Hippopotamus amphibius – Common Hippopotamus


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Regional Red List status (2016)	**Least Concern*†**
National Red List status (2004)	Least Concern
Reasons for change	No change
Global Red List status (2008)	Vulnerable A4cd
TOPS listing (NEMBA)	None
CITES listing (1995)	Appendix II
Endemic	No

*Watch-list Data †Watch-list Threat

The Common Hippopotamus is an ecosystem engineer by creating grazing lawns and acting as a resource vector between savannah grassland and aquatic systems (Subalusky et al. 2015). Intensifying drought conditions and water mismanagement will increasingly threaten this species within the assessment region.

Taxonomy

Hippopotamus amphibius Linnaeus 1758

ANIMALIA - CHORDATA - MAMMALIA - CETARTIODACTYLA - HIPPOPOTAMIDAE - *Hippopotamus - amphibius*

Common names: Common Hippopotamus (English), Seekoei (Afrikaans), Imvubu (Ndebele, Xhosa, Zulu, Swati), Kubu (Sepedi, Sesotho, Setswana), Mvuvhu (Venda)

Taxonomic status: Species

Taxonomic notes: Grubb (1993) lists five subspecies: *H. a. amphibius* from eastern Gambia to Sudan, Ethiopia, the northern Democratic Republic of the Congo (DRC), Tanzania and Mozambique, *H. a. tschadensis* from Nigeria and Chad, *H. a. kiboko* from Somalia and Kenya, *H. a. constrictus* from Angola, the southern DRC and Namibia, and finally, *H. a. capensis* from Zambia southwards to South Africa. It is important to note, however, that this classification has not been widely accepted (Eltringham 1999; Beckwitt et al. 2016), and recent taxonomic research of this species is lacking. Furthermore, these five subspecies are visually indistinguishable in the wild, and the geographic extent of each range remains vague (Eltringham 1993).

Assessment Rationale

Range wide, populations of the Common Hippopotamus (hereafter Hippo) have declined over the past several decades due to habitat loss and degradation, ongoing droughts, and poaching. Within the assessment region, however, the Least Concern listing remains as the minimum population is currently (2013–2015 counts) estimated as 11,061 individuals, which equates to *c*. 6,637–7,743 mature individuals (assuming a 60–70% mature population structure). The Kruger National Park (KNP) subpopulation has increased over three generations (1985–2015) from 2,510 in 1986 to 7,270 individuals in 2015. Similarly, subpopulations in Mpumalanga have increased by 78% between 2003 and 2013 and by 20–30% in Limpopo over the same period. The trend in KwaZulu-Natal Province (KZN) between 2004 and 2011 was an increase of 4% per year but the population declined between 2011 and 2013. Additionally, reintroductions into private protected areas will also continue to bolster population size.

Increasing frequencies of drought spells due to climate change threatens this species as reduction in grazing area causes both direct mortality and forces Hippos into surrounding agricultural landscapes, which may lead to conflict – both increased persecution and poaching. The latter is already manifesting in some regions. For example, in KZN, poaching rates increased by an average of 21% / year between 2004 and 2013, which represents an emerging threat to this species. Additionally, continued land transformation, altered hydrological patterns, and deteriorating water condition due to human development will decrease available area of occupancy. Although these threats are not suspected to be causing a net decline in the population over three generations, they should be carefully monitored and further research should quantify more accurate population size and trends for the assessment region. Once such data are available, this species should be reassessed as the cumulative impacts of intensifying threats may cause a population decline in future.

Despite being an iconic African species, relatively little is published on aspects of its ecology and behaviour. A metapopulation approach is required to understand the different threats and opportunities around the country. This should include identifying areas where Hippos can be reintroduced to enhance ecosystem functioning, identifying areas where sustainable use can be implemented, and identifying interventions to mitigate local- or regional-scale threats.

Regional population effects: This species' range is connected to Mozambique both through the waterways of the Great Limpopo Transfrontier Park and Ndumo Game Reserve in KZN. Since rivers traverse borders, rescue

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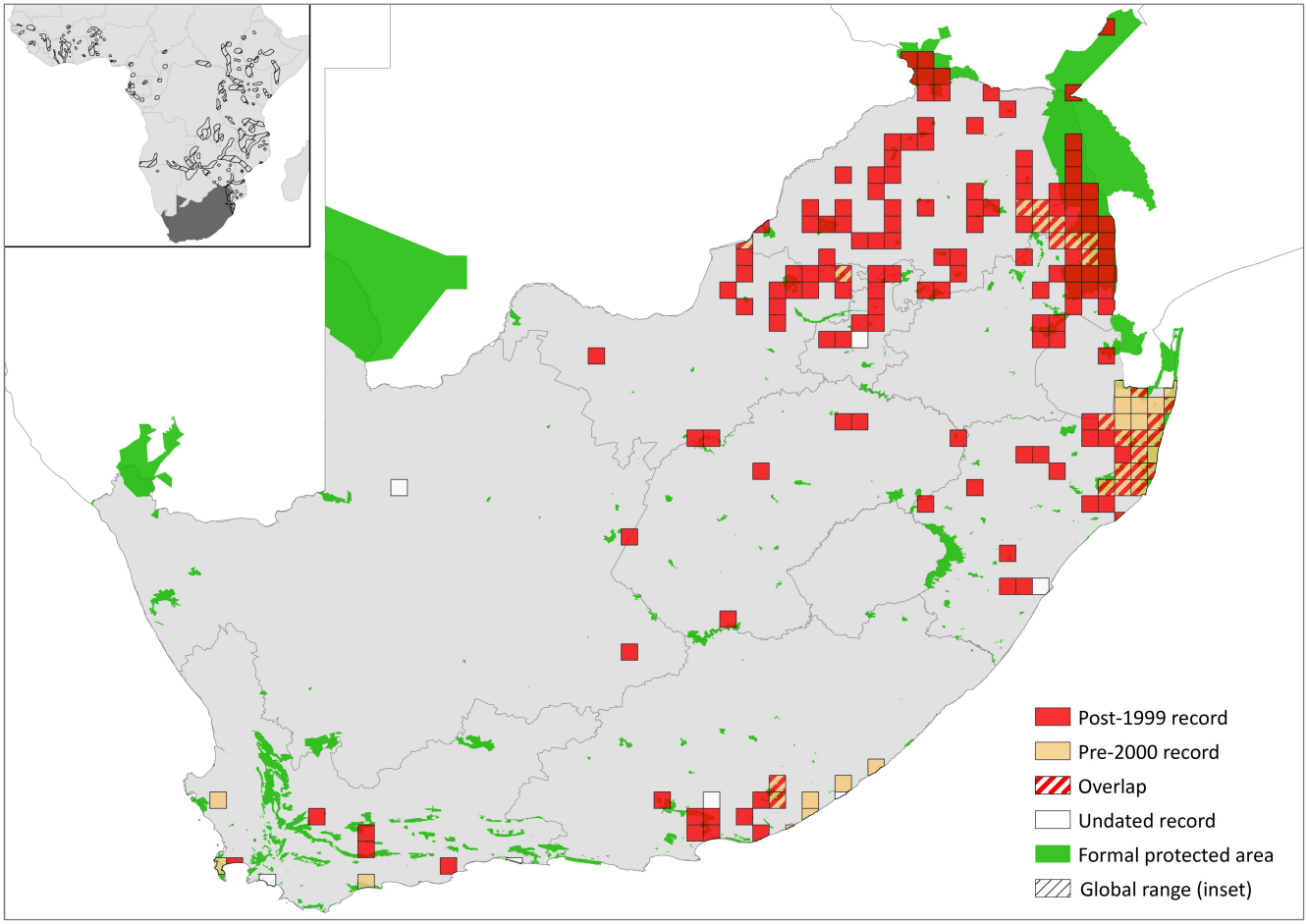

Figure 1. Distribution records for Common Hippopotamus (*Hippopotamus amphibius*) within the assessment region

Table 1. Countries of occurrence within southern Africa

Country	Presence	Origin
Botswana	Extant	Native
Lesotho	Absent	-
Mozambique	Extant	Native
Namibia	Extant	Native
South Africa	Extant	Native
Swaziland	Extant	Native
Zimbabwe	Extant	Native

effects are possible. However, the many small Hippo subpopulations on game farms and small game reserves are not connected. There is a genetic isolation of these small and genetically non-viable subpopulations.

Distribution

Historically, Hippos were widespread throughout sub-Saharan Africa, occurring in virtually all suitable habitats (rivers throughout savannah biomes), but avoiding desert. Their distribution extended along the coastline below the escarpment from the Western Cape to KZN to Mozambique, through the Lowveld/bushveld of the former Transvaal and into Zimbabwe, with extensive use of the Orange River system. Bernard and Parker (2006) describe the presence of this species in engravings, near Carnarvon in the Northern Cape Province dating back between 3,200–2,500 years. It is suggested that the change in Hippo distribution since the engravings were made may be attributable to overexploitation by humans (Bernard & Parker 2006).

Within the assessment region, this species still occupied much of its former range in 1959, although it had disappeared from most of South Africa except for the KNP (Sidney 1965) and northeastern KZN, where subpopulations survived in the coastal lakes and estuaries of St Lucia and Kosi, Lake Sibaya and the Pongola River downstream of Jozini Dam. Historical decline was probably due to over-hunting (Bernard & Parker 2006) and dams that changed natural processes in rivers. For example, in Mpumalanga, several rivers often stopped flowing in dry seasons. Currently, populations are considered fragmented, but widespread across the country (Figure 1). They occur in low-lying areas of northeastern KZN, isolated localities in the Limpopo Province and North West Province, and have been reintroduced into the Fish and Sundays Rivers of the Eastern Cape. They occur throughout KNP, mainly in the major rivers, but also in isolated pools and man-made dams throughout the area.

Within KZN, the population has contracted on the Phongola floodplain due to human population growth and the increasing intensity of agriculture on the region's floodplains. The remnants of this population survive in Ndumo Game Reserve. Natural expansions have taken place up the Mkuze River into irrigation and other small dams on game ranches. Additionally, a small population is confirmed to reside in southern Swaziland on a small extension of the Phongola Poort (Jozini) Dam which protrudes into the country. Other subpopulations are

expected to occur in Swaziland but we would have to consult with conservation authorities there for confirmation.

The species has been widely reintroduced into the northern bushveld parks in North West Province (Power 2014). They once occurred in the Orange River (Skead 1980), as well as the Vaal River, while there exists even older (11,000–12,000 years ago) archaeological evidence from engravings in the Northern Cape to suggest the species did occur widely during sufficiently wet years (Plug & Badenhorst 2001).

Population

The overall Hippo population in Africa is estimated at approximately 80,000 individuals (Lewison & Oliver 2008), and, across the southern African region, populations are generally considered stable but are declining in other parts of Africa (Lewison & Oliver 2008). Hippo populations are naturally regulated by rainfall, due to the fact that they spend much of the day in or near water (Field 1970). Within the assessment region, there are two major subpopulations, occurring in the Lowveld of northeastern South Africa and that of northern KZN. Most groups are fragmented by fences or other barriers to movement across the water-savanna ecotone. Water quality and quantity has declined, which has possibly led to fragmentation too. Overall, the minimum current (2013–2015 counts) population size is observed (based on game censuses using aerial surveys) to be 11,061 individuals (Table 2), which equates to *c*. 6,637–7,743 mature individuals (assuming a 60–70% mature population structure). Most subpopulations around the country have increased over the last decade (SANBI 2011).

The total Hippo count in KNP in 1986 was estimated at 2,510 individuals across the five major rivers (Joubert 2007). In 2008, an aerial census put the population size at 3,100 individuals (Ferreira et al. 2013). The most recent census (2015), based on helicopter counts along rivers and dams, is 7,270 individuals (S. Ferreira pers. comm. 2016), but drought conditions will have reduced the population more recently. Although estimating a population trend for Hippos is difficult due to a large degree of uncertainty associated with Hippo census data and the substantial annual fluctuations in population due to rainfall, this is thought to be a genuine increase over *c.* three generations (1985–2015) in KNP (M. Hofmeyr pers. comm. 2016). The recent drought in 2016 has led to low levels of natural mortality from reduction in grazing areas, but these mortalities are considered insignificant compared to the overall population increase (M. Hofmeyr pers. comm. 2016). Recent research indicates the Hippos of KNP are a single genetically isolated management unit (Beckwitt et al. 2016).

In Mpumalanga, the current Hippo subpopulation is estimated at ~ 1,000 animals, where 574 animals occur in provincial and private nature reserves, whilst an estimated 429 Hippo occur in the provincial river systems (Table 2). In Mpumalanga, the numbers of Hippo increased from 562 animals in 2003 to 1,003 animals in 2013, an increase of 78%. These totals are based on game censuses on provincial nature reserves, and private nature reserves on the western boundary of KNP, and regular Hippo counts along the Lowveld rivers. Most of the Hippo subpopulations in the protected areas and rivers close to the KNP show strong positive growth trends, in spite of significant Hippo removals through damage-causing animal (DCA) complaints and pro-active Hippo capture operations.

In Limpopo, the Hippo numbers are currently estimated at ~ 650 animals. The rivers on the western boundary of KNP were surveyed in 2012. However, other river systems in the province were last surveyed in 2003. The Hippo subpopulations in the Olifants and Letaba Rivers have

Table 2. Summary of population size estimates for Common Hippopotamus (*Hippopotamus amphibius*) in the assessment region

Province/Area	Type	No of sites	Previous population estimate		Current population estimate	
			Year	Count	Year	Count
Kruger National Park	Formally protected	1	1989	2,761	2015	7,270
KwaZulu-Natal	Formally protected	10	2004	1,541	2013	1,545
	Private & communal	22	2004	67	2013	252
	Subtotal	**32**		**1,608**		**1,797**
Eastern Cape	Formally protected	1	2009	22	2013	19
	Privately protected	4			2014	90
	Subtotal	**5**				**109**
Limpopo	**Subtotal**	**6**	**2003**	**542**	**2003–2012**	**651**
Mpumalanga	Protected areas		2003	283	2013	574
	Provincial river systems		2003	279	2013	429
	Subtotal			**562**		**1,003**
North West	Formally protected					57
	Private & communal					54
	Subtotal					**111**
Swaziland	**Subtotal**	**Unknown**				**120**
TOTAL		**44**				**11,061**

increased by about 20–30% between 2003 and 2013 (542–651 individuals; Table 2). Due to lack of survey effort it is not possible to make statements about population trends in the other river systems. Similarly, in Mpumalanga, between 2004 and 2014 a total of 300 Hippo were removed from the provincial population through DCA procedures and hunting.

Hippo in KZN are mainly confined to the large rivers, coastal lakes and estuaries of northeastern Zululand and Maputaland regions of the province. R. H. Taylor (Ezemvelo KZN Wildlife) gives a total for 1986 of 1,264 for KZN, with the largest concentration (595) on Lake St Lucia, but he suggests a better estimate of 1,423 averaged over the five years 1982–1986. Recent population estimates for KZN (Goodman & Craigie 2014) yielded figures of 1,893 in 2012 and 1,797 in 2013. These occurred in 10 formally protected areas and on 22 private and communal protected areas. Currently the largest single populations are found in the St Lucia Game Reserve component of the iSimangaliso Wetland Park (1,004 individuals) and Ndumo Game Reserve (189 individuals). The trend in the provincial population between 2004 and 2011 showed a fairly consistent increase of 4% per annum (Goodman & Craigie 2014) but has stabilised and even possibly declined between 2011 to 2013. The numerical status of the KZN Hippo population at the end of 2013, comprises of 10 subpopulations in protected areas (1,545 individuals) and 22 subpopulations on private and communal land (252 individuals) in northeast Zululand. In protected areas the population has grown slowly (1% pa) over the past eight years, but appears to have declined in the past two years. On private land the population is small (252), but has increased gradually from 67 (2004) to 252 (2013) (Table 2), signifying a growth rate of 13% per annum. It is important to reiterate that, due to the uncertainty attached to Hippo census data, these population trends should be viewed cautiously.

In the North West Province, there are 57 individuals on formally protected areas and an additional 54 on private lands (Power 2014). In the Eastern Cape Province, the population is estimated to be *c.* 90 in at least four protected areas. However, this may be an underestimate as not all data from protected areas are available.

In Swaziland the population is currently estimated at about 120 animals. The Hippo distribution expanded between 2004 and 2014, and some DCA Hippo control is done to limit conflict between Hippo and humans.

The generation length for this species is calculated as 10 years (Pacifici et al. 2013), which yields a 30-year three-generation period. Collation of accurate long-term data are needed to estimate population trends on a national scale. No systematic monitoring data over this time period are currently available.

Current population trend: Stable with localised declines.

Continuing decline in mature individuals: Locally (for example, poaching in KZN).

Number of mature individuals in population: 6,637–7,743

Number of mature individuals in largest subpopulation: *c.* 7,000 in KNP (2015).

Number of subpopulations: At least 44

Severely fragmented: No

Habitats and Ecology

The Hippo is an amphibious creature, spending the majority of its day in water, and emerging at night to feed on dry land (Eltringham 1999). Subtropical floodplain forest, grassland and coastal grassland are especially important habitat types for this species. Thus, the ecological requirements for Hippos include a supply of permanent water, large enough for the territorial males to spread out at a depth of about 1.4 m (Taylor 2013), and adequate grazing on open grassland within a few kilometres of the daytime resting sites. Freshwater for drinking is essential when they live in a saline environment – such as at St Lucia (Taylor 2013). Although, they are restricted to regions in the proximity of water, they are able to disperse efficiently from one water source to another. Open water is not always essential as Hippos can survive in muddy wallows but must have access to permanent water to which they can return in the dry season. The essential factor is that the skin must remain moist as it will crack if exposed to the air for long periods. A curious feature is the red secretion from modified sweat glands, which is thought to have an antibiotic function.

Wright (1964) argues very convincingly that the greatest benefit of an amphibious lifestyle is thermoregulation as a large body produces a considerable amount of metabolic heat. The water environment acts as a heat sink. Hippos leave their wallows soon after sunset and graze nocturnally on short grass swards up to several kilometres from water. These swards, which are kept short by the grazing activities of the Hippo, are known as Hippo lawns. Although the Hippo grazes every night, except for mothers with very young calves, there are usually individuals present in the water all night, as some return after a few hours and others leave later. Hippos consume approximately 40 kg of grass each night (Klingel 1983), and may walk up to 35 km during these nocturnal foraging activities. Their movements are not hindered by general fences. Natal Buffalo Grass (*Panicum maximum*), Bushveld Signal Grass (*Urochloa mosambicensis*) and Couch Grass (*Cynodon dactylon*) were commonly selected for in northern KZN (Scotcher et al. 1978), whereas *Ischaemum fasciculatum* is known to be a preferred species in the St Lucia region. During droughts, Hippos need to range further, as food resources near to water become depleted. In severe droughts when food resources are too far for a daily return to their pools, some Hippo may not return to water every night, and will lie up in the shade of a tree during daylight hours. This species feeds by plucking the grass with its wide, muscular lips and passing it to the back of the mouth to be ground up by the molars. The front teeth (incisors and canines) play no part in feeding. The amount of food ingested is small relative to the size of the animal but its resting habits by day reduce its energetic demands. The stomach is a complex four-chambered structure in which fermentation digestion occurs, i.e. this species does not ruminate.

The Hippo social system is based on mating territoriality (Klingel 1991). Hippos are gregarious, social and polygamous animals. Territorial males monopolise a length of the shoreline of the river or lake but tolerate bachelors within the territory provided they behave submissively. Non-breeding males may also settle outside of territorial areas. Fights for the possession of a territory can be fierce and the animals may inflict considerable damage on each other with their huge canines. Minor conflicts are usually settled by threat displays, of which the "yawn" is the most conspicuous. There is little

association between animals when they are feeding at night, except between females and their dependent young, and during these periods males do not behave in a territorial fashion. Both males and females spread their dung by wagging their tails vigorously while defecating, both in the water and on land, where it is thought to have a signalling rather than a territorial function. These dung piles may serve for orientation. Vocalisations take the form of complex bellows and grunts, which presumably also have a signalling function. Sounds may be made either on land or in the water and may be transmitted simultaneously through air and water, which is the only known case of amphibious calls in a mammal.

A study in the KNP (Smuts & Whyte 1981) examined carcasses of 225 Hippos randomly culled between 1974 and 1975, and 238 between 1976 and 1977 during population reduction programs. This study showed that Hippos are born at a sex ratio of 1♂:1♀. Male mortality rates appear to be much higher than females as this ratio changed to 1♂:2.97♀♀ in the adult age classes. Calves weigh 50 kg at birth and may be born at any time of the year, but the majority are born during the mid-summer (rainy) months. The gestation period is just 8 months – an extraordinarily short time for such a large animal. Growth of the Hippo foetus in the womb is therefore very rapid. Black Rhinos (*Diceros bicornis*), which are very similar in size to Hippos, produce a calf weighing about 40 kg, but their gestation time is almost twice as long as Hippos. Growth for the first ten years of life is also very rapid, the average increase in weight is in the order of 100 kg per year, so that at 10 years old they can weigh in excess of 1,200 kg (Whyte, unpubl. data). Males and females are very similar in size, males being only slightly larger than the females. The average weight for 86 adult males culled in KNP was 1,546 kg while 192 females averaged 1,385 kg (Whyte unpubl. data). Females may conceive as early as eight years old, but the average age of sexual maturity is 9–10 years. The mean calving interval is 21.8 months (Smuts & Whyte 1981), and lactation lasts for 10–12 months (Laws & Clough 1966). The comparison of data collected in the droughts of 1964 (Pienaar et al. 1966) and data of Smuts & Whyte (1981), which were acquired during a period of above average rainfall (1974/75), showed that Hippo reproduction is very sensitive to deteriorating environmental conditions. Both conception and the percentage of females lactating were significantly higher in the pluvial 1970s.

Ecosystem and cultural services: Hippos form a vital component and are a flagship species of natural water ecosystems. They are important ecosystem engineers, acting as carbon and nutrient vectors between savannah grassland and aquatic habitats (Subalusky et al. 2015). They also physically alter the environment they live in, creating feeding lawns, paths, and channels in swampland. Hippos may be responsible for increasing the fertility of coastal waters, for example, Taylor (2013) estimated the quantities of nutrients brought into the St Lucia estuarine system by Hippos.

Use and Trade

This species is traded both locally and internationally for meat, trophies and in the live animal trade on a subsistence and commercial level. The trade in Hippo ivory is regulated by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and currently this trade is not expected to have any severe effects on the population. In fact, some expect that trade in Hippo resources has warranted the introduction of Hippo into additional suitable habitats.

An experimental cull of Hippo in the KNP was conducted in 1966, and subsequently culls were executed annually between 1974 and 1982, during which a total of 1,105 individuals were culled (Joubert 2007). Population declines in the 1980s called for the end of culling, and in the late 1980s culling was no longer considered a necessary strategy for population management, especially considering that Hippo abundance was naturally regulated by environmental conditions, e.g. drought (Whyte 1987). Culling at St Lucia has been documented by Taylor (2009). In the period from 1981 to 1983 a total of 184 Hippos were removed. Since 2005 a small number (up to 22 per year) of Hippos have been captured each year. The purpose is to dampen the estimated 3% per annum population increase and also to provide Hippos for conservation needs elsewhere. At the same time an objective has been to gain the necessary expertise in the capture of Hippos.

More recently (2016), Hippo culling has been reinstated in the KNP, where a population of over 7,000 Hippos was recently recorded (S. Ferreira unpubl. data). Culling is managed adaptively given the current drought conditions (M. Hofmeyr pers. comm. 2016). These culls are attributable to a lack of forage resources in the park, as a result of the severe drought across South Africa during late 2015/early 2016.

Threats

Habitat loss and land transformation have threatened and continue to threaten Hippo populations across their African range, particularly with regards to the drainage of

Table 3. Use and trade summary for the Common Hippopotamus (*Hippopotamus amphibius*)

Category	Applicable?	Rationale	Proportion of total harvest	Trend
Subsistence use	Yes	Meat, trophies (including ivory) and live animal trade.	Minority	Stable
Commercial use	Yes	Meat, trophies (including ivory) and live animal trade.	Majority	Stable
Harvest from wild population	Yes	Meat, trophies (including ivory), harvest for biological control, killing of damage causing animals and live animal trade.	Majority	Stable
Harvest from ranched population	Yes	Meat, trophies (including ivory) and live animal trade.	Minority	Stable
Harvest from captive population	No	-	-	-

Table 4. Possible net effects of wildlife ranching on the Common Hippopotamus (*Hippopotamus amphibius*) and subsequent management recommendations

Net effect	Neutral
Data quality	Suspected
Rationale	Wildlife ranches may be improving aquatic habitats for this species by protecting indigenous flora and improving water flow. They are also a vehicle with which to reintroduce this species into suitable habitat. However, ranchers tend to introduce very small groups of Hippo (often fewer than 10), which do not have linkages with other groups and hence have little long-term genetic viability without artificial genetic mixing. Additionally, rivers are often fenced out of private lands, thus Hippos are consequently introduced into dams. In contrast to other large mega-herbivores, ranched populations, while providing some benefit to a small number of individuals, are unlikely to benefit the conservation or the functioning of wild Hippo populations in South Africa.
Management recommendation	Include habitat and population monitoring parameters in Hippopo management plans.

wetland regions and the expansion of agricultural development onto floodplains (Smuts & Whyte 1981; Jacobsen & Kleynhans 1993). With the increased droughts associated with climate change and the increased human demands for water, Hippo subpopulations are further pressurised. Additionally, lack of grass foraging areas with drought and bush encroachment are a concern. The redirection of water from natural rivers and lakes towards agricultural areas, results in additional habitat loss and deterioration (Cole 1992; Jacobsen & Kleynhans 1993; Viljoen & Biggs 1998). Additionally, poaching for meat and ivory (from their large canine and incisor teeth) has been recognised as a long-lasting and ongoing threat to this species (Vega 1995), and is enhanced by the increase in human settlement along the boundaries of protected regions (Wittemyer et al. 2008). Estimates of the amount of Hippo ivory illegally exported have also increased. A 1994 assessment by TRAFFIC, the monitoring agency of international trade for the IUCN, reported that illegal trade in Hippo ivory increased sharply following the international elephant ivory ban in 1989. Between 1991 and 1992, approximately 27,000 kg of Hippo canine teeth were exported, an increase of 15,000 kg from the 1989 and 1990 estimates (Weiler et al. 1994). In 1997, more than 1,700 Hippo teeth *en route* from Uganda to Hong Kong were seized by customs officials in France (TRAFFIC 1997). Five thousand kilograms of Hippo teeth (from an estimated 2,000 Hippos) of unknown origins were exported from Uganda in 2002 (New Vision 2002). The DRC once supported Africa's largest Hippo populations, but recent field assessments have revealed population declines of more than 95% due to unregulated hunting pressure (Hillman Smith et al. 2003). Within the assessment region, the projected number of Hippo poached in KZN in 2010 was an underestimate, since poaching incident reports along the Pongolo River in Ndumo, KZN, ceased midway through the year. Between 2004 and 2013, Hippo poaching incidents have shown an increasing trend, with average poaching in KZN increasing by 21% / year between 2004 and 2013 (average of six poached per year) (Goodman & Craigie 2014). Generally, within the assessment region, poaching is not considered a major threat to this species.

Mismanagement of water systems and siltation may lead to a decline in habitat and the availability of drinking water,

Table 5. Threats to the Common Hippopotamus (*Hippopotamus amphibius*) ranked in order of severity with corresponding evidence (based on IUCN threat categories, with regional context)

Rank	Threat description	Evidence in the scientific literature	Data quality	Scale of study	Current trend
1	*2.1.3 Agro-industry Farming* and *7.1 Fire & Fire Suppression*: loss of habitat and habitat quality through agriculture, fire management and siltation. Current stresses *1.1 Ecosystem Conversion* and *1.2 Ecosystem Degradation*.	Jacobsen & Kleynhans 1993 Jewitt et al. 2015	Anecdotal Indirect (remote sensing)	Regional Regional	Ongoing, yet manageable via conservation planning and committed implementation.
2	*7.2 Dams & Water Management/Use*: altered hydrology, due to abstraction of surface and ground water, especially for agricultural use.	-	Anecdotal	-	As water demand on rivers increases, they change from perennial to seasonal flowing rivers. Also the drawdown of groundwater is resulting in the desiccation of wetlands.
3	*5.1.1 Hunting & Collecting Terrestrial Animals*: illegal poaching for meat, ivory and traditional medicine, due to increasing human populations, particularly in areas adjacent to protected areas.	Goodman & Craigie 2014	-	Local	Increasing in KZN by 21% per year, yet manageable via stricter law enforcement.
4	*11.2 Droughts*: increased frequency and duration of drought due to climate change.	Viljoen 1995 Boko et al. 2007	Empirical Projected	Local National	Increasing. Climate change is expected to aggregate water stress.

particularly during low rainfall years. Hippo pools may dry out, leading to habitat loss, heat stress and increased competition. The Hippo's reliance on freshwater habitats appears to put them at odds with human populations and adds to their vulnerability, given the growing pressure on fresh water resources across Africa. Additionally, inappropriate fire management may threaten Hippo forage availability. Partial loss of habitat in major river systems such as the Orange River has altered habitat, but Hippos were long since removed from these areas and appear to be slowly re-colonising areas with suitable habitat.

Prolonged and enhanced drought conditions as a result of climate change is highly likely to have an effect on Hippo population stability. This is particularly true for many areas of sub-Saharan Africa, where the frequency of drought is likely to increase with an increase in global ambient temperatures (Apuuli et al. 2000; Boko et al. 2007). During drought conditions, Hippo populations exhibit a decreased birth rate and an increased mortality, due to heat stress, enhanced susceptibility to disease and a decline in forage resources (Smuts & Whyte 1981). Subpopulations can decline rapidly in these conditions. For example, during the 1991/92 drought, the KNP subpopulation declined 12.6% in two years (Viljoen 1995). During low rainfall years, Hippos may move into high risk areas, coming into conflict with other species or human settlements. Globally, reports of human mortalities from Hippo interactions have also increased in recent years. Ten countries reported growing numbers of Hippo-human conflicts, in several cases exacerbated by drought conditions. Similarly, Mpumalanga Province has recorded an increase in the number of DCA incidents over the past ten years as increasing human (especially adjacent to protected areas) and Hippo populations escalate human-wildlife conflict (J. Eksteen, unpubl. data). Hippos are thought to be responsible for more human deaths than any other mammal, and have been known to attack and kill humans when provoked (Kingdon 1979).

Lewison (2007) evaluates the relative impacts of the known threats to persistence—habitat loss (from agricultural or larger-scale development) and hunting pressure—on a model population. While accounting for rainfall variability and demographic stochasticity, the model results suggest that combinations of habitat loss and even moderate levels of adult mortality from hunting (1% of adults) can lead to relatively high probabilities of population declines over the next 30–40 years over its global range. This scenario should be closely monitored within the assessment region, particularly if wetland habitat loss continues, and the threat of poaching intensifies.

Current habitat trend: Declining, Hippos are not usually compatible with agriculture, where it occurs in their primary feeding grounds and around their day time refuges, with the exception of Citrus orchards, which are known to provide good grazing for this species. There are clear indications of range contractions in KZN along the Phongola flood plain and in the Kosi Bay area where agricultural activity has transformed floodplain grasslands and swamp wetlands (*sensu* Jewitt et al. 2015). Loss of permanent water and siltation affect aquatic habitat quality but not necessarily the food resources on the banks. Additionally, climate change, agriculture and industry are contributing to a decline in water quality and access to grazing lawns across the country. Likewise, the number of wildlife control issues in some areas is evidence that Hippo-human conflicts are increasing, which suggests that pressure on Hippo habitat is also increasing.

Conservation

Most populations of Hippo are located within protected areas and on game ranches, mostly in dams across South Africa. Only small proportions of the total Hippo population in South Africa occur on non-protected private, communal and municipal lands, and may be regarded as

Table 6. Conservation interventions for the Common Hippopotamus (*Hippopotamus amphibius*) ranked in order of effectiveness with corresponding evidence (based on IUCN action categories, with regional context)

Rank	Intervention description	Evidence in the scientific literature	Data quality	Scale of evidence	Demonstrated impact	Current conservation projects
1	*2.1 Site/Area Management*: sustainable conservation of water resources and hydrological patterns and creation of riverine corridors.	Jacobsen & Kleynhans 1993	Empirical	Regional	Development of weirs and storage dams, may be necessary for Hippo survival.	-
2	*2.2 Invasive/Problematic Species Control*: clearance of alien invasive vegetation.	-	Anecdotal	-	-	Working for Water Programme, Department of Environmental Affairs
3	*5.4 Compliance & Enforcement*: monitoring and enforcing anti-poaching policies.	-	Anecdotal	-	-	SANParks and provincial conservation agencies
4	*5.3 Private Sector Standards & Codes*: encouragement of sustainable management of privately owned subpopulations.	-	Anecdotal	-	-	-
5	*3.1.3 Limiting Population Growth*: prevent Hippo populations from increasing to a level where they cause damage to ecosystems.	-	Anecdotal	-	-	SANParks and provincial conservation agencies

damage-causing animals in these areas, which requires training in holistic management techniques.

A primary conservation intervention, which applies to all aquatic species, is to manage agricultural and industrial development more stringently to ensure that water resources are not drained, diluted or polluted. The government's Working for Water programme is expected to benefit this species.

The species is not recommended for reintroduction in many parts of the North West Province, for the following reasons (Power 2014): a) winter frost, b) high risk of escape (and subsequent destruction), and c) their bulk grazing behaviour could have adverse effects on the grass sward (see Skinner & Chimimba 2005). Reintroductions should follow the IUCN reintroduction and translocation guidelines and should be done for conservation rather than commercial purposes.

Recommendations for land managers and practitioners:

- Develop a Biodiversity Management Plan and identify areas to create conservation corridors.
- Continue and intensify the national population monitoring of all free-ranging Hippo populations, and establish monitoring parameters, especially in the context of climate change.
- Ensure that illegal mortalities are reported to the relevant authorities.
- Employ correct fire regimes to ensure habitat remains suitable.
- The sustainable use of this species as part of wildlife-based rural economies should be carefully managed but is encouraged (M. Hofmeyr pers. comm. 2016).

Research priorities:

- The impact of illegal hunting or poaching on population stability and trends.
- The rates of land-use change near Hippo subpopulations.
- The effect of climate change on population numbers, distribution and loss of Area of Occupancy.
- The effects of siltation of Hippo pools and declining water quality on the dynamics and distribution of this species.
- Taylor (2014) presents the following recommendations which are specific for St Lucia, but generally apply to all the larger populations in South Africa:
    1. To gain an understanding of the Hippo population dynamics and to develop a population dynamics model.
    2. To understand the social structure and interactions between Hippos.
    3. To describe the impacts of Hippos on the environment in their role as "bio-engineers".
    4. To determine the carrying capacity for the population – and what the consequences will be if this is exceeded.
    5. Understanding Hippo-human interactions – both from the aspect of crop-damage and for tourism.
    6. The identification of key aquatic systems that could improve with the reintroduction of Hippos and strategies to implement the reintroductions.

Encouraged citizen actions:

- Report sightings on virtual museum platforms (for example, iSpot and MammalMAP), especially outside protected areas.
- Manage water resources on private properties by clearing alien invasive vegetation and removing barriers to dispersal to different river systems in times of drought.

Data Sources and Quality

Table 7. Information and interpretation qualifiers for the Common Hippopotamus (*Hippopotamus amphibius*) assessment

Data sources	Census (unpublished), field study (unpublished)
Data quality (max)	Observed
Data quality (min)	Estimated
Uncertainty resolution	Total count/best estimate
Risk tolerance	Evidentiary

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Details of the methods used to make this assessment can be found in *Mammal Red List 2016: Introduction and Methodology.*