regional and international agreements to which South Africa is a party, e.g. AEWA, BCC.

ACTION 9.2: DECLARE SPECIAL MANAGEMENT AREAS[3] IMPORTANT FOR THE SPECIES.	
Responsible Party	DEA
Collaborators	Colony managing authorities, other relevant authorities
Timeline	a) Within one year of the gazetting of the APBMPBMP b) Within five years of the gazetting of the APBMP
Resources Needed	Internal

[3]Special Management Areas are declared in accordance with the National Environmental Management: Integrated Coastal Management Act

Indicator	a) Important Special Management Areas identified (see 9.1a); b) Proclamation of Special Management Areas

ACTION 9.3: IDENTIFY FISHERY ACTIVITIES AND MANAGEMENT PROCESSES IMPACTING AFRICAN PENGUINS AND ADVISE APPROPRIATE AUTHORITIES ON MITIGATION INTERVENTIONS.	
Responsible Party	DEA
Collaborators	DAFF, Researchers, Fishery Organisations, NGOs
Timeline	a) Within a year after the gazetting of the APBMP c) Within two years after the gazetting of the APBMP
Resources Needed	Internal and external
Indicator	a) Fishery processes identified c) Mitigation interventions identified and reported to DAFF

ACTION 9.4: ADVISE ON ZONATION OF SHIPPING LANES, BUNKERING OPERATIONS AND SHIPPING ACTIVITIES SO AS TO MINIMIZE THE RISK OF OIL SPILLS NEAR SEABIRD COLONIES	
Responsible Party	DEA (STT)
Collaborators	DoT, SAMSA, Managing authorities, Stakeholders
Timeline	Within 2 years
Resources Needed	Internal
Indicator	Develop a sensitivity map with recommendations (including for identification of and incorporation in Special Management Areas)

ACTION 9.5 CONVENE AN OILED WILDLIFE RESPONSE WORKING GROUP	
Responsible Party	DEA
Collaborators	NGOs, Academia, Colony managers, SAMSA, DoT, Transnet, Industry
Timeline	Within one year of the APBMP being gazetted
Resources Needed	Internal and External

Indicator	a) Terms of Reference developed and available; b) Relevant participants identified; c) Meeting minutes available.

ACTION 9.6: REVIEW AND IMPROVE THE IMPLEMENTATION AND MONITORING OF PREDATOR MANAGEMENT AT ALL AFRICAN PENGUIN COLONIES	
Responsible Party	DEA, Managing Authorities
Collaborators	Academia, NGOs
Timeline	Ongoing
Resources Needed	Internal & External
Indicator	a) Annual reports on predation and mitigation from Managing Authorities b) Mechanism established to advise on additional mitigation

ACTION 9.7: DESCRIBE / QUANTIFY THE SOCIO-ECONOMIC AND ECOSYSTEM BENEFITS OF AFRICAN PENGUINS TO SOUTH AFRICA	
Responsible Party	DEA, Academia
Collaborators	Management Authorities, Department of Tourism
Timeline	5 years
Resources Needed	Finances
Indicator	Report on the irreplaceable value of the African Penguin completed

ACTION 9.8: IMPLEMENT CONSERVATION TRANSLOCATIONS IN SUITABLE LOCATIONS	
Responsible Party	Management Authorities, NGOs
Collaborators	DEA, Academia
Timeline	Ongoing
Resources Needed	Operational budget, specialised skills, monitoring equipment/capacity
Indicator	Annual report detailing the implementation of conservation translocations Number of successful translocations

ACTION 9.9: DRAFT A RISK ASSESSMENT ON THE RELEASE OF CAPTIVE-BRED PENGUINS INTO THE WILD	
Responsible Party	DEA
Collaborators	SANBI, NGOs, Academia
Timeline	a) Within 1 year of the APBMP being gazetted b) Ongoing c) Within three years
Resources Needed	Operational budget, specialised skills
Indicator	a) Scientific decision tree developed to include demographics, age, the number for the release of captive-bred penguins b) Monitor stress-related responses in captive birds pre and post-release c) Risk Assessment conducted and a final report issued including the evaluation of the health (micro-biomes, innate immunity, screening for known diseases) of captive birds to be released

ACTION 9.10: IMPLEMENT A PILOT PROJECT ON THE RELEASE OF CAPTIVE-BRED[4] PENGUINS INTO THE WILD	
Responsible Party	Managing Authorities
Collaborators	SANBI, all captive facilities housing penguins, Academia, NGOs
Timeline	a) Initiate the release of captive-bred penguins as soon as possible following the approval of the Risk Assessment; b) Ongoing; c) Ongoing d) At the end of the APBMP period.
Resources Needed	Internal and External
Indicator	a) Implement a pilot project on the release of captive-bred penguins; b) Monitor and evaluate the success of the project (survival, recruitment and breeding); c) Monitor stress-related responses in captive birds pre- and post-release d) Report at the end of the APBMP period

[4] Provided Risk Assessment approved by Management Authority

ACTION 9.11 CONTINUE LONG-TERM MONITORING OF COLONY SIZES, DEMOGRAPHIC PARAMETERS AND EFFICACY OF MANAGEMENT INTERVENTIONS FOR AFRICAN PENGUINS	
Responsible Party	DEA, Managing authorities
Collaborators	SANBI, Academia, NGOs
Timeline	As stipulated below
Resources Needed	Funding for population analyst; database management; colony monitoring by both remote (electronic) and manual (ranger) means
Indicators	a) Annual standardized reporting including a summary of demographic data; b) Annual reports of numbers breeding at all wild colonies in order to track achievement of objective 1 of the APBMP; c) By the end of 2021 updated assessments of annual survival and emigration/immigration of African Penguins at key wild colonies (based on capture-mark-recapture studies) for use in 9.12 d) By the end of 2021 updated assessments of annual breeding success and chick condition of African Penguins at key wild colonies for use in 9.12 e) By the end of 2021 updated assessments of the annual breeding success of African Penguins in captivity (Studbook) f) Annual reports of management interventions undertaken at different localities and measures implemented to gauge their success. g) Annual reports of: a. Artificial nest success vs. natural nests b. Genetic diversity c. Mortality

ACTION 9.12: FURTHER DEVELOP SYSTEM AND META-POPULATION MODELS OF AFRICAN PENGUINS TO INFORM AND BENEFIT CURRENT AND FUTURE CONSERVATION INTERVENTIONS	
Responsible Party	DEA, Management Authorities
Collaborators	SANBI, Academia, NGOs
Timeline	As stipulated below
Resources Needed	Funding for population analyst
Indicator	a) A preliminary report based on current demographic information by the end of 2020. b) A final report based on updated demographic information by the end of 2023.

ACTION 9.13 DEVELOP A STRATEGIC RESEARCH PLAN FOR AFRICAN PENGUINS	
Responsible Party	DEA
Collaborators	SANBI, Management Authorities, NGOs, Academia
Timeline	As stipulated below.
Resources Needed	Experts to serve on the Seabird Technical Team
Indicators	a) Report identifying and prioritising research gaps submitted to DEA's Top Predator Scientific Working Group (TPSWG) by the end of 2019[5]. b) The report reviewed by TPWG and submitted to funders and universities by 30 June 2020. c) Annual assessment of achievement of research priorities by APBMP Steering Committee.

ACTION 9.14 ESTABLISH A REPOSITORY FOR COMMUNICATION BETWEEN STAKEHOLDERS INVOLVED IN THE BIODIVERSITY MANAGEMENT PLAN.	
Responsible Party	DEA
Collaborators	All APBMP stakeholders
Timeline	Within a year of the gazetting of the APBMP
Resources Needed	Internal

[5] This should include (but not be limited to) consideration of the impacts of seismic operations, marine pollution and climate change on African Penguins, an updated assessment of the efficacy of rehabilitation of oiled African Penguins and assessments of the economic, employment and ecosystem benefits of African Penguins.

Indicator	a) A drive to house Communication platform such as meeting minutes, agendas, scientific papers etc. b) Including marketing and public awareness material for inclusion in the repository and to share among the different stakeholders

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