DRAFT GUIDANCE: NON-DETRIMENT FINDINGS

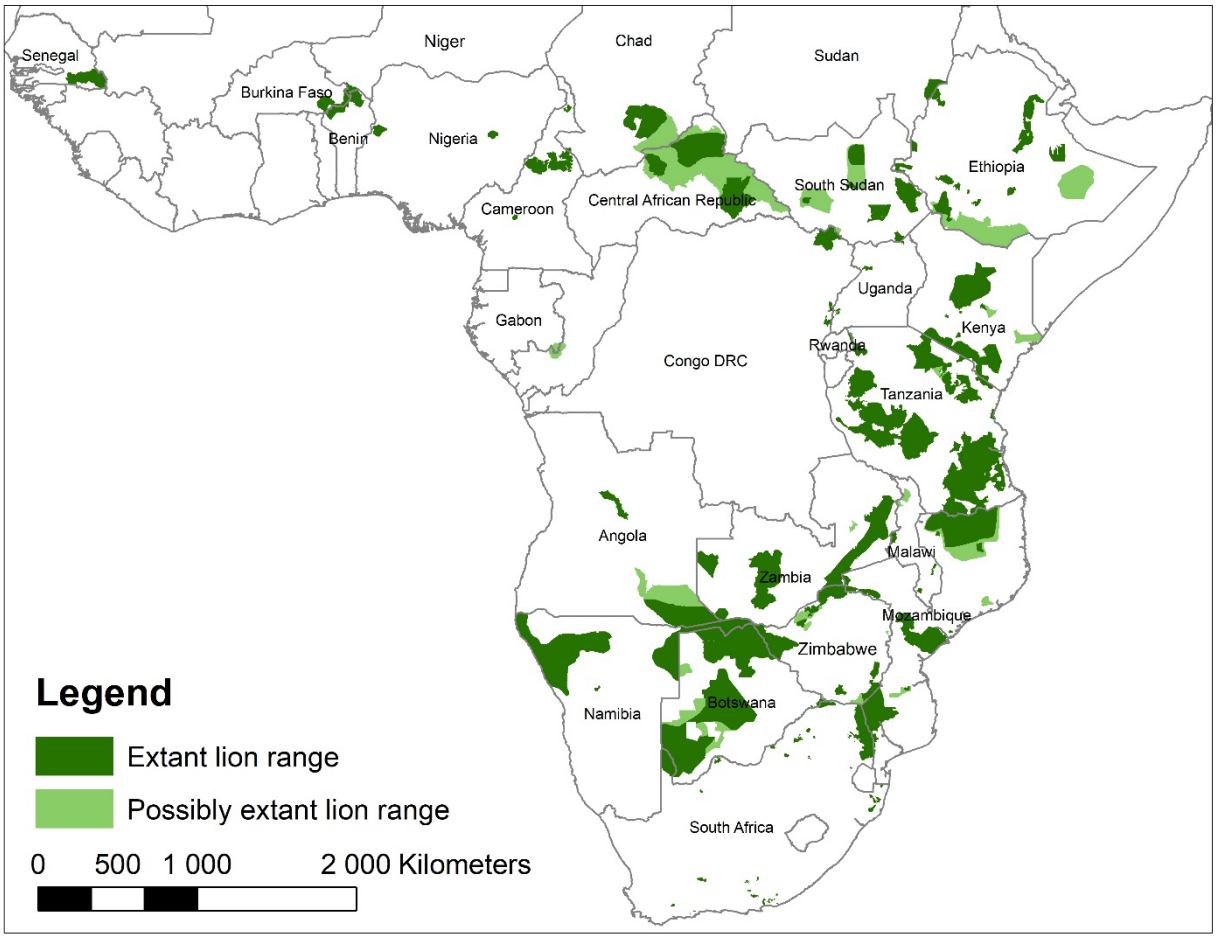
Draft guidance for Non-Detriment Findings for African lions (*Panthera* leo) under CITES

Contents

1. Background and scope of work

At the 19th meeting of the Conference of the Parties (CoP19, Panama City, 2022), a suite of Decisions relating to African lions (*Panthera leo*), including Decision 19.205 paragraph c) was adopted. This Decision directs the CITES Secretariat, in collaboration with African lion range States, the Convention on Migratory Species (CMS) and the International Union for Conservation of Nature (IUCN) to support capacity-building in African lion conservation and management including where appropriate, in the making of non-detriment findings by range States according to Resolution Conf. 16.7 (Rev. CoP17) on *Non-Detriment Findings* and the implementation of Resolution Conf. 17.9 on *Trade in hunting trophies of species listed in Appendix I or II*.

2. Status of Lions in Africa



Panther leo was assessed in 2014 for the IUCN Red List of Threatened Species as Vulnerable under criterion A2abcd and reassessed in 2023 as Vulnerable under the same criterion based on an estimated ~36% decline in the species natural range over the last three generations (21 years) and, therefore, a similar population reduction is suspected (Nicholson et al. In press). Extant Lion range in 2023 is estimated to be 1,566,529.59 km², only 7.4% of its historical range (Nicholson et al. In press). This is an estimated 36% range decline since 2002, where range was estimated in this assessment to 2,460,986 km². This decline, which is likely to continue, reflects a combination of recent known and inferred decline, as well as improved knowledge. It is estimated that across their range there is a

population of ~23,000 adult and subadult lions in Africa[1,2], an estimated decline from ~33,000 lions in 2006[3].

While the global population is listed as Vulnerable, listings will differ across regions. Currently, the West African and the Southern African lion population are regionally assessed. The West African population was regionally assessed in 2014 as Critically Endangered (C2(a)ii) based on the fact that there are fewer than 250 mature adults remaining and that 90-100% of those individuals are in one subpopulation (that being in the W-Arly-Penjari (WAP) complex across Benin, Niger and Burkina Faso)[4]. The Southern African population, currently being reassessed, was listed as Least Concern in 2016 due to the stable or increasing number of lions within the country[5].

As lions are wide-ranging, often not restricted to protected area boundaries, there are multiple areas across their range where a population may regularly cross international borders. In such cases, the species would benefit from transboundary management and co-operation between range states, especially as threats, policies, and management in one country, will likely affect the conservation success of neighbouring populations. Key transboundary lion populations are identified in Table 1.

Table 1: A list of key transboundary African lion populations

	Name	**Countries**	**Notes**
1	W-Arly-Penjari (WAP) Complex	Benin, Burkina Faso, Niger	
2	Benoué Complex, Sena Oura	Cameroon, Sena Oura	Movement of lions between Benoue and Sena Oura
3	Greater Virunga Transboundary Collaboration	Uganda, Democratic Republic of the Congo	
4	Garamba, Lantoto	South Sudan, Democratic Republic of the Congo	
5	Eastern Central African Republic and South Sudan Wilderness	Central African Republic, South Sudan	Not a recognised transboundary population but there is likely movement of lions between these two areas.
6	Boma-Gambella	South Sudan, Ethiopia	
7	Dinder, Atatish, Bejimiz	Sudan, Ethiopia	
8	Maasai, Serengeti, Mkomazi, Tsavo	Tanzania, Kenya	These areas are largely connected.
9	Niassa-Selous	Tanzania, Mozambique	

[1] Nicholson et al. In press. IUCN Red List of the African Lion
[2] African Lion Database. Unpublished data
[3] Nicholson et al. In press. IUCN Red List Assessment for the African Lion (2023)
[4] Henschel, P., Bauer, H., Sogbohoussou, E. & Nowell, K. 2015. *Panthera leo* (West Africa subpopulation). The IUCN Red List of Threatened Species 2015: e.T68933833A54067639.
[5] Miller S, Riggio J, Funston P, Power RJ, Williams V, Child MF. 2016. A conservation assessment of *Panthera leo*. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa

	Name	Countries	Notes
10	Kavango Zambezi (KAZA)	Angola, Namibia, Botswana, Zambia, Zimbabwe	Largest transfrontier conservation area.
11	Luangwa Valley	Zambia, Malawi, Mozambique, Zimbabwe	Definite movement between Zimbabwe and Zambia, potentially only dispersals between Zambia and Mozambique/Malawi
12	Kgalagadi Transfrontier Park	South Africa, Botswana	Formally recognised and managed as a transfrontier area
13	Greater Limpopo Transfrontier Conservation Area	South Africa, Mozambique, Zimbabwe	Formally recognised and managed as a transfrontier area
14	Greater Mapungubwe	South Africa, Botswana, Zimbabwe	Formally recognised and managed as a transfrontier area

3. NDF Methodology

3.1 Who is responsible for conducting NDFs?

The Scientific Authority is responsible for conducting NDFs. While each country's Management Authority is responsible for issuing or denying export permits, the Management Authority must first request guidance from the Scientific Authority on whether exports will be detrimental to a species.

Exactly who participates in the development of an NDF is up to the Scientific Authority, but other possible role players and stakeholders for African lions are outlined in Table 2.

Table 2. Stakeholder matrix for development of NDFs

Stakeholder	Relevance and information to be provided
Scientific Authority	Responsible for the entire NDF process. Gathers all preliminary information, invites stakeholders to submit information to be considered / participate in the process, as appropriate, leads NDF workshop, collates and analyses all information, makes recommendation to Management Authority
Management Authority	Responsible for managing permit requests from exporters / importers, requesting advice on whether trade will be detrimental, participates in NDF workshop (brings valuable knowledge to process), issuing or denying permits based on outcome of NDF and legal acquisition finding (LAF).
National government conservation departments	Curators of national mammal statistics, expertise in national and international legislation, implementers of

Stakeholder	Relevance and information to be provided
	national policy and legislation, maintain formal contacts with other governments
Provincial/regional government conservation departments	Curators of regional mammal statistics, expertise in provincial/regional and national legislation, implementers of provincial/regional national policy and legislation
National parks departments and reserve managers	Curators of mammal statistics for protected areas, expertise in regulations of protected areas
Species experts from government, the academic and private sector	Expert knowledge on species biology, ecology, threats, NDF processes, national/international policy and legislation, quota setting, amongst other things
Professional hunting operators and other members of the wildlife industry	Bring field knowledge of lion populations and annual offtakes, possibly illegal offtakes, can bring vital knowledge to the NDF process

3.2 Preliminary assessment (or Pre-NDF check)

In general, most guidance documents for NDFs recommend conducting some form of preliminary assessment to determine whether an NDF is necessary and/or the level of detail that should be included in developing the NDF. In the specific case of NDFs for African lions, while some of the generic preliminary checks may not be necessary (Figure 2), the outcome is likely to be that some form of NDF is required, although a comprehensive assessment may not be needed, depending on the population, the source of the specimens and the proposed trade. For further reading about preliminary assessments for NDFs, the reader is directed to the generic guidelines (Module 1 and 2) currently under development[6] and to CITES (2010)[7].

A first check is that the species has been identified correctly. In most cases with trophy hunting exports, verification that trophies are from African lions will be straightforward based on the obvious appearance of the skins, but in cases where exports comprise separate lion parts, such as skeletons (bones), skulls, teeth, or claws, expert identification will be required. Conducting an effective NDF is reliant upon the correct identification of the species concerned and verification that it is specimens of this species that are to be exported.

The second pre-check is that the species concerned is listed on Appendix I or II[8], and in the case of the African lion, the species is currently (2022-2025) confirmed as Appendix II[9]. Additionally, consideration should be given to any annotations that may be applicable, in the case of African lion there is one relevant to all range States and one only relevant to South Africa. The applicable annotation is – annotation A4:

> For *Panthera leo* (African populations): a zero annual export quota is established for specimens of bones, bone pieces, bone products, claws, skeletons, skulls and teeth removed from the ***wild and traded for commercial purposes***. Annual export quotas for trade in bones, bone pieces, bone products, claws, skeletons, skulls and teeth for ***commercial purposes, derived***

[6] Module 1 and 2 of guidance on making non-detriment findings
[7] CITES. 2010. International Expert Workshop on Non-Detriment Findings. CoP15 Inf. 3 Fifteenth Meeting of the Conference of the Parties Doha (Qatar), 13-25 March 2010 (Working Group Reports). From AC24 Doc. 9.1; Annex 1; Mammal Working Group Final Report.
[8] https://cites.org/eng/app/appendices.php
[9] https://checklist.cites.org/#/en

from captive breeding operations in South Africa, will be established and communicated annually to the CITES Secretariat. [emphasis added]

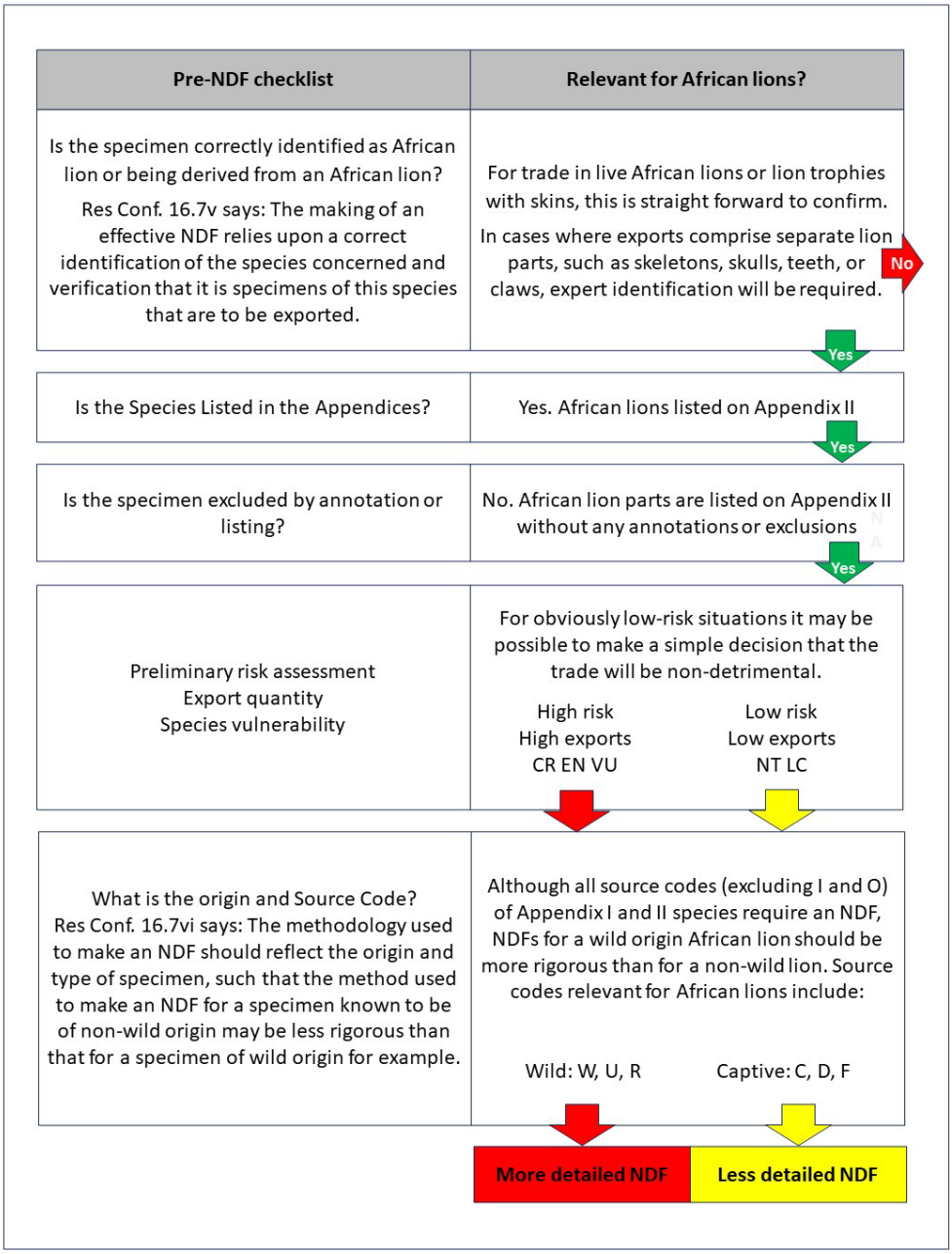


Figure 2. Preliminary checks before conducting NDFs for lions (adapted from Module 2[10]). This will help the Scientific Authority determine the comprehensiveness required to conduct an NDF (is a rapid or a detailed assessment required).

3.3 Source code

Resolution Conf. 16.7 paragraph 1. vi) states: The methodology used to make an NDF should reflect the origin and type of specimen, for example the method used to make an NDF for a specimen known to be of non-wild origin (e.g., captive-bred) may be less rigorous than that for a specimen of wild origin. Although all source codes (excluding O) of Appendix I and II species require an NDF, some are not

[10] Module 2 of guidance on making non-detriment findings

relevant for African lions (Table 3. NDFs for a wild origin African lion should be more rigorous than for a non-wild lion.

Table 3.[11] Source codes relevant for exports of African lions

Source Code	Description	Definition	Relevance for African lions
W	Wild	Specimens taken from the wild	High
R	Ranched animal	Specimens of animals reared in a controlled environment, taken as juveniles from the wild, where they would otherwise have had a very low probability of surviving to adulthood	Not relevant to African lions
D	Appendix-I animals bred in captivity	Appendix-I animals bred in captivity for commercial purposes in operations included in the Secretariat's Register, in accordance with Resolution Conf. 12.10 (Rev. CoP15), as well as parts and derivatives thereof, exported under the provisions Article VII, paragraph 4, of the Convention	Not currently relevant
C	Bred in captivity	Animals bred in captivity in accordance with Resolution Conf. 10.16 (Rev.), as well as parts and derivatives thereof, exported under the provisions of Article VII, paragraph 5	Only relevant for South Africa
F	Born in captivity	Animals born in captivity (F1 or subsequent generations) that do not fulfil the definition of 'bred in captivity' in Resolution Conf. 10.16 (Rev.), as well as parts and derivatives thereof.	Only relevant for South Africa
U	Unknown[12]	Source of the specimen is unknown but must be justified.	

3.4 Detailed NDF Checklist - Criteria and Indicators

If the preliminary assessment indicates a detailed NDF is required, the following process may be followed. Note that it is anticipated that most assessments for African lions will require a detailed NDF, but this is the prerogative of the Scientific Authority.

In Table 4, the far-left column provides questions relating to different factors (e.g., biological characteristics or control of harvest) that are to be considered when assessing the impacts of exports. The second column provides five responses to each question and the third column provides a score for each response. Clear answers that indicate there is a high degree of confidence that the harvest will be sustainable (not detrimental) will have a low score while increasing levels of uncertainty lead to higher scores. Although more than one answer might be considered relevant, just one answer should be selected using best judgement.

For the purposes of this guidance document, a fourth column has been added that provides possible or likely responses for African lions. In some cases, a single response may apply to Africa lions across all range states (e.g., life history characteristics that remain the same whichever country is conducting the NDF), while in other cases there may be different responses for different countries due to variability

[11] CITES. 2017. A Guide to the Application of CITES Source Codes.
[12] Note that the use of this source code for African lions should trigger a more detailed NDF so that the source of the specimen, part or derivative, can be determined and one of the other source codes provided.

between countries (e.g., national distribution of lions). In all cases, it is left to the judgement of the Scientific Authorities to decide which answers are most fitting for their circumstances based on the best available information.

It should be emphasised that the compilation of the checklist does not necessarily constitute a finding of non-detriment. Rather, the use of the checklist should inform the non-detriment finding and can guide the Scientific Authority in obtaining the necessary information.

To assist in estimating harvest/offtake rates for the second half of the NDF checklist, a summary table of harvest regime has been developed[13] (see Annex I).

3.5 Quotas as a management tool

Many range States use additional methods or tools to reduce the risks of over-harvesting African lions. One such method used by many countries is that of export quotas. Resolution Conf. 14.7 (Rev. CoP 15)[14] states:

> *'2. In the context of CITES, an annual export quota is a limit on the number or quantity of specimens of a particular species that may be exported from the country concerned within a 12-month period…….*
>
> *3. An export quota system is a management tool, used to ensure that exports of specimens of a certain species are maintained at a level that has no detrimental effect on the population of the species. The setting of an export quota advised by a Scientific Authority effectively meets the requirement of CITES to make a non-detriment finding for species included in Appendix I or II and, for species in Appendix II, to ensure that the species is maintained throughout its range at a level consistent with its role in the ecosystems in which it occurs.*
>
> *……*
>
> *6. The fundamental principle to follow is that decision-making regarding the level of sustainable exports must be scientifically based, and harvests managed in the most appropriate manner. This requires that implementation, including administrative, legislative and enforcement measures, take account of the regulatory and biological context.'*

Considerations for setting and managing African lion quotas

<u>Setting quotas – key considerations:</u>

- Quality and comprehensiveness of population data to inform robust quota setting. It is important to consider the use of updated population monitoring techniques as well as age-based methods to gather population data.
- Domestic use and other sources of lion mortality.
- African lion national population data –
  - It is important to ensure all possible sources of information have been reviewed, for example, national census data, academic papers, IUCN Red List assessment and African Lion Database, and that the most comprehensive and up-to-date information is used.
  - It is also important to consider national populations trends and the proportion of lion populations within different source types, for example, wild versus captive-bred populations, as well as the populations within and outside hunting blocks.
- Any existing African lion NDFs – use these to help inform/ guide the development of quotas, ensuring all data and information are up to date.
- Existing national hunting management practices and whether these facilitate the management, including monitoring of a quota.

[13] CITES. 2000. Checklist to Assist in Making Non-Detriment Findings for Appendix II Exports (CoP 11 Inf. 11.3). Gigiri, Kenya.

Process

- Establish a quota setting process and procedure that are clearly outlined, transparent, accountable, and takes into consideration the guidelines in Resolution Conf. 14.7 (Rev. CoP15) on *Management of nationally established export quotas*.
- Establish a primary body who will approve national quotas.

Type of quota that could be considered: Age-restricted quota (NOTE: training to correctly age specimens will be needed – links provided below)

- Age-restricted quota allocation and trophy hunting practices with lions harvested being >7 years of age.
- Some of the characteristics used to age lions are:
  - Mane development
  - Nose pigmentation
  - Facial scarring
  - Jaw slackness
  - Tooth wear and colouration
  - Skull development
- Training materials are available online[15] and even short online training courses have been shown to improve the ability of observers to accurately age lions.
- More details can be found in Miller et al. 2016[16]

Monitoring

- Establish feedback monitoring systems for critical data to inform the quota setting process.
- Wherever possible implement long term lion monitoring frameworks across areas where lion hunting takes place and conduct data collection and analysis for each area in collaboration with hunting associations / operators.

Conversion factors

- Careful consideration needs to be taken when assessing the trade in lion because some trade terms do not equate to a whole individual. For African lions, these include trade terms, such as bones, claws and teeth. In certain cases, such as claws, conversion factors can be applied to produce upper and lower estimates on number of individuals.
- For example: African lions usually have 18 claws, thus the total number of claws in trade can be divided by 18 to give a lower estimate on the number of lions this represents. The upper estimate will be the total number of claws as each claw may have come from a different individual.

[15] https://www.agingtheafricanlion.com/

[16] Jennifer R.B. Miller, Guy Balme, Peter A. Lindsey, Andrew J. Loveridge, Matthew S. Becker, Colleen Begg, Henry Brink, Stephanie Dolrenry, Jane E. Hunt, Ingela Jansson, David W. Macdonald, Roseline L. Mandisodza-Chikerema, Alayne Oriol Cotterill, Craig Packer, Daniel Rosengren, Ken Stratford, Martina Trinkel, Paula A. White, Christiaan Winterbach, Hanlie E.K. Winterbach, Paul J. Funston. 2016. Aging traits and sustainable trophy hunting of African lions, *Biological Conservation*, Volume 201, Pages 160-168,ISSN 0006-3207, https://doi.org/10.1016/j.biocon.2016.07.003.

Table 4. The full checklist approach to conducting an NDF (adapted from Rosser & Haywood (2002)[17]). Column 1 provides each factor to be considered, as well as a question to assist in assigning a score, and possible answers for African lions to be elaborated on by the Scientific Authority based on best available information. Column 2 provides a score description against which the question can be answered. Column 3 provides a score for each description. Column four shows a range of possible scores for African lions in different countries. Note that some factors might have similar scores across countries, while others may differ considerably across countries. This checklist can also be found in CITES (2000)[18]. See also CITES (2010)[19]. A spreadsheet designed to help capture all the scores is also available (see Annex 2).

Factors affecting management of harvesting regime	Score description	Score	Lion
Biological characteristics			
Life history: What is the species' life history? Basic life history characteristics indicate the likely sensitivity of a species to harvest. For example, r-selected species with a high intrinsic rate of increase are likely to be at less risk from harvest than K-selected species, which mature slowly and have low reproductive rates. African lions are long-lived (lionesses up to 14 -16 years, males up to 12 -14 years in the wild). Average litter size 1-4 cubs. Cub survival is high (>50% survival in the first year of life), which leads to longer birth intervals. Birth interval may vary according to habitat. If a female produces three cubs every 2.5 -3 years, the net effect is approximately one cub per year.	High reproductive rate, long-lived	1	
	High reproductive rate, short-lived	2	
	Low reproductive rate, long-lived	3	3
	Low reproductive rate, short-lived	4	
	Uncertain	5	
Ecological adaptability: To what extent Is the species adaptable (habitat, diet, environmental tolerance etc)? Ecological adaptability indicates the likely sensitivity to harvest and encompasses factors such as the species' breadth of habitat use, dietary breadth, and environmental tolerance (niche breadth). These factors are divided into the broad categories of generalist or specialist. Generalists can switch prey or habitat types relatively easily and are likely to be less affected by disturbances in their range than specialists that occupy a narrow ecological niche. A specialist with a low level of ecological adaptability is somewhat more likely to be negatively impacted by harvest for trade than a generalist (though not in all cases). For example, a given predator population at the top of a food chain, is likely to be more sensitive to harvest than a given herbivore population, lower in the food chain.	Extreme generalist	1	
	Generalist	2	2
	Specialist	3	
	Extreme specialist	4	
	Uncertain	5	

[17] Rosser, A. R., and M. J. Haywood. 2002. Guidance For CITES Scientific Authorities: Checklist to Assist in Making Non-Detriment Findings for Appendix II Exports. IUCN, Gland, Switzerland and Cambridge, U.K.
[18] CITES. 2000. Checklist to Assist in Making Non-Detriment Findings for Appendix II Exports (CoP 11 Inf. 11.3). Gigiri, Kenya.
[19] CITES (2010). International Expert Workshop on Non-Detriment Findings. CoP15 Inf. 3 Fifteenth Meeting of the Conference of the Parties Doha (Qatar), 13-25 March 2010 (Working Group Reports). From AC24 Doc. 9.1; Annex 1; Mammal Working Group Final Report.

Factors affecting management of harvesting regime	Score description	Score	Lion
Unlike many carnivores, lions can be considered generalists because they use a wide range of habitats and prey species. Lions have been successfully reintroduced to various habitats while they readily adapt to hunting in varied habitats.			
Dispersal efficiency: How efficient is the species' dispersal mechanism at key life stages? Species which have mechanisms that ensure a wide dispersal of individuals during some part of their life history may be less susceptible to the effects of harvest than species that do not disperse widely. Such species can more easily recolonize areas from which they have been locally extirpated. Lions are generally poor dispersers due to biological, social, and anthropogenic constraints. Male cubs disperse from their maternal pride at maturity but in so doing face high-risk environments where they may not thrive. Most young lionesses remain in the natal territory or do not disperse far. Many lions that disperse out of protected areas are killed.	Very good	1	
	Good	2	
	Medium	3	
	Poor	4	4
	Uncertain	5	
Interaction with humans: Is the species tolerant to human activity other than harvest? The tolerance of a species to human activity may indicate its likely sensitivity to the effects of harvest. Species mostly tolerant of human intervention are also likely to be the least affected by harvest. Many African lion populations are dependent on conservation and occur primarily in protected areas. Across Africa, lion populations in fenced areas are significantly closer to their estimated carrying capacity than unfenced populations. Lions are sensitive human modified landscapes.	No interaction	1	
	Pest/commensal	2	
	Tolerant	3	
	Sensitive	4	4
	Uncertain	5	
National status			
National distribution: How is the species distributed nationally? The pattern of distribution of a species provides some indication of a species' sensitivity to harvest. Widespread species with a continuous distribution at the national or regional level are likely to be less sensitive to harvest or other threatening factors than species with a widespread but fragmented distribution. Population fragmentation may produce sub-populations, adapted to a specialized or restricted habitat, that are too small to be viable. Localized endemic species adapted to specific habitats that are naturally	Widespread, contiguous in country	1	
	Widespread, fragmented in country	2	
	Restricted and fragmented	3	

Factors affecting management of harvesting regime	Score description	Score	Lion
fragmented, such as mountain chains, are more likely to be at risk from habitat change and the effects of harvest. For African lions this will be country dependent.	Localised	4	
	Uncertain	5	
National abundance: What is the abundance nationally? Species that are generally very abundant and occur at high densities are likely to be less sensitive to harvest than less common species occurring at naturally low densities. For species that are already uncommon or rare, the margin of error associated with the harvest is likely to be low. For example, predators are generally less numerous than prey species, or mahogany trees are generally less numerous than daisies. For African lions this will be country dependent.	Very abundant	1	
	Common	2	
	Uncommon	3	
	Rare	4	
	Uncertain	5	
National population trend: What is the recent national population trend? Trends in national population status provide some indication about a species' likely susceptibility to harvest: species with an increasing population are likely to be less sensitive to harvest than species whose population is decreasing. Ideally, trends in the national population status should be measured over a period independent of the harvest regime, and should recognise the "shifting baseline" phenomenon, in which each manager takes the population level first encountered as the baseline level. This phenomenon is very important for a species or population that has experienced a history of harvest and commercial use. Mathematical modelling suggests an independent time period of three generations is necessary as a minimum. The time period over which the population trend is assessed should be indicated in the assessment. If data from actual population surveys are available, ideally results from a minimum of three censuses should be used to evaluate trends. As population monitoring improves, the age and sex structure of the population should also be assessed. Failing this, trends in measures or indices of relative abundance can also be used. In the absence of such data from the field, indices of habitat loss can be used to infer whether populations are likely to be declining. For African lions this will be country dependent.	Increasing	1	
	Stable	2	
	Reduced, but stable	3	
	Reduced and still decreasing	4	
	Unknown	5	

Factors affecting management of harvesting regime	Score description	Score	Lion
Quality of information: What type of information is available to describe abundance and trend in the national population? The quality of data used to describe population trends is an important consideration in determining the robustness of the advice on non-detriment findings. For example, if all the data presented are recent and quantitative, then the confidence in the results of the assessment will be high. In contrast, if most data are anecdotal, the chance of making a robust non-detriment finding will be lower. Consequently, more emphasis is placed on good local qualitative knowledge than on out-of-date quantitative data. For African lions this will be country dependent.	Quantitative data, recent	1	
	Good local knowledge	2	
	Quantitative data, outdated	3	
	Anecdotal information	4	
	None	5	
Major threats: What major threat is the species facing: overuse/ habitat loss and alteration/ invasive species/ other: and how severe is it? Assessing the severity of the impact of the major threat provides a basis to weigh up the relative impact of the harvest. The major threat to the species at the national level should be provided in the assessment as should the severity of the threat. For example, if habitat loss is the major threat and its impact on the species is severe and irreversible, then it may be difficult to justify a harvest at all from an area not affected by the habitat destruction. In contrast, if the effects of habitat loss are reversible, a well-regulated harvest could possibly provide incentives to reverse the habitat loss. It is vital to any evaluation of non-detriment that the Scientific Authority assesses the impact of trade in relation to other threats to the species. For African lions this will be country dependent.	None	1	
	Limited/reversible	2	
	Substantial	3	
	Severe/irreversible	4	
	Uncertain	5	
Harvest Management			
Illegal off-take or trade: How significant is the national problem of illegal or unmanaged off-take or trade? The total harvest to which a population is subject at the national level must be considered in assessing the impacts of a harvest. Consequently, it is necessary to try to assess the levels of both unmanaged and illegal harvest, even though reliable information is particularly difficult to collect. Nonetheless, managers can often make an intuitive assessment of the significance of such harvest, in relation to the level of regulated legal harvest. Good local information and information from rangers and other enforcement personnel in the field is often exceedingly useful in evaluating the level of illegal harvest. For African lions this will be country dependent.	None	1	
	Small	2	
	Medium	3	
	Large	4	
	Uncertain	5	

Factors affecting management of harvesting regime	Score description	Score	Lion
Management history: What is the history of harvest? The management history of a harvest provides a good starting point to assess the likely sustainability of the harvest. A harvest with a long history of effective management, particularly well-regulated adaptive management, is more likely to be sustainable than an unmanaged harvest. A managed harvest, with adaptive management based on reliable monitoring of how harvest affects the population is the optimum situation. A managed harvest is one in which there is some degree of oversight and feedback, whether it be under a formal or an informal process. Any harvest regime necessarily contains an element of experiment and requires feedback and monitoring for absolute safety. An ongoing but informally managed harvest may not have a nationally approved structure, but may nonetheless have a good chance of sustainability, particularly if associated with strong local resource ownership. In contrast, the necessary feedback will not have taken place in a newly established programme of harvest, so the probability of sustainability may still be open to question. An unmanaged harvest is one in which there is no oversight and the harvest is taken in a purely opportunistic manner, giving least confidence in its sustainability. For African lions this will be country dependent.	Managed harvest: ongoing with adaptive framework	1	
	Managed harvest: ongoing but informal	2	
	Managed harvest: new	3	
	Unmanaged harvest: ongoing or new	4	
	Uncertain	5	
Management plan or equivalent: Is there a management plan related to the harvest of the species? The development and adoption of a national management plan or equivalent is necessary to build the political will to establish the process of sustainable use. Furthermore, a harvest managed according to a nationally approved management plan is likely to have undergone a process of review and scrutiny before official adoption and should thus have a higher chance of reliability. Ideally national management plans should be developed in conjunction with local inputs, because most harvested species are likely to be patchily rather than uniformly distributed throughout a range state, and so any harvest should be managed at the local level to avoid local extirpations. In range States with a strong federal/state or provincial system, strong management plans at the state or provincial level would be the equivalent of strong national management plans. Consequently, the optimum harvest management situation will include approved and co-ordinated local and national management plans. In cases where there is no approved plan and informal or unplanned management takes place, there will be little confidence in the probability that the harvest is sustainable or that the export is non-detrimental. For African lions this will be country dependent.	Approved and co-ordinated local and national management plans	1	
	Approved national/state/ provincial management plan(s)	2	
	Approved local management plan	3	
	No approved plan: informal unplanned management	4	
	Uncertain	5	
Aim of harvest regime in management planning: What is harvest aiming to achieve? The aim of the harvest regime for a species has a considerable bearing on the probability that a harvest will be	Generate conservation benefit	1	

Factors affecting management of harvesting regime	Score description	Score	Lion
sustainable. Where the main aim is to generate conservation benefits, particularly on a habitat or ecosystem level, the likelihood that the harvest will not be detrimental to the wild population should be higher. Where control of the target population is the aim, the rationale is that a managed situation is better in conservation terms than an unmanaged situation. For example, people may be more likely to tolerate crocodilians, and their habitats, if there is some visible form of management and protection of human life and economic returns. Where the aim is to maximize economic yield, the sustainability of the programme will have a lower probability, depending on the long-term strategy. Whilst maximum short-term economic yield derives from mining the resource completely, a strategy to maximize economic yield in the long-term should result in a more sustainable programme. Although this may only be true in theory, and in many cases harvesting is opportunistic and unselective, giving the low confidence in the sustainability of the harvest. Mining of the resource to commercial near extinction is often the result, followed by exploitation of other species. For African lions this will be country dependent.	Population management/control	2	
	Maximise economic yield	3	
	Opportunistic, unselective harvest, or none	4	
	Uncertain	5	
Quotas: Is the harvest based on a system of quotas? Quotas have been used as a means of regulating and managing harvests for decades, and export quotas have become increasingly common in CITES as questions have been raised about particular harvest regimes. As in the adoption of management plans, the optimum situation is one in which: a) a national quota is based on local quotas that guard against local over-exploitation, and b) the quota is based on knowledge of species' biology, life history, demographics, and reproductive capacity. Quotas can be based on the numbers of individuals removed from the wild, or on specific age or size classes within the population. A well-managed, biologically-based harvest programme may involve harvest only of immature animals or plants, depending on the life history of the species concerned. For many species in trade detailed biological information is not readily available, so a system of "cautious", co-ordinated local and national quotas may be adopted. "Cautious" national quotas are those which are very small relative to the likely national population size. Finally, untried local quotas based on a biological understanding of the species would be expected to give a higher chance of sustainability than a situation in which market driven, arbitrary or no quotas are set. "Market driven" describes the situation in some countries where the traders are able to demand a given quota, or quotas are assigned based on expected commercial demand. An arbitrary quota is one based on no apparent knowledge of the species. For African lions this will be country dependent.	Ongoing national quota: based on biologically derived local quotas	1	
	Ongoing quotas: "cautious" national or local	2	
	Untried quota: recent and based on biologically derived local quotas	3	
	Market-driven quota(s), arbitrary quota(s), or no quotas	4	
	Uncertain	5	
Control of harvest			

Factors affecting management of harvesting regime	Score description	Score	Lion
Harvesting in Protected Areas: What percentage of the legal national harvest occurs in State-controlled Protected Areas? Resource ownership and tenure can play an important role in determining the sustainability of harvests. If tenure and ownership are strong, the incentive for good management and regulation is likely to be greater. Protected areas have a variety of designations and purposes, depending on the national legal and political systems in place. The term, State Protected Area is here used to encompass a variety of PAs and multiple use zone types, where sustainable use and harvest are allowed, including forest, game and marine reserves, and so called "National Parks" in China and UK. Range States may have several types of such PAs which offer different degrees of protection from harvest. In general, greater confidence can be placed in the likely sustainability of the harvest if most of it occurs either in such State PAs or in other areas with strong tenure. For African lions this will be country dependent.	High	1	
	Medium	2	
	Low	3	
	None	4	
	Uncertain	5	
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? Strong local control over resource use may range from the local community management or private land management systems in place in southern Africa to the strong local control practised by communities. In all these cases either a local community or a private landowner is responsible for managing and regulating the harvest. In such systems, it is generally thought to be in the long-term best interests of those who own the resource to ensure that it is used in a sustainable manner. Consequently, greater confidence will be placed in the likely sustainability of the harvest if most harvest occurs in areas with strong resource ownership. For African lions this will be country dependent.	High	1	
	Medium	2	
	Low	3	
	None	4	
	Uncertain	5	
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? When there is neither strong state, nor community, nor private tenure, a system of open access prevails. In such cases there is no local control over the resource and a danger that there will be no incentive to regulate the harvest, resulting in a "free for all". Little confidence can be placed in the sustainability of harvest if most occurs in areas with actual or de facto open access. For African lions this will be country dependent.	None	1	
	Low	2	
	Medium	3	
	High	4	
	Uncertain	5	

Factors affecting management of harvesting regime	Score description	Score	Lion
Confidence in harvest management: Do budgetary and other factors allow effective implementation of management plan(s) and harvest controls? This question requires a judgement on the effectiveness of harvest controls. A variety of factors such as low budgets, lack of trained staff, other capacity deficiencies, or a lack of political will, may prevent harvest controls from being implemented adequately. A response that indicates a lack of confidence in harvest management should not be seen by the respondent as an indictment of his/her government, but rather a recognition of existing deficiencies. For African lions this will be country dependent.	High confidence	1	
	Medium confidence	2	
	Low confidence	3	
	No confidence	4	
	Uncertain	5	
Monitoring of harvest			
Methods used to monitor the harvest: What is the principal method used to monitor the effects of the harvest? Monitoring of the harvest is essential to ensuring the sustainability of any harvest. Direct population estimates of the harvested population or other measures of absolute density or abundance are generally considered the best methods but may be very expensive and time consuming to implement, or may be impossible for the species concerned for biological reasons. In the absence of direct population measures, quantitative indices of population abundance and trend (measures of relative density or abundance) of the harvested population can be used. Alternatively qualitative indices may be used, which, if based on good local knowledge, can provide good indications of the effects of harvest. Under CITES, all Scientific Authorities are required to monitor exports, so that these can be halted or reduced if levels are thought to be detrimental to the survival of species, or the species is being used at a level inconsistent with its role in its ecosystem. CITES Annual Report data can play a very important role in monitoring, and better use of these data, along with better communication between Scientific Authorities of different countries, would allow Scientific Authorities to build up increasingly accurate pictures of the effects of international trade on population trends. This question could receive multiple ticks in answer, but only the most effective/principal monitoring system should be scored. For African lions this will be country dependent.	Direct population estimates	1	
	Quantitative indices	2	
	Qualitative indices	3	
	National monitoring of exports	4	
	No monitoring or uncertain	5	
Confidence in harvest monitoring: Do budgetary and other factors allow effective harvest monitoring? This question requires a judgement on the effectiveness of the monitoring system in use. For example a Scientific Authority may know that direct population estimates are conducted, but that budgetary, staffing and other resource constraints result in such population counts only	High confidence	1	
	Medium confidence	2	

Factors affecting management of harvesting regime	Score description	Score	Lion
being conducted at long intervals, insufficient to monitor the effects of an annual harvest programme. A response that indicates a lack of confidence in harvest monitoring should not be seen by the respondent as an indictment of his/her government, but rather a recognition of existing deficiencies. For African lions this will be country dependent.	Low confidence	3	
	No confidence	4	
	Uncertain	5	
Incentives and benefits from harvesting			
Utilisation 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? This question aims to determine how use affects the species in relation to the major threat affecting the species. In some cases, use of the species may convey conservation benefits that mitigate the effects of some other major threat such as habitat destruction. In other cases, use does not affect the species detrimentally and does not have any mitigating effects on other major threats, so any use has a neutral effect. Thereafter, the harvest may become increasingly harmful in conjunction with the major threats. In yet other cases, the use may exacerbate other threats (such as disease, invasive species, or habitat deterioration), thereby necessitating a more cautious or precautionary non-detriment finding. The non detriment finding should never be taken out of context from other impacts and conservation benefits impinging on the species. For African lions this will be country dependent.	Beneficial	1	
	Neutral	2	
	Harmful	3	
	Highly negative	4	
	Uncertain	5	
Incentives for species conservation: At the national level, how much conservation benefit to this species accrues from harvesting? In some rare cases the species derives a direct benefit from the harvesting programme. In many cases, the benefit may not be financial, but in such cases, the harvest programme may significantly reduce illegal collection. For African lions this will be country dependent.	High	1	
	Medium	2	
	Low	3	
	None	4	
	Uncertain	5	
Incentives for habitat conservation: At the national level, how much habitat conservation benefit is derived from harvesting? This question looks at the broader implications of harvest to support	High	1	

Factors affecting management of harvesting regime	Score description	Score	Lion
habitat conservation. Any potential benefit to habitat conservation should be known and demonstrated. If a benefit is intended but it cannot be shown, this question should be answered as "low". If no conservation benefit is intended, this question should be answered "none". For African lions this will be country dependent.	Medium	2	
	Low	3	
	None	4	
	Uncertain	5	
Protection from harvest			
Proportion strictly protected: What percentage of the species' natural range or population is legally excluded from harvest? Strict protection, both legally and in practice, of representative parts of a species' range, or of a portion of the population sufficient to ensure its survival, should prevent harvest threatening the whole national population of a species. This question aims to assess the percentage that is strictly protected (where strict protection is defined as a prohibition on removal from the wild). For many species, the existence of strict protected areas where harvest is not allowed, with adequate enforcement controls, is an important assurance that core areas can provide recruitment to a population subject to harvest. For African lions this will be country dependent.	> 15%	1	
	5–15%	2	
	< 5%	3	
	None	4	
	Uncertain	5	
Effectiveness of strict protection measures: Do budgetary and other factors give confidence in the effectiveness of measures taken to afford strict protection? This question requires an assessment of the effectiveness of protection measures. Several factors including budgets and the resource ownership of such protected areas may have a bearing on how effective they are. A response that indicates a lack of effectiveness of strict protection measures should not be seen by the respondent as an indictment of his/her government, but rather a recognition of existing problems and challenges. For African lions this will be country dependent.	High confidence	1	
	Medium confidence	2	
	Low confidence	3	
	No confidence	4	
	Uncertain	5	
Regulation of harvest effort: How effective are any restrictions on harvesting (such as age or size, season or equipment) for preventing overuse? This question requires an assessment of the effectiveness of harvest restrictions. These restrictions generally comprise closed seasons, or portions of the population which cannot be targeted (based on size, for example). Much of the	Very effective	1	
	Effective	2	

Factors affecting management of harvesting regime	Score description	Score	Lion
success of these measures will depend on the political will for enforcement and on the degree to which harvesters are law-abiding. For African lions this will be country dependent.	Ineffective	3	
	None	4	
	Uncertain	5	

4. Special considerations for conducting NDFs for African lions

4.1 Data Sources

Potentially important sources of quantitative data that may be used for developing NDFs include formal animal counts conducted by government, private, or community reserves (the more rigorous the counting method the better – less rigour means more uncertainty), permits issues for restricted activities by the government, professional hunting registers (for example, as maintained by the South African and Zimbabwean Government), as well as the CITES trade database.

For information on threats to African lions, the global IUCN Red List of Threatened Species (2014) identifies the main threats:

- indiscriminate killing (primarily as a result of retaliatory or pre-emptive killing to protect human life and livestock);
- prey base depletion;
- habitat loss and conversion has led to a number of subpopulations becoming small and isolated; and
- trophy hunting has a net positive impact in a some areas, but may have at times contributed to population declines in other areas

Ideally, countries should develop national or regional Red List assessments, but it is acknowledged that conducting such assessments is not feasible for most African lion range States due to resource and/or capacity limitations.

4.2 Reliability of data

When using population data, one must be aware of the limitations and reliability of the data used. In recent years, there has been considerable debate regarding the reliability of the population data determined through index-based methods such as spoor counts and call-in surveys[20, 21,22]. This is particularly the case with spoor counts as recent studies have shown that the results produced are inaccurate and have inappropriately large confidence intervals[23].

It is strongly recommended that NDFs be guided with the best available data that are derived from robust and scientifically sound survey methods[24]. Basing quotas on population information that is "guessed" or unreliable can lead to over-harvesting. Unsustainable trophy hunting levels, through poorly regulated management and high hunting quotas, has been found to cause lion population

[20] Midlane, N., Justin O'riain, M., Balme, G.A. & Hunter, L.T.B. (2015) To track or to call: comparing methods for estimating population abundance of African lions Panthera leo in Kafue National Park. Biodiversity and Conservation, 24, 1311–1327. Kluwer Academic Publishers

[21] Dröge, E., Creel, S., Becker, M.S., Loveridge, A.J., Sousa, L.L. & Macdonald, D.W. (2020) Assessing the performance of index calibration survey methods to monitor populations of wide-ranging low-density carnivores. Ecology and Evolution, 10, 3276–3292. John Wiley and Sons Ltd.

[22] Braczkowski, Alex., Gopalaswamy, A.M., Elliot, N.B., Possingham, H.P., Bezzina, A., Maron, M., et al. (2020) Restoring Africa's Lions: Start With Good Counts. Frontiers in Ecology and Evolution, 8. Frontiers Media S.A.

[23] Dröge, E., Creel, S., Becker, M.S., Loveridge, A.J., Sousa, L.L. & Macdonald, D.W. (2020) Assessing the performance of index calibration survey methods to monitor populations of wide-ranging low-density carnivores. Ecology and Evolution, 10, 3276–3292. John Wiley and Sons Ltd.

[24] Braczkowski, Alex., Gopalaswamy, A.M., Elliot, N.B., Possingham, H.P., Bezzina, A., Maron, M., ET AL. (2020) Restoring Africa's Lions: Start With Good Counts. Frontiers in Ecology and Evolution, 8. Frontiers Media S.A.

declines[25,26,27, 28]. It is therefore vital that quotas are only set for populations where reliable data are available.

4.3 Scale of assessment

Defining the geographic scale of an NDF assessment is critical from the beginning. NDFs can be made at different geographic scales, starting as small as individual hunting concessions, moving through sub-national (provincial) and national scales, right through to an international level. When considering the levels of harvesting of African lions for an NDF (e.g., through trophy hunting statistics), the main impacts of extraction will be felt at the harvest site, and this is key to understanding the sustainability of the offtakes.

If it is determined that harvesting rates are sustainable (i.e., non-detrimental) at a local level, then it is likely that populations of African lions in other parts of their national range will not be negatively impacted by these harvest rates. In cases where harvesting only takes place in a single location, then the local NDF may be sufficient, and the Scientific Authority can use this information in conjunction with the preliminary assessments outlined above.

According to Morgan[29], the most useful 'unit of measurement' in determining whether exports will not be detrimental to the survival of the species is the national population of the country involved. If there are multiple harvest sites within a country, then these must all be included in the NDF assessment.

Examples of NDFs at an international level tend to apply to migratory species and species where shared stocks are commercially used (e.g., sturgeons) rather than terrestrial mammals like African lions. However, it is still important to consider potential wider impacts of harvesting of African lions, especially when dealing with transboundary populations and it is important to ensure that harvest from an area in question does not impact negatively on populations in neighbouring countries.

4.4 Transboundary populations

In situations where African lions cross international boundaries, NDF considerations may be complex. The Scientific Authority has an obligation to consider the conservation status, the level of trade, and the threats faced by African lions in neighbouring countries, as well as the potential capacity constraints that may impact the conservation of lions. If the threats and levels of trade are high in neighbouring countries and conservation management experience capacity constraints, this should be considered in the development of the NDF. It is strongly recommended that Scientific Authorities of African lion range States liaise, collaborate and, ideally, share in the development of NDFs or create consultative bodies for this purpose. This can be accomplished through both formal and informal communication channels between CITES Management and Scientific Authorities in neighbouring range States.

4.5 Data deficiency

Many Scientific Authorities from African lion range States face limitations in quality and quantity of data needed to make a detailed NDF. Despite the recently completed global Red List assessment for the African lion[30], only one range State has a Regional Red List assessment for the species. There is considerable variability in access to data and, while many countries have comprehensive datasets, others know almost nothing about their African lion populations. In Module 1 and 2 risk evaluation and

[25] Lindsey, P.A., Roulet, P.A. & Romañach, S.S. (2007) Economic and conservation significance of the trophy hunting industry in sub-Saharan Africa. Biological Conservation.
[26] Croes, B.M., Funston, P.J., Rasmussen, G., Buij, R., Saleh, A., Tumenta, P.N. & De Iongh, H.H. (2011) The impact of trophy hunting on lions (Panthera leo) and other large carnivores in the Bénoué Complex, northern Cameroon. Biological Conservation, 144, 3064–3072.
[27] Groom, R.J., Funston, P.J. & Mandisodza, R. (2014) Surveys of lions Panthera leo in protected areas in Zimbabwe yield disturbing results: What is driving the population collapse? Cambridge University Press. ORYX
[28] Mweetwa, T., Christianson, D., Becker, M., Creel, S., Rosenblatt, E., Merkle, J., et al. (2018) Quantifying lion (Panthera leo) demographic response following a three-year moratorium on trophy hunting. PLoS ONE, 13. Public Library of Science.
[29] Morgan, David H. W. 2008. “CITES Non-Detriment Findings in Context.”
[30] Nicholson et al. In press. IUCN Red List of the African Lion

uncertainty is discussed in details including the uncertainty arises from a lack of information, incomplete knowledge, or unpredictable circumstances.

In cases where uncertainty is high, it may be possible to take steps to improve the quality and quantity of information to reduce that uncertainty and to enable better evidence-based decisions (Table 5). Simply because a species is threatened does not mean that harvests cannot take place, but additional safeguards are required based on the assessment of risk. This may require identifying new sources of information or setting up research projects to generate data.

While a precautionary approach may be warranted, a rigid regulatory approach to preventing trade or denying an NDF may not be necessary. Instead, under the right circumstances, a cautious approach can be taken to maintain the status-quo until such time as more data can be obtained, and this can be achieved, in part, by placing conditions on the harvest and export of the species in question (termed a '[conditional NDF]').

In practice, decisions will always need to be made where scientific knowledge is inadequate, incomplete, out of date or unreliable[31]. Uncertainty frequently surrounds species' range, numbers and status, population dynamics, the impact of harvest on populations, what constitutes a sustainable level of harvesting, and the role of species in their ecosystems. But uncertainty and risk are not limited to biological issues, and changes in socio-economic and political factors can also affect the demand for species in trade and affect the sustainability of harvests.

4.6 Adaptive management

Given some inevitable uncertainty in the information available when conducting NDFs, and assuming that Scientific Authorities pursue new information to reduce risk and uncertainty, another valuable tool that may reduce the requirement for negative NDF findings is adaptive management[32].

Adaptive management is discussed in detail in Module 2. It is a structured, iterative approach to making good decisions, despite imperfect knowledge, uncertainty, and accompanying risk. It involves actively learning from the outcomes of management actions and making adjustments based on new information and insights. It can be thought of as 'learning by doing' and recognises that natural systems are dynamic, and there is often limited knowledge about their functioning and response to interventions. It is particularly valuable in situations where there are complex ecological interactions, diverse stakeholder interests, and changing environmental conditions.

Of relevance to the making of NDFs for trade that may be important for socio-economic reasons, the approach of adaptive management is not to suspend harvesting while awaiting greater knowledge, but rather to use information gained during an iterative management process to build greater understanding and reduce uncertainty.

Adaptive management will not work in all situations, however, and precaution can be built into initial assumptions in cases where risks are assessed to be greater. The process requires rigorous monitoring to generate new information, and this may not be achieved due to poor planning or insufficient funds. Scientific Authorities must apply their minds carefully when considering adaptive management in situations where trade poses a risk to a species.

For more information on how to build adaptive management into the NDF process, Scientific Authorities are directed to the CITES guidance document on the subject.

[31] CITES. 2004. CITES and the Precautionary Principle (Submitted by the United Kingdom) (CoP 13 Inf. 44).
[32] Module 2 of guidance on making non-detriment findings.

Table 5. Information requirements for conducting detailed NDFs: Why each characteristic is important for NDFs, the current state of knowledge among range States regarding the characteristics, and how information deficiencies can be improved to strengthen NDF assessments.

NDF Characteristic	Why these are important	Current state of knowledge	How to improve knowledge
Biological characteristics: • Life history traits • Ecological adaptability • Dispersal efficiency • Interactions with humans	These characteristics determine the extent to which African lions can sustain a level of wild harvest. They need to be understood to set effective quotas.	These attributes are generally well-known for African lions, and there is low variability between populations in different countries.	In general, this information is not lacking, and information is readily available in the literature.
National status: • National distribution • National abundance • National population trend • Information quality • Major threats	These characteristics contribute towards the evaluation of the species conservation status and affect the risks that might arise from harvesting. Even if not formally assessed as being at risk of extinction, African lions might be affected by other drivers of biodiversity loss (e.g., habitat loss) that might lead to a decline in population size, area of occupancy or other measures of population viability. Exploitation for trade might then increase the pressure on the species and increase the risks to it.	Range States have varying degrees of knowledge of the national status of African lions, with only one country having conducted a Regional Red List Assessment. Some range States have virtually no current knowledge of the status of their African lions.	It is acknowledged that conducting national surveys is an expensive exercise that many range States have insufficient financial resources, technical expertise, and capacity to undertake. It is recommended that range States lacking such resources make their needs known to CITES, IUCN or other international conservation organisations and work with them to try to reduce the information gaps. Likewise, international conservation organisations should engage with range States to identify needs and work to resolve these.
Harvest management: • Rates of illegal offtake • Management history	The extent and degree of harvest or offtake (legal and illegal) directly affects risk. Occasional harvesting of just a few individuals from a large and robust population is likely to be low risk but more intensive harvests from smaller or more vulnerable populations increase the risk. In African lions,	Range States have varying degrees of knowledge of rates of offtakes, while the management histories, state of development of management plans, and abilities to set quotas	It is acknowledged that gathering information on offtakes and the development of management plans and quota systems requires financial and technical resources that may be unavailable to range States. They are recommended to seek advice

NDF Characteristic	Why these are important	Current state of knowledge	How to improve knowledge
• Management plan • Aim of harvest • Quotas	these risks might be amplified if the wrong age and sex individuals are removed (e.g., by hunting females or young males rather than by hunting males over the age of 7 years). Moreover, when offtakes rates are not known, especially illegal offtakes, this raises the level of uncertainty in the NDF development.	differ widely. Some range States do not have management plans.	and support from CITES, IUCN or other international conservation organisation, while international organisations are encouraged to provide support.
Control of harvest: • Harvesting in protected areas • Harvesting in areas with strong tenure • Open access harvesting • Confidence in harvest management.	Resource ownership and tenure can play an important role in determining the sustainability of harvests. If tenure and ownership are strong, the incentive for good management and regulation is likely to be greater. It is generally thought to be in the long-term best interests of those who own the resource to ensure that it is used in a sustainable manner. Consequently, greater confidence will be placed in the likely sustainability of the harvest if most harvest occurs in areas with strong resource ownership. When there is neither strong state, community, or private tenure, a system of open access prevails. In such cases there is no local control over the resource and a danger that there will be no incentive to regulate the harvest, resulting in a "free for all".	There is great variability in land tenure systems between African lion range States, but each country should know the systems in place in areas where harvesting is known to take place. However, it is unlikely that all range States know where all harvesting takes place.	This is primarily an internal issue for range States, who need to engage with national parks authorities, private landowners, and communities to better understand where harvesting activities are occurring in their countries. Range States that have not yet done so are recommended to identify all potential stakeholders (landowners involved in harvesting) to gather information on where harvesting is taking place and to identify who has control of it.
Monitoring of harvest: • Monitoring methods • Confidence in monitoring	Monitoring offtakes is essential to ensuring the sustainability of any harvest. If the numbers of African lions removed are not known, it will be impossible to assess the impact on populations. Under CITES, all Scientific Authorities are required to monitor exports so that these can be halted or reduced if levels are thought to be detrimental to the survival of species, or the	Many African lion range States monitor their offtakes very carefully, but some do not and, in these cases, it is not known how much information they have. The quality of the monitoring is not known for all countries, meaning that the	Direct monitoring of harvesting is the best option but may be expensive and time consuming to implement. Alternatively qualitative indices may be used, which, if based on good local knowledge, can provide good indications of the effects of harvest.

NDF Characteristic	Why these are important	Current state of knowledge	How to improve knowledge
	species is being used at a level inconsistent with its role in its ecosystem.	confidence in reporting is not always clear.	CITES Annual Report data can play an important role in monitoring, and better use of these data, along with better communication between Scientific Authorities of different countries, would allow Scientific Authorities to build up increasingly accurate pictures of the effects of international trade on population trends.
Incentives and benefits from harvesting: • Utilisation compared to other threats • Species conservation incentive • Habitat conservation incentive	These characteristics consider the benefits brought to conservation through incentivising the people who harvest African lions. They can be viewed as methods to encourage sustainable and responsible use rather than just demonstrating that lion populations can sustain the current offtake rates. Approaches that incentivise sustainable use may lead to growing African lion populations rather than just keeping the status quo.	These are hard indicators to measure, but many range States do monitor some related metrics (such as the % of hunting income that goes to communities). Countries with limited knowledge of their African lion populations will also have limited knowledge of incentives.	To better understand the incentives derived from African lions, range States need to identify relevant information sources that link to incentive type schemes (e.g., CBNRM groups, trophy hunting operators), if these exist.
Protection from harvest: • Proportion protected from harvest • Effectiveness of protection • Regulation of harvest	These characteristics determine whether there are populations of African lions that are protected from all forms of harvesting. Such populations can be a buffer for exploited lions and might become important in future as a source population if African lions decline in other areas due to over-harvesting.	Range States should have detailed knowledge of which protected areas are afforded protection from hunting but may not have good knowledge of the African lion populations in these areas. Some may also not know how effective the protection afforded by these areas is.	Range States without a good understanding of how many African lions occur in areas sheltered from hunting can improve this aspect of their NDF assessment by improving knowledge of the species distribution. They also need to conduct effective monitoring to evaluate how effective their protection measures are. As described above, however, resource limitations can impair this knowledge, so external support may need to be found.

4.7 Species role in the ecosystem

CITES Article IV, paragraph 3 states:

> *'A Scientific Authority in each Party shall monitor both the export permits granted by that State for specimens of species included in Appendix II and the actual exports of such specimens.* ***Whenever a Scientific Authority determines that the export of specimens of any such species should be limited in order to maintain that species throughout its range at a level consistent with its role in the ecosystems in which it occurs*** *and well above the level at which that species might become eligible for inclusion in Appendix I, the Scientific Authority shall advise the appropriate Management Authority of suitable measures to be taken to limit the grant of export permits for specimens of that species.*

An ecological role refers to the function or position that a species has within an ecosystem and describes the interactions and relationships between species and their environment, including other species, habitats, and resources. African lions are indicator species for a healthy ecosystem and serve several key ecological roles such as helping to maintain a healthy balance among herbivores[33] and keeping mesopredator (e.g., jackals) populations under control by supressing population growth of these species[34]. Other impacts of removing African lions have been observed, for example, the extirpation of lions and leopards in Ghana led to the growth of populations of Olive baboons *(Papio anubis*), which not only led to increased predation on smaller antelope species[35], but also resulted in an increased spread of zoonotic gastrointestinal parasites which may have been transmitted to humans[36]. African lions also have high cultural and ecotourism value which helps incentivise responsible management of ecosystems by people.

When developing NDFs for African lions, Scientific Authorities should consider the following potential ecosystem impacts (adapted from Oldfield[37]):

- Will the harvest rate reduce the abundance of another native species;
- Will the harvest result in an increase in the abundance of a non-native species or over-abundance of another species;
- Will the harvest result in a change in any ecosystem process or structural feature;
- Will the harvest result in a change in behaviour of the species being assessed or other species;
- Will the harvest result in a change in genetic structure or variability of the population that indicates that one or more of the ecological functions of the species' are, or will become, impaired.

Although African lions are transboundary species, they are not strictly migratory, so it is unlikely that impacts of harvesting will reach beyond the ecosystems in which they live. If their ecosystem stretches into another country, however, the Scientific Authority should consider the impacts of harvesting on their neighbour.

[33] Ripple W.J. & Beschta R.L. (2012) Trophic cascades in Yellowstone: the first 15 years after wolf reintroduction. *Biological Conservation*, 145, 205-213.)
[34] Yarnell, R. W., Phipps, S, W. L., Burgess, L. P., Ellis, J. A., Harrison, S. W. R., Dell, S., MacTavish, D., MacTavish, L. M. & Scott, D. M. (2013). The influence of large predators on the feeding ecology of two African mesocarnivores: the black-backed jackal and the brown hyaena. South African Journal of Wildlife Research 43, 155–166
[35] J. Bro-Jørgensen, D.P. Mallon (Eds.), Antelope Conservation: From Diagnosis to Action (Wiley-Blackwell) (2016)
[36] John Asiedu Larbi, Stephen Akyeampong, Amina Abubakari, Seth Offei Addo, Dinah Okoto, Henry Hanson, "Zoonotic Gastrointestinal Parasites of Baboons (*Papio anubis*) in the Shai Hill Reserve in Ghana", *BioMed Research International*, vol. 2020, Article ID 1083251, 6 pages, 2020. https://doi.org/10.1155/2020/1083251
[37] Module 1 and 2 of guidance on making non-detriment findings

5. Interpreting the findings of a detailed NDF

The NDF scoring system described above will not, in many cases, provide an unequivocal answer to the question of whether the volumes and rates of harvesting and trade are detrimental to African lions. In other words, deciding whether there is a positive finding will often require further thought and consideration by the Scientific Authority.

A widely used option to visualise the scores obtained from a detailed assessment is the radar chart. Developing a radar chart to bring all the scores together is a simple procedure that only requires access to, and intermediate level knowledge of, Excel spreadsheets and charts. A template for adding detailed NDF checklist scores is included as Annex 2 of this document. This template automatically creates a radar chart for viewing.

Two hypothetical radar plots with different findings are shown in Figure 4. Each radar plot produces a central area of colour (usually red for NDFs), with more red signifying a larger number of high scores. Small areas of red in a radar chart (Example Species A in Figure 4) suggest that the proposed or ongoing trade poses relatively low risk to the species and that there is high confidence in the scores, and that that this may (but not necessarily) lead to a positive finding. Large areas of red in a radar chart (Example Species B in Figure 4) suggest that the proposed or ongoing trade poses relatively high risk or that there is low confidence (i.e., uncertainty) in the scores, which may lead to a negative or conditional finding.

The radar chart fulfils two roles. First, it assists with the decision-making process of making a non-detriment finding and allows possible problems to be identified and rectified as soon as possible. Second, in the example case of Species B in Figure 4, factors that receive high scores could be further investigated to determine whether anything can be done to improve their score and allow a new NDF to be conducted in future. For example, the hypothetical national distribution is scored as uncertain. This received a score of 5 because of the uncertainty involved but could be improved if the country responsible were able to conduct a national survey of African lions. Another example of an action that would improve the score for Species B would be the development and implementation of a national management plan for African lions.

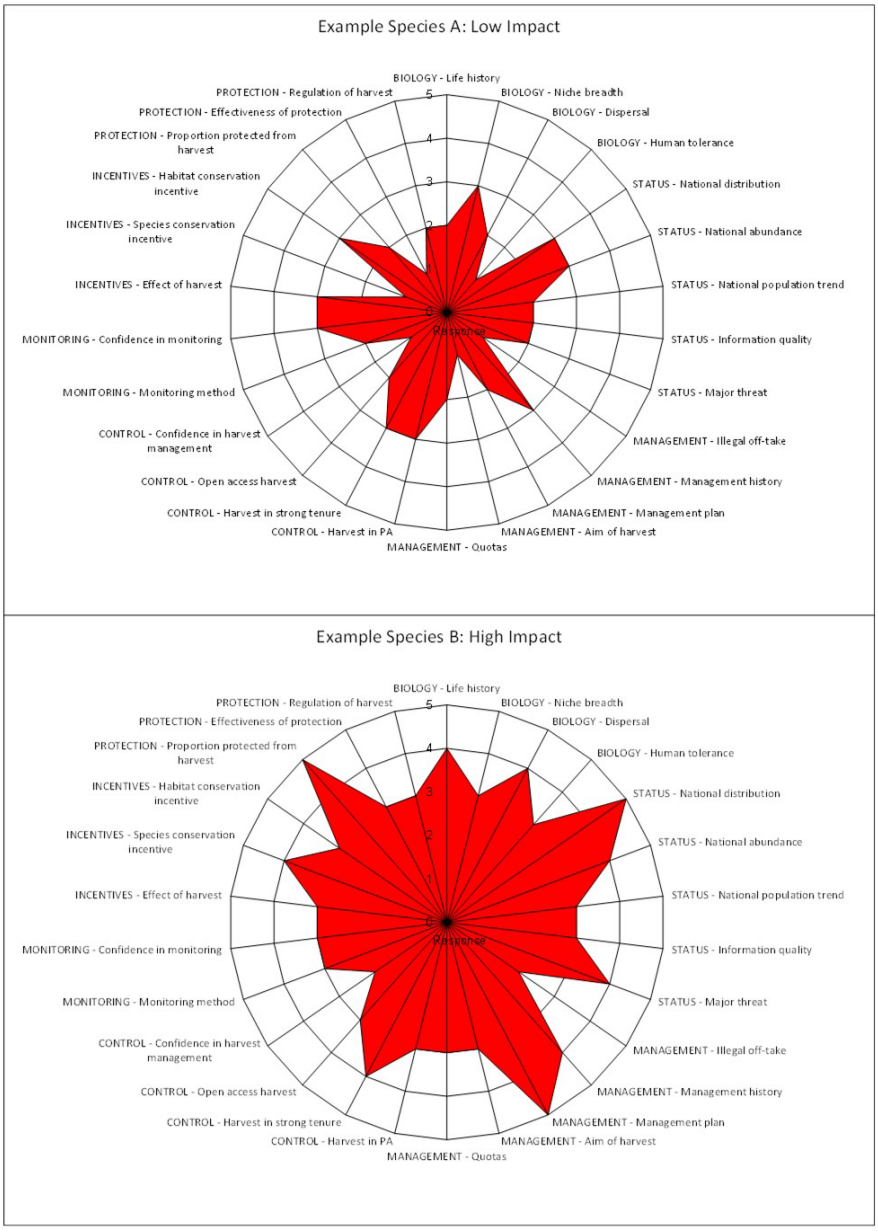


Figure 4. Radar plots for detailed NDF assessments for two hypothetical species. Each radar plot produces a central area of colour (usually red for NDFs), with more red signifying a larger number of high scores. Example species A visualises the scores for a species with small areas of red which suggests that the proposed or ongoing trade poses relatively low risk to the species and that there is high confidence in the scores. Example species B visualises the scores for a species with large areas of red which suggests that the proposed or ongoing trade poses relatively high risk or that there is low confidence (uncertainty) in the scores.

6. Making a decision

Non-detriment decisions can be positive or negative. A positive NDF ('positive finding') means that the Scientific Authority believes that the proposed on ongoing export/trade of African lions or their parts will be non-detrimental to the species. A negative NDF ('negative finding') means that the Scientific Authority believes that the proposed or ongoing export/trade may be detrimental and may negatively impact the species. Such a finding generally means that trade should not continue or should not be approved.

A ‘conditional NDF’ or ‘conditional finding’ means that a positive non-detriment finding has been made subject to certain (precautionary) conditions set by the exporting Scientific Authority and/or by those responsible for managing harvests. These conditions are intended to mitigate defined risks and ensure sustainability of harvests. This approach can be taken to make positive NDFs, and allow some trade, even where information or data are limited or of poor quality; the conditions thus provide safeguards against the risk of over-exploitation. In practice, it is rare to find a positive NDF being made without any conditions at all; ‘conditional NDFs’ are the norm, and the chances are that any NDF uses some of the measures outlined below.

Annex 1. Summary of harvest regime Template

Annex 2. Detailed checklist calculations