Non-detriment finding for *Hippopotamus amphibius* (Hippopotamus)

Reference Number: Hip_amp_Apr2011

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Summary of findings

The non-detriment finding undertaken for *Hippopotamus amphibius* (Hippopotamus) demonstrates that international trade poses a low risk to this species in South Africa. The species is well managed and the Scientific Authority does not have any current concerns relating to the harvest of the species.

The biological characteristics of the species do not render it at a high risk to over-harvesting (Figure 1). Although a long-lived species with a low reproductive rate compared to some other larger mammals, hippos are generally tolerant of human activities and are regarded as a pest species outside of protected areas, particularly in communal areas. Although restricted to areas in proximity of water, individuals are able to disperse efficiently between water sources. The species is reasonably adaptable to different environments and hippos are known to forage in agricultural lands.

The national status of *Hippopotamus amphibius* favours sustainable utilization (Figure 1). The species is regionally listed in the IUCN Red List category of Least Concern and there are currently no major threats facing the species. Although the regional population is fragmented, the species is widespread in the country, occurring in all provinces but most numerous in Limpopo, Mpumalanga, North West Province and KwaZulu-Natal. Hippos are regarded as common in South Africa, with recent quantitative data indicating that the regional population is comprised of more than 6300 individuals. The national population is increasing, especially within the Kruger National Park but also within protected areas in North West Province. Animals emigrating out of these protected areas have resulted in a significant increase in hippo numbers in surrounding lands where they are often regarded as pests. The removal of problem hippos is however offset by the introduction of hippos onto private land in Gauteng, North West Province and KwaZulu-Natal.

The weakest area of the non detriment finding for *Hippopotamus amphibius* relates to the absence of a system of quotas for regulating harvest (Figure 1). However, the legal harvest of hippos, which includes harvesting for hunting trophies, harvesting for biological control and killing of damage causing animals, is minimal, with population management and control being the predominant aim of the harvest. Legal harvest takes place predominantly in protected areas and on commercial farms, the latter characterized by strong local control over resource use. Illegal off-take is of minor concern. The species is furthermore well managed and there are sufficient controls in place to ensure sustainability in the event of an increase in harvesting pressure or a proposal to harvest large numbers of individuals from the population. Mpumalanga has a policy for handling damage causing animals and there is a framework for regulating damage causing animals in KwaZulu-Natal. Hunting on game farms in all
provinces is regulated by permitting systems and culling of hippos on protected areas is undertaken in accordance with the goals of approved local management plans. Monitoring of the effects of harvest (Figure 1) is based on direct population estimates. There are budgetary, manpower and logistical constraints for the implementation of management plans and monitoring programmes, although most culling operations for hippos are nevertheless effectively implemented and regular monitoring of hippo numbers does take place.

Compared to other large animals such as the white rhino, the conservation of this species has not benefited significantly from the hunting and game farming industries and likewise there is a low benefit for habitat conservation (Figure 1). This lack of conservation incentives, however, is not thought to affect the overall low risk outcome of the non-detriment finding.

The effective protection of the species from harvest also contributes to the low risk that international trade poses to the species (Figure 1). Around 75% of the South African hippo population is legally excluded from harvest, which is regarded as effective since a very small percentage of the hippo population is lost to poaching.

**Figure 1.** Radar chart summarizing the non detriment finding evaluation for *Hippopotamus amphibius* (Hippopotamus) in accordance with the CITES NDF checklist. The limited areas shaded in the radar chart demonstrate an overall low risk to the species. Explanations of scores given are detailed in Table 1.
Table 1. NDF evaluation in accordance with the CITES NDF checklist. Scores assigned to each question are indicated along with detailed explanations/justifications.

<table>
<thead>
<tr>
<th>Biological characteristics</th>
<th>1. Life history: What is the species’ life history?</th>
<th>2. Ecological adaptability: To what extent is the species adaptable (habitat, diet, environmental tolerance etc.)?</th>
<th>3. Dispersal efficiency: How efficient is the species’ dispersal mechanism at key life stages?</th>
<th>4. Interaction with humans: Is the species tolerant to human activity other than harvest?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High reproductive rate, long-lived</td>
<td>Extreme generalist</td>
<td>Very good</td>
<td>No interaction</td>
</tr>
<tr>
<td></td>
<td>High reproductive rate, short-lived</td>
<td>Generalist</td>
<td>Good</td>
<td>Pest / Commensal</td>
</tr>
<tr>
<td></td>
<td>Low reproductive rate, long-lived</td>
<td>Specialist</td>
<td>Medium</td>
<td>Tolerant</td>
</tr>
<tr>
<td></td>
<td>Low reproductive rate, short-lived</td>
<td>Extreme specialist</td>
<td>Poor</td>
<td>Sensitive</td>
</tr>
<tr>
<td></td>
<td>Uncertain</td>
<td>Uncertain</td>
<td>Uncertain</td>
<td>Uncertain</td>
</tr>
</tbody>
</table>

Individuals reproduce on average every 2 years and every 18 months at optimum levels. The intrinsic rate of increase of populations ranges between 8% and 10%. This is a K-selected species that has a low reproductive rate compared to some other larger mammals.

The species is reasonably adaptable to different environments, tolerating semi-arid to very mesic conditions. Individuals do not appear to be susceptible to poor water quality, for example in Gauteng they are able to survive in water with a pH of less than 4. Although hippos graze on both long and short grass, they are regarded as specialist grazers and are also habitat engineers in that they create grazing lawns. When individuals escape from protected areas, their feeding behaviour alters and they have been found foraging in lucerne and maize fields. In the Sabie area, hippos are known to occasionally feed on banana trees. As hippos are restricted to areas in proximity of water, they cannot be considered extreme generalists.

Individuals move up and down rivers in times of drought and are able to move easily between water sources. They may walk up to 35km during their nocturnal foraging activities. General fences do not hinder the movement of hippos.

Individuals that have escaped from protected areas are regarded as pests, particularly in agricultural lands. Citrus orchards provide good grazing habitat and some citrus farmers in the Lowveld actually regard hippos on their land as an extra security measure and have consequently adapted their farming practices. Crops are protected with electric fencing, but farmers only protect sugar cane until it reaches a height of 1.5 m (hippos do not venture into sugar cane taller than this). In communal areas hippos are considered a pest or problem animal, particularly in the Maputaland area of KwaZulu-Natal where hippos are regularly shot or snared. Hippos are also regarded as problem...
animals in the communal areas of North West Province in land bordering on dams and rivers. Although regarded as a pest by humans, hippos are generally tolerant of human activities.

<table>
<thead>
<tr>
<th>National status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5. National distribution:</strong> How is the species distributed nationally?</td>
</tr>
<tr>
<td>Widespread, contiguous in country</td>
</tr>
<tr>
<td>Widespread, fragmented in country</td>
</tr>
<tr>
<td>Restricted and fragmented</td>
</tr>
<tr>
<td>Localized</td>
</tr>
<tr>
<td>Uncertain</td>
</tr>
</tbody>
</table>

Historically the species occurred in all provinces with available water. Today there are numerous populations in Limpopo, Mpumalanga and North West Province. In KwaZulu-Natal hippos occur at eight localities within protected areas and in 18 localities on communal and private land. In the Free State, there is one small population in a protected area and two small populations on private land. There is one small population on private land in the Northern Cape and in the Western Cape hippos occur in about four localities within protected areas, both private and state owned. In Gauteng, hippos occur naturally in the Dinokeng area but have also been introduced into the Cradle of Humankind World Heritage Site.

<table>
<thead>
<tr>
<th>6. National abundance:</th>
<th>What is the abundance nationally?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very abundant</td>
<td></td>
</tr>
<tr>
<td>Common</td>
<td>X</td>
</tr>
<tr>
<td>Uncommon</td>
<td></td>
</tr>
<tr>
<td>Rare</td>
<td></td>
</tr>
<tr>
<td>Uncertain</td>
<td></td>
</tr>
</tbody>
</table>

There are between 3000 and 4000 hippos in the Kruger National Park. In Mpumalanga, in open rivers outside the Kruger National Park, approximately 413 hippos were counted during a 2009 survey. According to a 2003 survey in Limpopo, approximately 295 hippos occur in that province. There are approximately 1650 hippos in KwaZulu-Natal, both within protected areas and on private land (2009 figures), while approximately 300 hippos occur both on private land and within protected areas in North West Province. The hippo population in the Eastern Cape is around 100 (about 30 occurring on state land and 70 occurring on private land in the Cacadu Region). There are no more than 20 hippos in each of the provinces of Gauteng, Western Cape and Free State and only 3 individuals in the Northern Cape. Thus altogether the total hippo population of South Africa is estimated at 6300 individuals. Hippos are not expected to be present in the arid areas of the country (approximately two thirds of South Africa), except perhaps in rivers in low numbers. As the figures provided for the Kruger National Park are results of river counts only, there may be many more hippos that weren’t counted, while in Mpumalanga and Limpopo many individuals on private land are not counted. The total figure of 6300 is therefore conservative and may be regarded as an underestimate.

<table>
<thead>
<tr>
<th>7. National population trend:</th>
<th>What is the recent national population trend?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing</td>
<td>X</td>
</tr>
<tr>
<td>Stable</td>
<td></td>
</tr>
<tr>
<td>Reduced, but stable</td>
<td></td>
</tr>
<tr>
<td>Reduced and still decreasing</td>
<td></td>
</tr>
<tr>
<td>Uncertain</td>
<td></td>
</tr>
</tbody>
</table>

In Mpumalanga, in the permanently flowing rivers outside of the Kruger National Park, the numbers of hippo are increasing significantly, sometimes at a rate of between 25% and 30% per annum as animals emigrate out of the park. Historically, hippo numbers were managed in the Kruger National Park but are now increasing in the absence of any population control. For example, in 1988 there were approximately 370 hippos in the Crocodile River, which almost doubled to 700 in 2002 and
In the Sabie River, the hippo population was maintained at between 800 and 900 individuals, but had increased to 1138 by 2009. Numbers of hippo in the Olifants River are reasonably stable at between 800 and 900 individuals. A population of 1119 hippo now occurs in the Letaba River, where between 700 and 800 hippopotami occurred in the past. Stable populations of approximately 200 animals occur in the seasonal rivers (Limpopo and Levuvhu). In Limpopo province, numbers of hippo in the Limpopo River and Olifants River outside of Kruger have also increased from 50 to 100 and from 150 in 1994 to 186 in 2003, respectively. These figures may be underestimates and concern has been expressed for the growing problem of human wildlife conflict. In the North West Province, hippo numbers are definitely increasing significantly due to a range expansion of the species into areas where rainfall is favourable and habitat suitable. Private landowners are introducing hippos into dams. Populations within protected areas such as Madikwe and Pilanesberg have become too large, resulting in animals emigrating out of these areas. Hippos in the Crocodile River migrate between the North West and Limpopo provinces. In KwaZulu-Natal, populations have remained stable on protected areas since 2004, however the numbers of hippo on private land are increasing as public introduce hippos into rivers and dams. There is however a definite decline in communal areas where animals are poached, but overall the population in KwaZulu-Natal has remained stable at around 1600 individuals over the last 6 years. In the Eastern Cape, the small hippo population in the Great Fish River Nature Reserve is counted from a helicopter every third year and in 2006 14 hippos were counted and in 2009 22 hippos were counted. In Gauteng, there is growing public interest in introducing hippo onto private land for aesthetic reasons.

<table>
<thead>
<tr>
<th>8. Quality of information: What type of information is available to describe abundance and trend in the national population?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantitative data, recent</td>
</tr>
<tr>
<td>Good local knowledge</td>
</tr>
<tr>
<td>Quantitative data, outdated</td>
</tr>
<tr>
<td>Anecdotal information</td>
</tr>
<tr>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>9. Major threats: What major threat is the species facing (underline following: overuse/ habitat loss and alteration/ invasive species/ other: ) and how severe is it?</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
</tr>
<tr>
<td>Limited/Reversible</td>
</tr>
<tr>
<td>Substantial</td>
</tr>
<tr>
<td>Severe/Irreversible</td>
</tr>
<tr>
<td>Uncertain</td>
</tr>
</tbody>
</table>

In KwaZulu-Natal, habitat for this species is being lost as a result of human population growth and expansion, particularly in the Maputaland area, but this is not considered a major threat currently as the species is adequately protected within protected areas. Any losses of hippo in communal areas are offset by the introduction of hippo onto private land and game farms. Another minor threat to the species is the poaching of individuals for their fat (utilized as muthi) and hides (for making sjamboks). In North West Province, hippos now occur in areas where they didn’t before. Due to the cessation of culling in protected areas, hippos have emigrated from protected areas into crop lands where food is abundant. Similarity in Mpumalanga, habitat for this species is being lost as a result of human population growth and expansion. Hippos are however moving out of protected areas into areas with a variety of agricultural activities, including citrus orchards where irrigation and mowing of grass has resulted in attractive grazing lawns. Furthermore, seasonal rivers have become permanent, further favouring range expansion of this species. There are thus no major threats facing the species in Mpumalanga or the North West Province.
### Harvest management

#### 10. Illegal off-take or trade: How significant is the national problem of illegal or unmanaged off-take or trade?

- None
- Small  
  - X
- Medium
- Large
- Uncertain

Incidences of illegal off-take have not been noted in the North West, Gauteng, Western Cape, Free State or Northern Cape provinces. Low levels of illegal off-take however do occur in Mpumalanga, the Eastern Cape and KwaZulu-Natal and illegal off-take in KwaZulu-Natal is on the increase.

#### 11. Management history: What is the history of harvest?

- Managed harvest: ongoing with adaptive framework  
  - X
- Managed harvest: ongoing but informal
- Managed harvest: new
- Unmanaged harvest: ongoing or new
- Uncertain

There is a formal framework for regulating the control of damage causing animals in KwaZulu-Natal, where incidences are investigated first to determine if the problem animal can be contained. Mpumalanga manages hippo complaints according to a policy on the handling of damage causing animals. Since management of problem / damage causing hippos is based on complaints received, it is largely reactive. In the Eastern Cape, the culling of damage causing hippos is regulated through a permitting system. In North West Province, KwaZulu-Natal and Limpopo, hippos are hunted on game farms under the control of a permitting system. Generally hippos are culled in protected areas in accordance with the goals contained in ecological management plans.

#### 12. Management plan or equivalent: Is there a management plan related to the harvest of the species?

- Approved and co-ordinated local and national management plans
- Approved national/state/provincial management plan(s)
  - X
- Approved local management plan
- No approved plan: informal unplanned management
- Uncertain

There are approved local management plans for protected areas and also some local management plans for private land outside of protected areas.

#### 13. Aim of harvest regime in management planning: What is harvest aiming to achieve?

- Generate conservation benefit
- Population management/control  
  - X
- Maximize economic yield
- Opportunistic, unselective harvest, or none
- Uncertain

#### 14. Quotas: Is the harvest based on a system of quotas?

- Ongoing national quota: based on biologically derived local quotas
- Ongoing quotas: “cautious” national or local
- Untried quota: recent and based on biologically derived local quotas
- Market-driven quota(s), arbitrary quota(s), or no quotas  
  - X
- Uncertain

There is no hunting quota for this species. Within protected areas, hippos are harvested / culled in order to meet the biological objectives of those protected areas.
### Control of harvest

**15. Harvesting in Protected Areas:** What percentage of the legal national harvest occurs in State-controlled Protected Areas?

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Uncertain</td>
</tr>
</tbody>
</table>

*The legal harvest of hippos is minimal and includes harvesting for hunting trophies, harvesting for biological control and killing of damage causing animals. In KwaZulu-Natal, legal harvest occurs predominantly in protected areas, with some hunting of hippos on game ranches.*

**16. Harvesting in areas with strong resource tenure or ownership:** What percentage of the legal national harvest occurs outside Protected Areas, in areas with strong local control over resource use?

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Uncertain</td>
</tr>
</tbody>
</table>

*In Mpumalanga, all of the legal harvest occurs outside of protected areas (including killing of damage causing animals), but there is local control over resource use on private land. The killing of damage causing hippos takes place on commercial farms and in communal lands.*

**17. Harvesting in areas with open access:** What percentage of the legal national harvest occurs in areas where there is no strong local control, giving *de facto* or actual open access?

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Uncertain</td>
</tr>
</tbody>
</table>

*The killing of damage causing hippos takes place on commercial farms and in communal lands.*

**18. Confidence in harvest management:** Do budgetary and other factors allow effective implementation of management plan(s) and harvest controls?

<table>
<thead>
<tr>
<th>Confidence</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High confidence</td>
</tr>
<tr>
<td></td>
<td>Medium confidence</td>
</tr>
<tr>
<td></td>
<td>Low confidence</td>
</tr>
<tr>
<td></td>
<td>No confidence</td>
</tr>
<tr>
<td></td>
<td>Uncertain</td>
</tr>
</tbody>
</table>

*There are budgetary, manpower and logistical constraints for the implementation of management plans in all provinces, although most culling operations for hippos are nevertheless effectively implemented. Targets for population control off-takes are often not met because hippos are difficult to remove, particularly as these operations are not well funded.*

### Monitoring of harvest

**19. Methods used to monitor the harvest:** What is the principal method used to monitor the effects of the harvest?

<table>
<thead>
<tr>
<th>Method</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct population estimates</td>
<td>X</td>
</tr>
<tr>
<td>Quantitative indices</td>
<td></td>
</tr>
<tr>
<td>Qualitative indices</td>
<td></td>
</tr>
<tr>
<td>National monitoring of exports</td>
<td></td>
</tr>
<tr>
<td>No monitoring or uncertain</td>
<td></td>
</tr>
</tbody>
</table>

*Monitoring in the provinces with the largest hippo populations (i.e. KwaZulu-Natal, Mpumalanga and Limpopo) involves direct population estimates.*
<table>
<thead>
<tr>
<th>20. Confidence in harvest monitoring: Do budgetary and other factors allow effective harvest monitoring?</th>
<th>High confidence</th>
<th>Medium confidence</th>
<th>Low confidence</th>
<th>No confidence</th>
<th>Uncertain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

There are budgetary, manpower and logistical constraints in all provinces, but generally regular monitoring of hippo numbers takes place.

## Incentives and benefits from harvesting

<table>
<thead>
<tr>
<th>21. Utilization compared to other threats: What is the effect of the harvest when taken together with the major threat that has been identified for this species?</th>
<th>Beneficial</th>
<th>Neutral</th>
<th>Harmful</th>
<th>Highly negative</th>
<th>Uncertain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>22. Incentives for species conservation: At the national level, how much conservation benefit to this species accrues from harvesting?</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
<th>None</th>
<th>Uncertain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

There has not been a large uptake of this species onto game ranches. Due to the nature of boundaries, rivers are often fenced out of private land and hippos are consequently introduced into dams instead of rivers, thus providing limited opportunities for conservation of the species. Compared to other large animals such as the white rhino, the conservation of this species has not benefited significantly from the hunting and game farming industries.

<table>
<thead>
<tr>
<th>23. Incentives for habitat conservation: At the national level, how much habitat conservation benefit is derived from harvesting?</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
<th>None</th>
<th>Uncertain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

There is a low benefit for habitat conservation. Stocking hippo on a game farm is often regarded as an “add on” and ideal hippo habitat is limited.

## Protection from harvest

<table>
<thead>
<tr>
<th>24. Proportion strictly protected: What percentage of the species’ natural range or population is legally excluded from harvest?</th>
<th>&gt;15%</th>
<th>5-15%</th>
<th>&lt;5%</th>
<th>None</th>
<th>Uncertain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Hunting of hippo on protected areas is not allowed. The +3500 hippo in Kruger National Park is strictly protected, representing almost 60% of the South African hippo population. Seventy-five percent of the hippo population in KwaZulu-Natal alone occurs within protected areas. It is therefore fair to say that about 75% of the South African hippo population is legally excluded from harvest.
25. Effectiveness of strict protection measures: Do budgetary and other factors give confidence in the effectiveness of measures taken to afford strict protection?

<table>
<thead>
<tr>
<th>Confidence Level</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>High confidence</td>
<td></td>
</tr>
<tr>
<td>Medium confidence</td>
<td>X</td>
</tr>
<tr>
<td>Low confidence</td>
<td></td>
</tr>
<tr>
<td>No confidence</td>
<td></td>
</tr>
<tr>
<td>Uncertain</td>
<td></td>
</tr>
</tbody>
</table>

A very small percentage of the hippo population is lost to poaching.

26. Regulation of harvest effort: How effective are any restrictions on harvesting (such as age or size, season or equipment) for preventing overuse?

<table>
<thead>
<tr>
<th>Effectiveness</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very effective</td>
<td></td>
</tr>
<tr>
<td>Effective</td>
<td>X</td>
</tr>
<tr>
<td>Ineffective</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Uncertain</td>
<td></td>
</tr>
</tbody>
</table>

The off-take targets established for the ecological management of protected areas in terms of the goals and objectives of a management plan is the main mechanism for restricting harvest. Management of damage causing animals outside of protected areas is effective, particularly in KwaZulu-Natal.

List of participants

1. Noluthando Bam – Deputy Director Biodiversity Management (Eastern Cape Department of Economic Development and Environmental Affairs)
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7. Theressa Frantz – Director: Applied Biodiversity Research (South African National Biodiversity Institute)
8. Pete Goodman – Coordinator Biodiversity Research (Ezemvelo KwaZulu-Natal Wildlife)
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11. Julius Koen – Deputy Director (Northern Cape Department of Environment and Nature Conservation)
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17. Elsabe Swart – Assistant Director (Northern Cape Department of Environment and Nature Conservation)
18. Adrian Tordiffe – Clinical & Research veterinarian (National Zoological Gardens of South Africa)
19. Savvas Vrahimis – Production Scientist (Free State Department of Tourism, Environment and Economic Affairs)