

Spotty Data: Managing International Leopard (*Panthera pardus*) Trophy Hunting Quotas Amidst Uncertainty

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ABSTRACT

Leopard (*Panthera pardus*) conservation has a strong international dimension. Hunting trophy export quotas established for African range states under the Convention on International Trade in Endangered Species (CITES) are a case in point. We test these quotas, and the methods for their establishment, against the benchmark of the general principles of precaution, sustainable use and adaptive management. The various national approaches and the CITES regime condoning them largely fail this test. For decades, CITES bodies have endorsed apparently arbitrary quotas lacking robust scientific bases, without regular adjustment. Thus, the quotas have been inadequately performing their assigned function within the Convention's framework. The way in which the CITES leopard quota regime has been operating is fundamentally at odds with the principles of sustainable use, precaution and adaptive management. To remedy this, we offer recommendations on how to embed a science-based, sustainable, precautionary and adaptive approach to quota-setting within the CITES system.

KEYWORDS: leopard, quotas, trophy hunting, Convention on International Trade in Endangered Species of Wild Fauna and Flora, precautionary principle/approach, adaptive management

1. INTRODUCTION

The leopard (*Panthera pardus*) was globally red-listed as 'vulnerable' in 2016,¹ following a 'least concern' listing in 2002 and a 'near threatened' listing in 2008. Many of the nine leopard subspecies are 'endangered' or 'critically endangered'.² This is

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1 Andrew B Stein and others, '*Panthera pardus*. The IUCN Red List of Threatened Species 2016' (2016) e.T15954A102421779 <<https://www.iucnredlist.org/species/15954/102421779>> (accessed 17 November 2019).

2 *ibid*; the subspecies are *Panthera pardus pardus* (Africa), *P. p. nimr* (Arabia—critically endangered), *P. p. saxicolor* (Southwest Asia—endangered), *P. p. melas* (Java—critically endangered), *P. p. kotiya* (Sri

due to a range of threats, including habitat loss and fragmentation, prey depletion, human–wildlife conflict, illegal hunting and trade and poorly regulated trophy hunting.³ Leopards remain in small parts of the species' historic range.⁴ The ranges of some subspecies have collapsed, with leopards disappearing from 98% of their former range.⁵ Three subspecies occupy 97% of the remaining leopard range, which puts the prospects of the other six subspecies into a stark perspective.⁶ Leopards are also notoriously difficult to count,⁷ and the lack of hard data on population numbers is often compensated for by optimistic 'guesstimates', with many stakeholders in sub-Saharan Africa relying upon widely criticised and outdated population assessments from the late 1980s.⁸

Despite all this, leopards do not yet receive as much attention as some of the other big cats, like tigers (*Panthera tigris*), snow leopards (*Panthera uncia*) and lions (*Panthera leo*), and continue to suffer from a widespread but clearly misplaced 'assumption that their conservation status is assured'.⁹ Leopards do have a unique potential to serve as 'ambassador species' for global biodiversity conservation. They are highly charismatic, their (still) widespread distribution overlaps the ranges of many other threatened species, and now that leopards too are plummeting to rarity they can be expected to increasingly capture the public's eye.¹⁰

There is a strong international dimension to leopard conservation. We focus on one aspect where this dimension is especially pronounced, and where science and politics meet, namely the nexus between intergovernmental regulation and leopard trophy hunting. Specifically, we analyse the export quotas established in this regard for various African range states under the Convention on International Trade in Endangered Species (CITES).¹¹

After exploring the broader context of intergovernmental cooperation for leopard conservation and the general features of CITES export quotas, we proceed to assess

Lanka—endangered), *P. p. fusca* (Indian subcontinent), *P. p. delacouri* (Southeast Asia into southern China), *P. p. japonensis* (northern China), *P. p. orientalis* (Russian Far East, Korean Peninsula and north-eastern China—critically endangered).

3 *ibid.*

4 Andrew P Jacobson and others, 'Leopard (*Panthera pardus*) Status, Distribution, and the Research Efforts across its Range' (2016) 4 *PeerJ* e1974.

5 Susana J Rostro-Garcia and others, 'An Adaptable but Threatened Big Cat: Density, Diet and Prey Selection of the Indochinese Leopard (*Panthera pardus delacouri*) in Eastern Cambodia' (2018) 5 *Royal Society Open Science* 171187.

6 Jacobson and others (n 4).

7 Guy A Balme, Rob Slotow and Luke TB Hunter, 'Impact of Conservation Interventions on the Dynamics and Persistence of a Persecuted Leopard (*Panthera pardus*) Population' (2009) 142 *Biological Conservation* 2681.

8 In particular, Rowan B Martin and Thomas de Meulenaar, *Survey of the Status of the Leopard (Panthera pardus) in Sub-Saharan Africa*, Report submitted to CITES Secretariat (CITES 1988).

9 Guy A Balme and others, 'An Adaptive Management Approach to Trophy Hunting of Leopards (*Panthera pardus*): A Case Study from KwaZulu-Natal, South Africa' in David W Macdonald and Andrew J Loveridge (eds), *Biology and Conservation of Wild Felids* (OUP 2010) 341, 342.

10 Ewan A Macdonald and others, 'Identifying Ambassador Species for Conservation Marketing' (2017) 12 *Global Ecology and Conservation* 204; Céline Albert, Gloria M Luque and Franck Courchamp, 'The Twenty Most Charismatic Species' (2018) 13 *PLoS One* e0199149.

11 Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973) 993 UNTS 243 (hereinafter CITES).

established CITES leopard quotas, and the methods through which they are determined, against the benchmark provided by the basic principles of precaution, sustainable use and adaptive management. The analysis employs a cross-disciplinary approach, combining international law methodology with insights regarding the ecological, socio-economic and political aspects of the subject matter.¹² From this analysis flow various recommendations concerning the way forward.

2. LEOPARDS AND INTERNATIONAL LAW

Leopards have a good claim to being the world's most international big cat, with 79 range countries, at least 40 transboundary populations¹³ and numerous relevant international treaties, both regional and global. The latter include, for instance, the two global site-based treaties, namely the Ramsar Convention on Wetlands of International Importance¹⁴ and the UNESCO World Heritage Convention.¹⁵ Many listed sites to which these treaties offer protection and other benefits include leopard habitat.¹⁶ To illustrate, Zambia has designated the Kafue Flats, Zambezi Floodplains, Busanga Swamps and five other sites as Wetlands of International Importance, covering over 4,000,000 hectares and including prime leopard habitat.¹⁷ Two relevant global species-based treaties are CITES and the Bonn Convention on the Conservation of Migratory Species (CMS).¹⁸ The former is the focus of this article. To provide sufficient context, however, we briefly address the CMS.

The CMS was previously of little relevance to leopard conservation. This changed in 2017 when the 12th CMS Conference of the Parties (COP) added the species to the Convention's Appendix II. Along with lions, leopards were added to the previously CMS-listed large carnivore species snow leopard, cheetah (*Acinonyx jubatus*), African wild dog (*Lycaon pictus*) and polar bear (*Ursus maritimus*), in recognition of the strong transboundary dimension to such species' conservation.¹⁹ The CMS COP

12 On the need for and nature of interdisciplinarity in international environmental law scholarship, see eg Elizabeth Fisher and others, 'Maturity and Methodology: Starting a Debate about Environmental Law Scholarship' (2009) 21 *Journal of Environmental Law* 213; and Arie Trouwborst and others, 'International Wildlife Law: Understanding and Enhancing its Role in Conservation' (2017) 67 *BioScience*, 784.

13 Governments of Ghana, Iran, Kenya and Saudi Arabia, 'Proposal for the Inclusion of the Leopard (*Panthera pardus*) on Appendix II of the Convention' (2017) UNEP/CMS/COP12/Doc.25.1.4.

14 Convention on Wetlands of International Importance especially as Waterfowl Habitat (1971) 996 UNTS 245.

15 Convention Concerning the Protection of the World Cultural and Natural Heritage (1972) 1037 UNTS 151.

16 See eg Arie Trouwborst and others, 'International Law and Lions (*Panthera leo*): Understanding and Improving the Contribution of Wildlife Treaties to the Conservation and Sustainable Use of an Iconic Carnivore' (2017) 12 *Nature Conservation* 83, Tables 3 and 4. On the importance of protected areas for leopard conservation, see eg Leandro Abade and others, 'Spatial Variation in Leopard (*Panthera pardus*) Site Use across a Gradient of Anthropogenic Pressure in Tanzania's Ruaha Landscape' (2018) 13 *PLoS One* e0204370.

17 The other sites are Bangweulu Swamps, Luangwa Flood Plains, Lukanga Swamps, Mweru wa Ntipa and Tanganyika; see <<http://www.ramsar.org>> (accessed 17 November 2019).

18 Convention on the Conservation of Migratory Species of Wild Animals (1979) 1651 UNTS 333 (hereinafter CMS).

19 Timothy Hodgetts and others, 'Improving the Role of Global Conservation Treaties in Addressing Contemporary Threats to Lions' (2018) 27 *Biodiversity and Conservation* 2747; Trouwborst and others

has a tradition of flexibly interpreting the term ‘migratory’, as not only including typical migrants like barn swallows (*Hirundo rustica*) and monarch butterflies (*Danaus plexippus*), but also species that cross borders primarily because their ranges overlap more than one country, such as cheetahs and gorillas (*Gorilla beringei*, *Gorilla gorilla*).²⁰ The Appendix II regime promotes coordinated conservation actions by range states, facilitates access to financial and institutional support and promotes sharing of data and best practices, while leaving parties’ options for sustainable use unaffected.²¹ For leopards in Africa, such actions will be developed primarily under the umbrella of the joint CMS–CITES African Carnivores Initiative, which also covers lions, cheetahs and African wild dogs, and had its first meeting in November 2018.²²

Until the 2017 COP, CMS listing proposals had always been adopted by consensus. On this occasion, however, a few countries blocked consensus, leading to the first votes in CMS COP history. Votes were necessary regarding listing proposals for leopard, lion, giraffe (*Giraffa camelopardalis*) and chimpanzee (*Pan troglodytes*).²³ The leopard proposal had been submitted by Ghana, Kenya, Saudi Arabia and Iran,²⁴ and was supported by 68 CMS parties. Four countries voted against: Uganda, Tanzania, Zimbabwe and South Africa. The principal argument they voiced was that leopards do not fit the Convention’s definition of ‘migratory species’, taking a much stricter interpretation of this term than they themselves and other parties had in the past.²⁵ It would appear, however, that this terminology was not actually the principal reason for opposition. This is especially clear in the case of Tanzania which, at the same COP, while opposing the listing of leopards, proposed the chimpanzee’s listing.²⁶ Rather, it seems likely that the leopard’s listing was seen as a first step towards a future uplisting to CMS Appendix I, which *would* create serious potential obstacles to the species’ utilisation, including trophy hunting.²⁷ The opposition of the aforementioned four countries regarding the leopard’s Appendix II listing may thus be indicative of a degree of apprehension regarding the future development of the CMS regime.²⁸

(n 16); David W Macdonald, Dominic DP Johnson and Harvey Whitehouse, ‘Towards a More Natural Governance of Earth’s Biodiversity and Resources’ (2019) 17 Conservation and Society 108.

- 20 See eg the broad interpretation of the term ‘migratory species’ in CMS COP Resolution 11.33 (2017), and prior to that COP Resolution 2.2 (1988); see also Michael Bowman, Peter Davies and Catherine Redgwell, *Lyster’s International Wildlife Law* (2nd edn, CUP 2010) 538–41.
- 21 CMS, arts IV–V; Bowman, Davies and Redgwell, *ibid* 551–64.
- 22 See <<http://www.cms.int/en/legalinstrument/african-carnivores-initiative>>.
- 23 Report of the 12th Meeting of the Conference of the Parties to the Convention on the Conservation of Migratory Species of Wild Animals (2017) UNEP/CMS/COP12/REPORT (hereinafter CMS COP12 Report).
- 24 Governments of Ghana, Iran, Kenya and Saudi Arabia (n 13).
- 25 CMS COP12 Report. For instance, CMS COP Resolution 11.32 (adopted by consensus in 2017) expressly recognizes with regard to lions that ‘*Panthera leo* . . . and all its evolutionarily significant constituents, including *Panthera leo persica*’ – the latter being confined to a single country, India – ‘satisfy the Convention’s definition of “migratory species”’; see also Hodgetts and others (n 19) 2752–53; Bowman, Davies and Redgwell (n 20) 538–41; Trouwborst and others (n 16) 108–09.
- 26 CMS COP12 Report.
- 27 CMS, art III; Bowman, Davies and Redgwell (n 20) 545–50.
- 28 This suggestion is based on informal conversations with stakeholders and a lack of alternative explanations with greater explanatory power. Incidentally, South Africa, Uganda and Zimbabwe subsequently filed reservations regarding the leopard’s Appendix II listing.

Table 1. Development of CITES leopard quotas over time

	1983	1985	1987	1989	1992	1994	2002	2004	2007	2019
Botswana	80	80	80	100	100	130	130	130	130	130
C.A.R.	–	–	40	40	40	40	40	40	40	40
Ethiopia	–	–	500	500	500	500	500	500	500	500
Kenya	80	80	80	80	80	80	80	80	80	(80)
Malawi	20	20	20	20	50	50	50	50	50	(50)
Mozambique	60	60	60	60	60	60	60	60	120	120
Namibia	–	–	–	–	100	100	100	250	250	250
South Africa	–	–	–	50	75	75	75	150	150	150
Tanzania	60	250	250	250	250	250	500	500	500	500
Uganda	–	–	–	–	–	–	–	–	28	28
Zambia	80	300	300	300	300	300	300	300	300	300
Zimbabwe	80	350	500	500	500	500	500	500	500	500
Total	460	1140	1830	1900	2055	2085	2335	2560	2648	2648

Notes: Years indicate COP meetings. New quotas and quota changes are shown in bold.

3. LEOPARD QUOTAS UNDER CITES

CITES entered into force in 1975. From the outset, the leopard has been listed on the Convention's Appendix I. Thus, as a rule, international trade for primarily commercial purposes is forbidden.²⁹ Procedurally, both an import permit and an export permit are required for leopard parts and products to legally cross borders between CITES countries.³⁰ *Legal* international trade is largely limited to hunting trophies and skins as part of export quotas for several African countries. These have been set and adjusted several times by the CITES COP, and are currently regulated by Resolution 10.14 on quotas for leopard hunting trophies and skins for personal use.³¹ **Table 1** shows how these quotas have developed since 1983. All changes hitherto involved quota *increases*, building up to a current total of 2,648, reached in 2007. *Illegal* trade in leopard products, meanwhile, remains a serious problem across the species' range.³²

At its 17th meeting, in 2016 in Johannesburg, the COP asked each range state involved to review whether its own leopard quota was still set at a level which is non-detrimental.³³ In response, two countries—Kenya and Malawi—asked for their quotas to be cancelled.³⁴ Three countries did not file a report in time. The other seven all submitted reports asking for current quotas to be maintained.³⁵ As discussed below, the CITES Animals Committee and Standing Committee both issued

29 CITES, art III.

30 *ibid.*

31 CITES Resolution Conf. 10.14 (Rev. COP16).

32 Stein and others (n 1); Panthera, 'A Scientific Overview of the Conservation Status of African Leopards (*Panthera pardus*), with a Specific Focus on Trophy Hunting' (2018) CITES Doc AC30 Inf. 23.

33 CITES COP Decision 17.114 (2016).

34 CITES SC 70 Doc 55 (2018).

35 *ibid.*

their approval of these requests in the course of 2018. The COP at its 18th meeting in Geneva in August 2019 left the various export quotas as they were.

In what follows, we review these leopard quotas within their broader context, and in light of present knowledge on leopard conservation and sustainable use. We do this with the recognition that current international wildlife law and policy, CITES included, reflect an assumption that consumptive forms of sustainable use, including trophy hunting, are in principle appropriate and compatible with wildlife conservation. We make no value judgement here on the broader ethical and societal questions concerning utilisation of wild animals.³⁶

4. THE ART OF SCIENTIFIC QUOTA-SETTING

Quota-setting is a delicate business. A quota should be based on the best information available, and be adjusted regularly to changing circumstances. Moreover, it must ensure two things, and this is a challenging balancing act. On the one hand, a quota must reflect a sustainable offtake. Under the CITES leopard quota regime, authorities of importing countries are in principle supposed to approve all import permit applications for leopard skins that are within one of the established CITES quotas.³⁷ In other words, they must be able to rely on the quota being sustainable—or ‘non-detrimental to the survival of the species’, in CITES terms.³⁸ On the other hand, each quota must be set high enough to allow for the ups and downs of adaptive harvest management, especially bearing in mind that CITES quotas are fixed for at least two or three years (the period between one COP and the next). Set a quota too high, and it opens the door to unsustainable offtakes. Set it too low, and it could curb the actual or potential benefits of trophy hunting.³⁹

The current ubiquitous use of quotas within the CITES framework is not expressly based on the Convention itself, which does not refer to them, but has developed subsequently. Wijnstekers characterises the use of quotas as ‘probably the most effective tool for the regulation of international trade in wild fauna and flora currently available’.⁴⁰ Quotas can certainly reduce bureaucratic burdens—when a single annual quota takes the place of various separate non-detriment findings (NDFs)—although such bureaucratic gains can also be achieved by conducting complex, holistic NDFs to set the framework within which trade can take place. The great majority of CITES quotas are individually set by range states, for Appendix II species. Quotas for Appendix I species can be assigned by the COP, either through an annotation to the species’ listing or through a resolution.⁴¹

36 See eg John A Vucetich and others, ‘The Value of Argument Analysis for Understanding Ethical Considerations Pertaining to Trophy Hunting and Lion Conservation’ (2019) 235 *Biological Conservation* 260.

37 CITES COP Resolutions Conf 10.14 and 9.24 (Rev COP13).

38 CITES, art III(2)(a).

39 IUCN Species Survival Commission, *Guiding Principles on Trophy Hunting as a Tool for Creating Conservation Incentives* (IUCN 2012).

40 Willem Wijnstekers, *The Evolution of CITES: A Reference to the Convention on International Trade in Endangered Species of Wild Fauna and Flora* (11th edn, CIC 2018) 561.

41 CITES COP Resolution Conf 9.21 (Rev COP18).

Some general tenets of CITES quota-setting are reflected in the 2013 Guidelines for Management of Nationally Established Export Quotas.⁴² According to these, a quota should be based on an NDF by the CITES Scientific Authority of the country involved, and should ‘ensure that the species is maintained throughout its range at a level consistent with its role in the ecosystem in which it occurs’, in accordance with CITES Article IV(3).⁴³ An NDF, in turn, is understood by the COP as ‘the result of a *science-based* assessment that verifies whether a proposed export is detrimental to the survival of the species or not’.⁴⁴ More concretely, according to non-binding guidance provided by the COP, NDFs should be based on ‘resource assessment methodologies which may include, but are not limited to, consideration of:

- A. species biology and life-history characteristics;
- B. species range (historical and current);
- C. population structure, status and trends (in the harvested area, nationally and internationally);
- D. threats;
- E. historical and current species-specific levels and patterns of harvest and mortality (e.g. age, sex) from all sources combined;
- F. management measures currently in place and proposed, including adaptive management strategies and consideration of levels of compliance;
- G. population monitoring; and
- H. conservation status.⁴⁵

An NDF should be made whenever an export quota is set or revised, and ought to be reviewed annually.⁴⁶ For the purposes of the Convention’s procedural trade requirements, the quota itself then takes the place of individual NDFs.⁴⁷ A CITES export quota is ‘not a target’ and there is ‘no need for a quota to be fully used’, whereby it is recognised that in some cases the export of specimens will take place after the year of their removal from the wild, ‘as happens with hunting trophies’.⁴⁸ The ‘fundamental principle to follow’ is that ‘decision-making regarding the level of sustainable exports must be scientifically based’, and harvests themselves well-managed.⁴⁹ Obviously, although there is no need for a quota to be fully used, the difference between a quota and the actual amount of exports should not be too great either. As the CITES Secretariat’s own training materials on export quotas acknowledge, ‘[e]xporting at levels far below a quota usually suggests that the quota was set arbitrarily’.⁵⁰

42 CITES COP Resolution Conf 14.7 (Rev COP15), Annex.

43 *ibid*, para 10.

44 CITES COP Resolution Conf 16.7 (Rev COP17) para 1(a)(i) (emphasis added).

45 *ibid*, para 1(a)(ix).

46 CITES COP Resolution Conf 14.7 (Rev COP15), Annex, para 10.

47 *ibid*, para 3.

48 *ibid*, para 2.

49 *ibid*, para 6.

50 CITES Secretariat, ‘The Role of Quotas in CITES’ (2013), ‘Train the Trainers’ PowerPoint presentation, CITES Virtual College <<https://cites.unia.es/cites/mod/resource/view.php?id=58>> (accessed 17 November 2019) 20.

Importantly, the CITES quota guidelines acknowledge that export quotas may not be the most suitable management tool in each context, and that their use may have undesirable effects, 'particularly if they are not adjusted as necessary to take into account changing biological, legal or administrative needs'.⁵¹ As elaborated below, this is a pertinent question with regard to leopards.

5. QUOTA-SETTING AND UNCERTAINTY

A lack of robust scientific information on which to base safe quota levels is an obvious Achilles' heel of any quota system.⁵² Regarding the real-world application of the aforementioned guidelines, to borrow the words of the CITES Secretariat, '[t]he expectation that annual quotas should be based on detailed demographic information on the harvested population and the use of some or other harvesting model may be unrealistic.'⁵³

Indeed, with leopards, a tremendously complicating factor is the widespread lack of reliable population estimates. This shortcoming is broadly recognised.⁵⁴ The following statement from the academic literature appears representative: 'Ideally, trophy hunting quotas should be based on robust population estimates, but wildlife management authorities rarely possess such data because of time, funding and logistical constraints.'⁵⁵ In addition, there are knowledge gaps regarding the extent to which, and conditions under which, trophy hunting benefits leopard conservation.⁵⁶

The key question thus becomes how to approach quota-setting in the face of such pervasive uncertainty? Possible approaches include the following: (1) basing quotas on expert opinions, guesstimates and/or simplified models; (2) applying adaptive harvest management; and (3) not having any quota unless there is sufficiently robust information to base it on. In practice, as explored below, all of these approaches and combinations thereof have actually been applied by range states with regard to leopards.

6. THE PRECAUTIONARY PRINCIPLE

A pre-eminent general principle that was specifically devised to guide decision-making in the face of uncertainty is the precautionary principle, also often referred to

51 CITES COP Resolution Conf 14.7, Annex, para 5.

52 Wijnstekers (n 40) 561.

53 CITES Secretariat (n 50) 28.

54 Eg Balme and others (n 9); Guy A Balme and others, 'Failure of Research to Address the Rangewide Conservation Needs of Large Carnivores: Leopards in South Africa as a Case Study' (2013) 7 Conservation Letters 3; Alex Brackowski and others, 'Who Bites the Bullet First? The Susceptibility of Leopards *Panthera pardus* to Trophy Hunting' (2015) 10 PLoS One e0123100; Jacobson and others (n 4); Stein and others (n 1); Sam T Williams and others, 'Population Dynamics and Threats to an Apex Predator Outside Protected Areas: Implications for Carnivore Management' (2017) 4 Royal Society Open Science 161090; Paolo Strampelli and others, 'Leopard *Panthera pardus* Density in Southern Mozambique: Evidence from Spatially Explicit Capture-Recapture in Xonghile Game Reserve' (2018) Oryx [published online, 7 September 2018]; Panthera (n 32).

55 Brackowski and others, *ibid* 2.

56 Some of these uncertainties correspond with those identified for lion trophy hunting by David W Macdonald and others, 'Lions, Trophy Hunting and Beyond: Knowledge Gaps and Why They Matter' (2017) 47 Mammal Review 247.

as the precautionary approach.⁵⁷ Generally speaking, the essence of the precautionary principle is straightforward. It aims to prevent serious and irreversible harm to the environment, by erring on the side of caution, giving nature the benefit of the doubt, not using a lack of full scientific certainty as a reason to delay action, and ultimately acting, guided by the information that is available, so as to ensure the best conservation outcome. *In dubio pro natura*. Precaution has become one of the most important general principles of international environmental law and policy, and there is hardly any environmental treaty or intergovernmental declaration from the last three decades that does not feature it.

The concrete application of the precautionary principle is necessarily context-dependent, and precise formulations differ from one document to another. For example, according to the Convention on Biological Diversity (CBD),⁵⁸ ‘where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat.’⁵⁹ In another variation on the theme, the parties to both CITES and the CMS have agreed that ‘by virtue of the precautionary approach and in case of uncertainty regarding the status of a species [or the impact of trade on the conservation of a species], the Parties shall act in the best interest of the conservation of the species concerned and . . . adopt measures that are proportionate to the anticipated risks to the species.’⁶⁰

Despite its apparent simplicity, the precautionary principle and its practical implications remain prone to considerable confusion, notwithstanding—or perhaps partly because of—a vast literature on its interpretation and application.⁶¹ In particular, the allocation of the burden of proof and the relationship between the precautionary principle, sustainable use and adaptive management are subject to a confusion of almost Babylonian proportions.⁶²

Two interrelated misunderstandings surface especially often in discussions about uncertainty, precaution and the utilisation of wildlife. These are the notions that (i) as a rule, the precautionary principle favours strict protection over sustainable use, and (ii) as a rule, the principle only allows for use insofar as there is adequate evidence of its sustainability, thus placing the burden of proof on proponents of use. Both of these recurrent misrepresentations are highly relevant to the issue of leopard export quotas and must therefore receive attention here.

57 Generally see eg Rosie Cooney and Barney Dickson (eds), *Biodiversity & the Precautionary Principle* (EarthScan 2005); Jacqueline Peel, *The Precautionary Principle in Practice: Environmental Decision-Making and Scientific Uncertainty* (The Federation Press 2005); Elizabeth Fisher, Judith Jones and René von Schomberg (eds), *Implementing the Precautionary Principle: Perspectives and Prospects* (Edward Elgar 2006); Arie Trouwborst, *Precautionary Rights and Duties of States* (Martinus Nijhoff 2006).

58 Convention on Biological Diversity (1992) 1760 UNTS 79 (hereinafter CBD).

59 CBD preamble.

60 CITES COP Resolution Conf 9.24 (Rev COP17); CMS COP Resolution 11.33.

61 Between 2000 and 2006 at least 20 books were dedicated to the principle, see Arie Trouwborst, ‘The Precautionary Principle in General International Law: Combating the Babylonian Confusion’ (2007) 16 *Review of European, Comparative & International Environmental Law* 185, fn 3.

62 Rosie Cooney, *The Precautionary Principle in Biodiversity Conservation and Natural Resource Management: An Issues Paper for Policy-Makers, Researchers and Practitioners* (IUCN 2004); Cooney and Dickson (n 57); Trouwborst, *ibid*.

7. PRECAUTION AND SUSTAINABLE USE

The compatibility, at a generic level, of the precautionary principle and sustainable use follows from various basic treaty provisions. For instance, the ‘conservation and sustainable use of natural resources’ are key objectives of the 2003 (revised) African Convention on the Conservation of Nature and Natural Resources,⁶³ and the treaty sets out a fundamental obligation for its parties to ‘adopt and implement all measures necessary to achieve the objectives of this Convention, in particular through preventive measures and the application of the precautionary principle’.⁶⁴ The unambiguous assumption here is that the application of the precautionary principle is a principal means to achieving sustainable use. It is in this light that one must view, for instance, the parties’ obligations to ‘manage harvestable populations . . . in a sustainable manner’ and to regulate hunting ‘with a view to ensuring that the use of any population is sustainable’.⁶⁵

Also within the overarching global biodiversity treaty, the CBD, a good marriage exists between the precautionary principle (stated in the Preamble, cited above) and the sustainable use of biodiversity, the latter being one of the Convention’s objectives⁶⁶ and defined as the ‘use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity’.⁶⁷ When adopting the Addis Ababa Principles and Guidelines for the Sustainable Use of Biodiversity in 2004, CBD parties agreed that in order to avoid potential adverse long-term impacts, ‘it is incumbent on all resource users, to apply precaution in their management decisions and to opt for sustainable use management strategies and policies that favour uses that provide increased sustainable benefits while not adversely affecting biodiversity’.⁶⁸

The treaty text of CITES pre-dates the explicit emergence of precautionary and sustainable use terminology, but both concepts have been embraced and jointly incorporated in the CITES COP’s subsequent practice. This practice includes a commitment to use the CBD Addis Ababa Principles and Guidelines when making NDFs.⁶⁹ Generally, the COP’s own guidelines reflect an understanding by CITES parties that, in the face of uncertainty, ‘restricting all international trade may not always be the most precautionary course of action’.⁷⁰ While trade *can* in various cases indeed be linked to over-utilisation and thus be detrimental to the survival of many species, the COP has also recognised that conversion of wildlife habitat to other forms of land use may result from failure to ‘take into account the needs of local people and provide incentives for

63 African Convention on the Conservation of Nature and Natural Resources <<http://www.african-union.org>> (2003) art II. The Convention entered into force in 2016 and currently has 17 contracting parties.

64 *ibid*, art IV.

65 *ibid*, art IX(2)-(3).

66 CBD, art 1.

67 *ibid*, art 2.

68 CBD COP Decision VII/12, Annex II, para 8(f).

69 CITES COP Resolution Conf 13.2 (Rev COP14).

70 Alison M Rosser, Naseer Tareen and Nigel Leader-Williams (2005) ‘The Precautionary Principle, Uncertainty and Trophy-Hunting’ in Cooney and Dickson (n 57) 58.

sustainable use of wild fauna and flora', and that 'returns from legal use may provide funds and incentives' for wildlife conservation.⁷¹

A case in point is the allowance for non-commercial trade of trophy-hunted Appendix I specimens, whether on the basis of individual permits only⁷² or a COP-appointed quota. The COP has acknowledged in this regard that 'well-managed and sustainable trophy hunting is consistent with and contributes to species conservation' by providing habitat conservation incentives, livelihood opportunities for rural communities, and 'benefits which can be invested for conservation purposes'.⁷³ Parties are therefore recommended to consider these various benefits 'when considering stricter domestic measures and making decisions relating to the import of hunting trophies'.⁷⁴ Eminent illustrations of the latter statement's purport are the hunting trophy import restrictions that were established or at least contemplated by various countries in the aftermath of the controversial death of a Zimbabwean lion named Cecil at the hands of an American hunter in 2015, which caused an unprecedented (social) media storm.⁷⁵

Appendix I annual export quotas established, *inter alia*, for hunting trophies through annotation include cheetah quotas allotted in 1992 to Botswana (5), Zimbabwe (50) and Namibia (150), and a quota of 1600 Nile crocodiles (*Crocodylus niloticus*) allotted to Tanzania.⁷⁶ Appendix I hunting trophy export quotas established by Resolution include, besides leopards, an annual quota of 12 markhor (*Capra falconeri*) for Pakistan, established in 1997,⁷⁷ and black rhinoceros (*Diceros bicornis*) quotas set in 2004 for Namibia and South Africa, for five male rhinos a year each—with the South African quota recently changed into 0.5% of its national black rhino population.⁷⁸ The black rhino Resolution advances the view that 'the financial benefits derived from trophy hunting of a limited number of specimens will benefit the conservation of the species directly and provide additional incentives for conservation and habitat protection, when such hunting is done within the framework of national conservation and management plans and programmes'.⁷⁹

It is notable that the CITES COP, when including the precautionary approach in its crucial Resolution 9.24 on species listing criteria, expressly adopted the neutral

71 CITES COP Resolution Conf 8.3 (Rev COP13); see also Melissa Lewis, 'CITES and Rural Livelihoods: The Role of CITES in Making Wildlife Conservation and Poverty Reduction Mutually Supportive' (2009) 12 *Journal of International Wildlife Law and Policy* 248.

72 CITES COP Resolution Conf 2.11 (Rev COP9).

73 CITES COP Resolution Conf 17.9.

74 *ibid*, para 7.

75 David W Macdonald and others, *Report on Lion Conservation with Particular Respect to the Issue of Trophy Hunting*, Report for UK Under Secretary of State for the Environment (WildCRU 2016); David W Macdonald and others, 'Cecil: A Moment or a Movement? Analysis of Media Coverage of the Death of a Lion, *Panthera leo*' (2016) 6 *Animals* 26; on the unintended consequences of hunting trophy import bans generally, see, *inter alia*, Amy Dickman and others, 'Trophy Hunting Bans Imperil Biodiversity' (2019) 365 *Science* 874.

76 CITES Appendix I.

77 CITES COP Resolution 10.15 (Rev COP14); see also Rosser, Tareen and Leader-Williams (n 70).

78 CITES COP Resolution Conf 13.5 (Rev COP18); see also Nigel Leader-Williams and others, 'Trophy Hunting of Black Rhino *Diceros bicornis*: Proposals to Ensure Its Future Sustainability' (2005) 8 *Journal of International Wildlife Law and Policy* 1.

79 CITES COP Resolution Conf. 13.5 (Rev COP18).

wording ‘to act in the best interest of the conservation of the species concerned’, instead of a presumption favouring trade restrictions.⁸⁰ Despite this lack of such a presumption on paper, the COP’s voting record regarding concrete species listing decisions *does* appear to show an overall preference for the tightening or maintenance of trade restrictions in cases of uncertainty, especially where ‘charismatic’ species are concerned.⁸¹ Recent examples from the 18th COP include the listing of the giraffe (*G. camelopardalis*) in Appendix II despite scientific advisory bodies and the CITES Secretariat advising that such listing was not in the species’ best interest;⁸² and the COP’s refusal, again contrary to scientific advice, to grant Namibia’s request for a slight relaxation of trade restrictions for white rhinoceros (*Ceratotherium simum*) from this country.⁸³ Such recurrent discrepancies between the COP’s established guidelines and parties’ actual voting behaviour constitute a well-known weakness in the functioning of the CITES regime more generally.⁸⁴

8. PRECAUTION AND THE BURDEN OF PROOF

In general terms, the adage ‘when in doubt, don’t’ is *not* an accurate representation of what the precautionary principle requires. At the same time, in various regulatory contexts, the principle has been given operational effect by requiring some degree, and sometimes a high degree, of proof before potentially harmful activities are

80 CITES COP Resolution 9.24 (Rev COP13).

81 Rosser, Tareen and Leader-Williams (n 70); Annecoos Wiersema, ‘Uncertainty and Markets for Endangered Species under CITES’ (2013) 22 *Review of European, Comparative & International Environmental Law*, 239; Daniel WS Challender and Douglas C MacMillan, ‘Investigating the Influence of Non-State Actors on Amendments to the CITES Appendices’ (2019) 22 *Journal of International Wildlife Law and Policy* 90; Albert and others (n 10).

82 According to IUCN and TRAFFIC, *IUCN and TRAFFIC Analyses of the Proposals to Amend the CITES Appendices at the 18th Meeting of the Conference of the Parties* (IUCN 2019), CITES COP18 Inf. 12 (9), there is ‘little evidence to suggest that the poaching of Giraffe is driven by international trade,’ whereas the ‘main populations that are subject to legal offtake for international trade are in Namibia, South Africa and Zimbabwe, where the hunting of Giraffe, mainly for trophies, and export is permitted, and populations are generally increasing, except in Zimbabwe where declines have not been attributed to international trade’. Likewise, the Secretariat, in CITES COP18 Doc 105.1 (2019), emphasized that the available evidence does *not* suggest that international trade is a driver for giraffe population declines, and that an Appendix II listing ‘would not address the main threats to the conservation of the species’, and therefore recommended parties to reject the listing proposal. Nevertheless, the COP adopted the proposal, with 106 parties in favour and 21 against, thus creating apparently unwarranted CITES bureaucracy in importing and exporting states, and potential hurdles to the species’ sustainable use.

83 IUCN and TRAFFIC, *ibid*; CITES COP18 Doc 105.1.

84 For instance, whereas according to COP Resolution 9.24 (Rev COP17) listing in Appendix I should only occur when the best information available indicates that particular biological and trade criteria are met, and despite the aforementioned neutral formulation of the precautionary approach, an ‘ethical or ideological opposition to any commercial use of a species has sometimes been a factor’ in such listing decisions—to put it in the understated words of Robert Jenkins, ‘The Significant Trade Process: Making Appendix II Work’ in Jon Hutton and Barnabas Dickson (eds), *Endangered Species, Threatened Convention: The Past, Present and Future of CITES* (Earthscan 2000) 47, 49. Particularly striking was the statement which Tanzania delivered during the closing plenary of COP18, on behalf also of eight other parties (Botswana, Democratic Republic of the Congo, Eswatini, Mozambique, Namibia, South Africa, Zambia, Zimbabwe). In the words of the summary record (CITES Doc COP18 Plen Rec 4 (Rev 1), 2019), these parties expressed ‘grave concerns with the implementation of the Convention and over the anti-sustainable use and anti-trade ideology that came to light during the polarized discussions on African charismatic large mammals.’

allowed to take place. In these instances, it is initially for the proponents of an activity to furnish a degree of proof of safety or sustainability, rather than for the opponents to demonstrate the activity's harmfulness. Under the precautionary principle, the practice of states shows a great variety of ways in which the burden of proof is divided amongst relevant actors.⁸⁵

The most rigorous evidentiary constructions tend to be limited to particularly vulnerable parts of the environment, and/or to settings where threats are relatively straightforward.⁸⁶ Road construction, pesticide use, fisheries and the introduction of alien species are good examples, as the potential environmental impacts of these activities are almost universally negative, as opposed to the harvesting of wildlife, the overall impact of which may be negative, neutral or positive, depending on the circumstances.⁸⁷ A prime example is the famous Wadden Sea judgment issued by the Court of Justice of the European Union in 2004 on the application of the EU Habitats Directive in light of the precautionary principle.⁸⁸ In designated sites that are part of the Natura 2000 protected area network, Member State authorities may authorise a potentially harmful activity—in this case mechanical cockle fishing—only 'if they have made certain that it will not adversely affect the integrity of that site'.⁸⁹ This is the case 'where no reasonable scientific doubt remains as to the absence of such effects'.⁹⁰ Another illustration can be found in the CBD Guiding Principles on Invasive Alien Species of 2002, according to which no intentional introduction of a potentially invasive alien species should take place without prior authorisation from a competent authority.⁹¹ Authorities should 'make all efforts to permit only those species that are unlikely to threaten biological diversity', whereby the 'burden of proof that a proposed introduction is unlikely to threaten biological diversity should be with the proposer of the introduction or be assigned as appropriate by the recipient State'.⁹²

An interesting example from a wildlife harvesting context is the interpretation of a provision from the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA),⁹³ which requires parties to 'prohibit the taking of birds' from certain listed populations 'during their various stages of reproduction and rearing and during their return to their breeding grounds if the taking has an unfavourable impact on the conservation status of the population concerned'.⁹⁴ An AEWA guidance document interprets this provision in light of the precautionary principle, as follows:

85 Trouwborst (n 57) 193–226.

86 *ibid.*

87 Cooney (n 62); Rosser, Tareen and Leader-Williams (n 70).

88 CJEU Case C-127/02 *Waddenvereniging and Vogelbescherming* [2004] ECR I-7405.

89 *ibid.*, para 61.

90 *ibid.*; the Court adds that this authorization criterion 'integrates the precautionary principle' and 'makes it possible effectively to prevent adverse effects on the integrity of protected sites' (para 58).

91 CBD COP Decision VI/23, Annex ('Guiding principles for the Prevention, Introduction and Mitigation of Impacts of Alien Species that Threaten Ecosystems, Habitats or Species'), Guiding Principle 10.

92 *ibid.*

93 Agreement on the Conservation of African-Eurasian Migratory Waterbirds (1995) 2365 UNTS 251 (hereinafter AEWA).

94 *ibid.*, art 2.1.2(a).

If it is known that taking will have an unfavourable impact on conservation status, taking must be prohibited (unless a[n] exemption is applicable);

If there is not sufficient data to determine whether taking will have an unfavourable impact, taking should be prohibited in accordance with the precautionary principle since it cannot be shown that any take will be sustainable;

If it is known that there will not be an unfavourable impact, Parties are not required to prohibit taking.⁹⁵

Notably, this interpretation does not apply to the taking of waterbirds as such, but concerns only certain vulnerable populations during periods of particular vulnerability.

Applied to trophy hunting export quotas under CITES, the precautionary principle does *not* as a rule require conclusive evidence of sustainability for any quota to be allocated although, as noted above, the COP does recommend that quotas are science-based.⁹⁶ Interestingly, according to one of the COP's non-binding guiding principles for NDFs, 'the data requirements for a determination that trade is not detrimental to the survival of the species should be proportionate to the vulnerability of the species concerned'.⁹⁷ It is instructive, furthermore, to consider the CITES regime for the setting of quotas, by the COP, for Appendix I species—like the leopard:

- a. a Party wishing the Conference of the Parties to establish a quota for a species included in Appendix I, or to amend an existing quota, should submit its proposal to the Secretariat, with supporting information including details of the scientific basis for the proposed quota, at least 150 days before a meeting of the Conference of the Parties; and
- b. whenever the Conference of the Parties has set an export quota for a particular species included in Appendix I, this action by the Parties satisfies the requirements of Article III regarding the findings by the appropriate Scientific Authorities that the export will not be detrimental to the survival of the species, provided that the quota is not exceeded and no new scientific or management data have emerged to indicate that the population of the species in the range State concerned can no longer sustain the agreed quota.⁹⁸

Rather than placing the burden of proof squarely on the shoulders of the proponents of trade, this regime involves a subtle division and shifting of evidentiary burdens amongst stakeholders. Initially, the prospective exporting range state requesting a quota is expected to provide 'supporting information including details of the scientific basis for the proposed quota'. Once a quota has been set by the COP on this

95 Jesper Madsen and others, 'Guidelines on Sustainable Harvest of Migratory Waterbirds' (2015) AEW Conservation Guidelines No 5, para 5.3.3.

96 CITES COP Resolution Conf 14.7 (Rev COP15), Annex, para 6; CITES COP Resolution Conf 16.7 (Rev COP17) paras 1(a)(i) and (ix).

97 Resolution Conf 16.7, *ibid*, para 1(a)(iv).

98 CITES COP Resolution Conf 9.21 (Rev COP18) para 1.

basis, importing countries are expected to approve any imports that are part of the quota, *except* when they have obtained ‘new scientific or management data’ which ‘indicate that the population of the species in the range state concerned can no longer sustain the agreed quota’.

9. PRECAUTION AND ADAPTIVE MANAGEMENT

Generally speaking, the precautionary principle can and has been implemented through a wide array of means, including impact assessments, licensing, use conditions and restrictions, buffer zones, best practice requirements, a variety of evidentiary requirements and moratoriums.⁹⁹ Ultimately, the principle aims for the implementation of the actions that are expected to work most effectively, or to be—in CITES and CMS parlance—‘in the best interest of the conservation of the species’. Therefore, the restriction or prohibition of trophy hunting, to focus on this article’s topic, ‘may be the precautionary response in some circumstances, but may not be in others’,¹⁰⁰ because curbing harvest or export may improve or worsen the fate of wildlife populations, depending on the circumstances.¹⁰¹ Ideally, any action on the basis of the precautionary principle is accompanied by research to reduce important uncertainties, and by monitoring of the measures’ impact, and then continuously adjusted in light of emerging information.¹⁰²

Particular challenges arise when the choice is between two or more courses of action *all* of which may result in adverse impacts that are potentially significant but hard to predict with any great accuracy.¹⁰³ In such situations, the precautionary principle does not offer quick and easy solutions, especially given the absence of a presumption in favour of strict protection over sustainable use.¹⁰⁴ An example of an especially daunting scenario of this kind is the debate on the appropriate way forward for CITES with regard to management of rhino horn trade, where diametrically opposed courses of action (banning trade or legalising it) can both *prima facie* be based on the available information.¹⁰⁵

It follows from these considerations that adaptive harvest management, if well administered and implemented, can be a very appropriate way of implementing the

99 Fisher and others (n 57); Trouwborst (n 57).

100 Rosser, Tareen and Leader-Williams (n 70) 66.

101 Cooney (n 62); Cooney and Dickson (n 57); Peter A Lindsey, Pierre-Armand Roulet and Stéphanie Romanach, ‘Economic and Conservation Significance of the Trophy Hunting Industry in Sub-Saharan Africa’ (2007) 134 *Biological Conservation* 455; Andrew J Loveridge and others, ‘The Impact of Sport-Hunting on the Population Dynamics of an African Lion Population in a Protected Area’ (2007) 134 *Biological Conservation* 548; IUCN Species Survival Commission (n 39); Fred Nelson, Peter Lindsey and Guy Balme, ‘Trophy Hunting and Lion Conservation: A Question of Governance?’ (2013) 47 *Oryx*, 501; Macdonald and others, *Report on Lion Conservation* (n 75).

102 Cooney (n 62); Fisher and others (n 57); Trouwborst (n 57).

103 Daniel Bodansky, ‘New Developments in International Environmental Law’ (1991) 85 *ASIL Proceedings* 413, 417.

104 Trouwborst (n 57) 184–87.

105 See eg Julie Ayling, ‘What Sustains Wildlife Crime? Rhino Horn Trading and the Resilience of Criminal Networks’ (2013) 16 *Journal of International Wildlife Law and Policy* 57; Wiersema (n 81); Michael ‘t Sas-Rolfes, ‘Rhino Poaching: What is the Solution?’ (2016) 7 *Solutions* 38; Bram Janssens and Arie Trouwborst, ‘Rhinoceros Conservation and International Law: The Role of Wildlife Treaties in Averting Megaherbivore Extinction’ (2018) 21 *Journal of International Wildlife Law and Policy* 146.

precautionary principle, as it involves the taking of discrete and careful steps under uncertain conditions, combined with the monitoring of management outcomes using suitable indicators, and the periodic adjustment of actions in light of the evolving information base.¹⁰⁶ The Guidelines for Applying the Precautionary Principle to Biodiversity Conservation and Natural Resource Management, adopted in 2005 by IUCN, TRAFFIC, Fauna & Flora International and ResourceAfrica, put it this way:

An adaptive management approach is particularly useful in the implementation of the Precautionary Principle as it does not necessarily require having a high level of certainty about the impact of management measures before taking action, but involves taking such measures in the face of uncertainty, as part of a rigorously planned and controlled trial, with careful monitoring and periodic review to provide feedback, and amendment of decisions in the light of new information.¹⁰⁷

Thus, rather than an alternative approach to applying the precautionary principle, adaptive harvest management is one way of implementing it.

The CBD Addis Ababa Guidelines and Principles also feature adaptive management, as a key tenet of sustainable use, involving the adjustment of management actions based on '[i]terative, timely and transparent feedback derived from monitoring the use, environmental, socio-economic impacts, and the status of the resource being used'.¹⁰⁸ Its rationale is described as follows:

Biological systems and the economic and social factors that can affect the sustainability of use of biological diversity are highly variable. It is not possible to have knowledge of all aspects of such systems before a use of biological diversity begins. Therefore, it is necessary for the management to monitor the effects of that use and allow adjustment of the use as appropriate, including modification, and if necessary suspension of unsustainable practices.¹⁰⁹

Another wildlife treaty combining the precautionary principle, sustainable use and adaptive management is the aforementioned AEWA. This treaty, which is built upon precaution as one of its 'fundamental principles',¹¹⁰ allows for the hunting of certain waterbird populations 'on a sustainable use basis' within the framework of international species action plans, which in turn are expected to implement 'the principles of adaptive harvest management'.¹¹¹ The latter is defined as the 'periodic process of

106 Carl J Walters, *Adaptive Management of Renewable Resources* (Macmillan 1986).

107 Cooney and Dickson (n 57) Appendix, Guideline 12.

108 CBD COP Decision VII/12, Annex II, para 9, principle 4.

109 *ibid.*

110 AEWA, art II(2).

111 AEWA, Annex 3, para 2.1.1; see also Melissa Lewis, 'AEWA at Twenty: An Appraisal of the African-Eurasian Waterbird Agreement and its Unique Place in International Environmental Law' (2016) 19 *Journal of International Wildlife Law and Policy* 22; Jesper Madsen and others, 'Implementation of the First Adaptive Management Plan for a European Migratory Waterbird Population: The Case of the Svalbard Pink-Footed Goose *Anser brachyrhynchus*' (2017) 46 *Ambio* 275.

setting hunting regulations based on a system of population and habitat monitoring, harvest-level recording, data analysis and defining regulatory options'.¹¹²

Regarding CITES, the parties' agreement to follow the Addis Ababa Principles and Guidelines when performing NDFs was already noted. Generally, adaptive management is a characteristic feature in the way the CITES COP has coped with uncertainty in the past,¹¹³ and the COP considers the 'implementation of adaptive management, including monitoring' to be an 'important consideration' in the making of NDFs.¹¹⁴ In 2016, the COP specifically recommended adaptive management for the regulation of trophy hunting:

RECOMMENDS that Parties exporting hunting trophies of CITES-listed species ensure that trophy hunting is sustainably managed, does not undermine the conservation of target species and, as appropriate, provides benefits to local communities by having in place:

- a. a robust regulatory framework relating to the harvesting of trophies;
- b. an effective enforcement mechanism with adequate deterrents in the form of penalties for non-compliance;
- c. a monitoring system designed to effectively monitor population trends and status; and
- d. an adaptive management system through which harvest levels can be adjusted according to the needs of the specific population and based on results of the monitoring programme.¹¹⁵

A clear illustration of the link between the precautionary principle and adaptive trophy hunting management is the downlisting of the Cape mountain zebra (*Equus zebra zebra*) from CITES Appendix I to II in 2016. This was done on the condition that South Africa (the only range state) would implement, as a 'precautionary measure' in terms of COP Resolution 9.24,¹¹⁶ 'a combination of active adaptive harvest management and management strategy evaluation to set a hunting quota for Cape mountain zebra', subject to regular CITES review.¹¹⁷

10. CITES LEOPARD QUOTAS: A CLOSER LOOK

The preceding analysis provides a useful lens through which to contemplate the way in which export quotas for leopards have been set and adjusted under CITES, including the recent and partly still ongoing review of these quotas.

112 AEWA, Annex 3, para 2.1.1 fn 4; see also Melissa Lewis, *Guidance on Implementing Adaptive Harvest Management through Domestic Legal Regulations* (AEWA EGMP Guidance No 1, 2018).

113 Wiersema (n 81); Annecoos Wiersema, 'Uncertainty, Precaution, and Adaptive Management in Wildlife Trade' (2015) 36 *Michigan Journal of International Law* 375.

114 CITES COP Resolution Conf 16.7 (Rev COP17), para 1(a)(viii).

115 CITES COP Resolution Conf 17.9, para 3.

116 CITES COP Resolution 9.24 (Rev COP13) Annex IV, para A(2)(a)(iii).

117 CITES Doc COP17 Prop 6, para A; see also Peter Novellie and others, 'Adaptive Governance of Cape Mountain Zebra, Can it Work?' (2017) 47 *African Journal of Wildlife Research* 79.

A fairly typical report is the one submitted by Mozambique. According to it, a 'pre-cautionary' leopard range can conservatively be estimated to cover 80% of the country.¹¹⁸ The report refers to the model Martin and De Meulenaar¹¹⁹ used to estimate leopard numbers in sub-Saharan Africa, which arrived at a number of over 37,000 leopards in Mozambique, while acknowledging the criticism this model has received.¹²⁰ Other national population estimates mentioned are 26,608 and 6,400 leopards, although the report ultimately concedes that 'reliable estimates of population size are unattainable at a national level'.¹²¹ It then explains in some detail how leopard trophy hunting in Mozambique is based on adaptive management, which is considered a 'useful approach to the paucity of data',¹²² and presents the various benefits of trophy hunting for leopard conservation. It documents how over the years its authorities have set the national trophy hunting quotas 'conservatively', just below the CITES export quota of 120, with export tags actually issued hovering around 50 per year in the period 2011–17.¹²³ The report concludes that the 'low level of off-take generated by safari hunting is not detrimental' to leopard survival in Mozambique and that the activities and revenues generated by it are of 'crucial importance for the conservation of the species,' so much so that safari hunting 'provides a net benefit to the species'.¹²⁴ The quota of 120 is considered to be non-detrimental.¹²⁵ The Government of Mozambique furthermore points out that its implementation of CITES Resolution Conf 10.14 has been 'spotless since its inception', and recommends that the Resolution's quota system and trade regime remain in place, and that unilateral attempts to 'circumvent it' through stricter domestic measures are avoided.¹²⁶

Strampelli and others, however, 'question the reliability of the estimates employed to set quotas for hunting leopards in Mozambique', while emphasising the 'need for caution' when setting such quotas.¹²⁷ The aforementioned predictive modelling exercise by Martin and De Meulenaar¹²⁸ has indeed been widely criticised for basing leopard population estimates exclusively on rainfall and vegetation types, while assuming, based on anecdotal records, that leopards occur at maximum densities in all available habitats, and excluding crucial factors such as prey availability and anthropogenic mortality.¹²⁹ Furthermore, the report is 30 years out of date.

118 Republic of Mozambique, 'Review of the Leopard (*Panthera pardus*) Quota of Mozambique, Established per Resolution Conf. 10.14 (Rev. CoP16) and Non-Detriment Determinations, in Accordance with CITES Decision 17.114' (2018) CITES AC30 Doc 15 – Annex 1, para 25.

119 Martin and De Meulenaar (n 8).

120 Republic of Mozambique (n 118) para 30.

121 *ibid*, paras 32–33.

122 *ibid*, para 52.

123 *ibid*, paras 86–87.

124 *ibid*, para 117.

125 *ibid*, para 118.

126 *ibid*, para 120.

127 Strampelli and others (n 54) 5.

128 Martin and De Meulenaar (n 8).

129 See eg Peter Jackson, *The Status of the Leopard in Sub-Saharan Africa: A Review by Leopard Specialists*, IUCN Cat Specialist Group Report (Gland 1989); Peter M Norton, 'How Many Leopards? A Criticism of Martin and De Meulenaar's Population Estimates for Africa' (1990) 86 *South African Journal of Science* 218; Theodore N Bailey, *The African Leopard: Ecology and Behavior of a Solitary Felid* (2nd edn, Columbia UP 2005); Balme and others (n 9); Stein and others (n 1); Strampelli and others (n 54).

Nevertheless, and despite burgeoning human populations and widespread habitat loss and conversion to agriculture in southern Africa, the Martin and De Meulenaar estimates have been and continue to be used by various countries as a baseline reference for quota-setting. For instance, in 2007, this estimate, despite being 20 years out of date, was invoked to justify Mozambique's CITES quota increase from 60 to 120, and was also relied on by Tanzania and Namibia in 2002 and 2004 to motivate these countries' successful requests to the CITES COP for quota increases, from 250 to 500 and from 100 to 250, respectively.¹³⁰ To acknowledge that certain figures constitute unreliable overestimates but to still rely on them for the plain reason that they are the *only* figures is not a precautionary approach. In the words of one of the documents that have been submitted to the Animals Committee over the leopard quota issue in 2018, 'admitting that no information is available may be less harmful than using incorrect information'.¹³¹

In a position statement, the IUCN Cat Specialist Group similarly identifies several 'frequent shortcomings' in the various national leopard quota review reports of 2018, noting *inter alia* that '[r]obust information on distribution, abundance and population size and trends at the national level and in hunting areas' is 'largely missing', that extrapolations based on incorrect assumptions have resulted in overestimates of abundance, and that management measures and offtake per unit and year are 'often not considering the trend of the population'.¹³² The Specialist Group does emphasise that the CITES leopard quota system constitutes a 'relatively unbureaucratic way for exporting hunting trophies', and that if the aforementioned shortcomings were to be ameliorated through more robust and consistent approaches which ensure non-detriment (by linking the quotas more persuasively with the conservation status of the populations involved), the quota system 'should and could provide an incentive for leopard conservation and maintenance of their habitats'.¹³³ Likewise, as a way forward for leopard trophy hunting in Mozambique, Strampelli and others recommend 'a sustainable and empirical quota allocation system, similar to that currently being developed for South Africa, which includes hunting regulations based on leopards' age, adaptive management strategies, and dynamic, evidence-based quota systems'.¹³⁴

There are indeed several reasons for taking a closer look at the South African situation. An important reason is that South Africa is apparently still the only country of those involved where robust data are currently available on leopard population trends.¹³⁵ The results from camera-trap surveys undertaken at 31 sites across the country in 2013–2017 by the South African Leopard Monitoring Project (a collaboration between Panthera, the South African National Biodiversity Institute and other partners) suggest an annual 8% decline of the national population.¹³⁶ In light of

130 CITES COP12 Doc. 23.1.2; CITES COP13 Doc. 19.1.

131 Panthera (n 32) 4.

132 IUCN SSC Cat Specialist Group, 'Position Statement on Leopard Quotas and Non-Detriment Findings' (2018) CITES Doc SC70 Inf 35.

133 *ibid.*

134 Strampelli and others (n 54) 5.

135 Gareth Mann and others, *South African Leopard Monitoring Project: 2017 Annual Report*, Working document for SANBI (SANBI 2018); Panthera (n 32).

136 *ibid.*

these evolving insights, the national leopard hunting quota allocation system has recently seen significant reform.¹³⁷

The CITES leopard quota review submitted by the South African authorities in 2018 concedes that prior to the recent monitoring project, 'reliable published information on leopard population sizes and trends at a national scale was poor to non-existent'.¹³⁸ It notes the Martin and De Meulenaar estimate, along with two subsequent national estimates of the South African leopard population, but observes that none of these was based on rigorous population counts at regional scales, and that their confidence intervals are 'so wide as to make them meaningless'.¹³⁹ The report highlights the recent yearly 8% decline, identifies the 'illegal killing of leopards for skins and other body parts for traditional ceremonies and medicines' as the major threat to the species in South Africa, and highlights that, in principle, '[w]ell-managed sport hunting is an important conservation tool'.¹⁴⁰ However, the report notes that recent research indicates that 'hunting quotas in Limpopo, which accounted for >60% of leopard trophies hunted in South Africa, were unsustainable'; that information from other parts 'similarly suggested that quotas were too high'; and that the 'clumping of trophy hunts' increased pressure on specific populations.¹⁴¹ The South African system for allocating leopard hunting quotas has therefore been 'completely overhauled'.¹⁴² The resultant adaptive management framework functions as follows:

Leopard hunting quotas are now adjusted annually based on population trend data generated by the South African Leopard Monitoring Project. Hunting will be excluded from any areas where leopard populations are in decline, and hunting will not be allowed in areas where scientifically robust data on leopard population trends are absent. Hunting zones eligible for a quota are thus those where scientifically robust population trend data indicate increasing or stable leopard populations (i.e. no statistically significant difference in observed leopard density over time). In 2016 and 2017, the leopard hunting quota was set at zero to allow time for the recovery of declining populations and improved management of trophy hunting, while for 2018, the Scientific Authority recommended a quota of seven male leopards of ≥ 7 years of age (five in Limpopo and two in KwaZulu-Natal).¹⁴³

A distinct feature of the policy currently being introduced in South Africa is that all hunting will be limited to males at least 7 years old.¹⁴⁴ While highlighting the

137 Republic of South Africa, 'Leopard Quota Review: South Africa' (2018) CITES AC30 Doc 15 – Annex 3; Panthera (n 32).

138 Republic of South Africa, *ibid*, para 3.

139 *ibid*.

140 *ibid*, paras 2–3.

141 *ibid*, para 4.

142 *ibid*.

143 *ibid*.

144 *ibid*, para 10; also Department of Environmental Affairs, 'Draft Norms and Standards for the Management and Monitoring of the Hunting of Leopard in South Africa for Trophy Hunting Purposes' (2017) 620 Government Gazette of the Republic of South Africa 40601, 14.

socio-economic value of leopard trophy hunting,¹⁴⁵ the report's conclusions regarding the benefits of trophy hunting for South African leopards themselves are cautious at best. Whereas it is considered 'unlikely that trophy hunting of leopards directly incentivizes the private sector to conserve leopard habitat', it is 'hoped' that the reformed adaptive management framework will 'ultimately incentivize management practices that contribute towards the conservation of leopards'.¹⁴⁶

From 2005 to 2016, on average, slightly less than half of the annual CITES export quota of 150 was utilised, and hence South Africa considers a quota increase 'unnecessary'.¹⁴⁷ However, it does recommend keeping the level at 150, because 'a reduction in the export quota would limit the flexibility that is crucial for the adaptive management approach adopted by South Africa for the allocation of leopard hunting quotas'.¹⁴⁸

This conclusion comes as something of a surprise. With a domestic leopard hunting quota of 7 for 2018, a number which seems unlikely to increase very fast in the coming years, it would appear logical to set the CITES quota at 25 or so for the next three years, and if things go really well, to request the COP at its next meeting to raise the quota again. Instead, South Africa asks for the retention of its 150 quota, for reasons of flexibility. To all intents and purposes, it is not obvious that the number 150 is based on any scientific logic—indeed it gives the impression of being somewhat arbitrary, and the balance between ensuring flexibility and guaranteeing sustainability completely lost. A thought experiment can serve to underline this. Imagine a CITES authority of some European country in 2020 considering the import of a leopard trophy from South Africa with tag number 149. Obviously, in light of the South African situation just described, this importing authority *cannot* blindly assume non-detriment, but *the CITES system says that it can*, and even *should*, in accordance with Resolutions 9.21 and 10.14.

This raises the question why South Africa would nonetheless wish to retain an ostensibly arbitrary quota. The official answer is 'flexibility', but South Africa's own quota review report does not appear to support this answer. We speculate that at least part of the explanation may lie in the sphere of international politics, probably involving a degree of wariness that once a quota is lowered, it is highly uncertain whether the COP will raise it again in future when requested, given the need for a consensus or at least two-thirds majority of CITES parties, and the intricacies of COP negotiations—with COP decisions increasingly being influenced by Western NGO agendas.¹⁴⁹ A parallel emerges between this suspected lack of faith in the workings of the CITES regime and its COP and the aforementioned debate regarding the leopard's listing under the CMS in 2017. There, the official objection of South Africa (and Uganda, Zimbabwe and Tanzania) mainly concerned the Convention's 'migratory species' definition, but perhaps the real motivation, as

145 Republic of South Africa 2018 (n 137) para 8.

146 *ibid*, para 7.

147 *ibid*, para 10.

148 *ibid*.

149 See also Wiersema (n 113); Hans Bauer and others, 'Lions in the Modern Arena of CITES' (2018) 11 Conservation Letters e12444; on NGO influence, see in particular Challender and MacMillan (n 81).

discussed above, relates to a lack of faith in the workings of the CMS regime and its COP.

Whereas we explored the example of South Africa in some depth, it should be stressed that similar questions arise with regard to the leopard export quotas of Zimbabwe, Tanzania (both having a quota of 500) and other range states. For instance, the Central African Republic recently reported that only two leopards have been trophy-hunted in the country since 2016, but still requested the retention of its current annual CITES quota of 40.¹⁵⁰ Stunningly, Ethiopia, while reporting the hunting of five leopards per year, nevertheless asked for its CITES quota of 500 to be maintained.¹⁵¹

All of this suggests that in the present context there may be some significant inadequacies in the functioning of the CITES system.

11. A FAILING SYSTEM

If it is strange that individual countries ask for quotas that seem arbitrary and too high, it is at least as strange that the CITES COP has approved and maintained these quotas for decades—up until today none has been lowered. Even in the present review round, CITES' institutions have been reluctant to make changes to the status quo. It appears that a recent NGO position statement makes a valid point when stating that quotas that 'have no scientific basis, yet that are approved by the CITES Parties, undermine the credibility of the Convention'.¹⁵²

It should be recalled that the various reports were compiled in response to the COP's 2016 request to the parties involved to verify whether their quotas 'are still set at levels which are non-detrimental to the survival of the species in the wild', accompanied by requests to the CITES Animals and Standing Committees to review the national reports.¹⁵³

The Animals Committee, after reviewing the submitted reports, concluded in July 2018 that the quotas of all seven countries (Mozambique, Namibia, South Africa, Tanzania, Uganda, Zambia and Zimbabwe) are 'set at levels which are non-detrimental'.¹⁵⁴ Importantly, however, the Animals Committee also—and quite sensibly, in light of the foregoing—requested the Standing Committee to consider establishing a more structural 'process to review and if necessary revise, quotas for Appendix I species'.¹⁵⁵ The Animals Committee furthermore noted the 'various ways' in which parties have implemented 'monitoring and adaptive management systems to ensure that the offtake of leopards is sustainable' and called for the sharing of such information 'in order that lessons learned and success stories can be multiplied and put to use in all range states concerned', while noting the potential role of the CMS–CITES African Carnivores Initiative in this connection.¹⁵⁶

150 CITES SC70 Doc 55 (2018).

151 *ibid.*

152 Humane Society International, 'Position Statement on Quotas for Leopard Hunting Trophies' (2018) CITES Doc AC30 Inf 18.

153 CITES COP Decisions 17.114-117 (2016).

154 CITES SC 70 Doc 55, para 5(i).

155 *ibid.*, para 5(f).

156 *ibid.*, para 5(b)-(e).

The Standing Committee, in October 2018, endorsed the Animals Committee's suggested approach, and the only amendments of Resolution 10.14 which it agreed to propose to the COP concern the removal of the quotas of Kenya and Malawi.¹⁵⁷ Significantly, the Standing Committee did also follow the Animals Committee's suggestion to recommend the COP to consider amendments to Resolution 9.21 'concerning approaches to review quotas for Appendix-I species'.¹⁵⁸ It should be borne in mind in this regard that the issues discussed in this article are not unique to leopards. For example, Van der Meer has recommended lowering Zimbabwe's CITES export quota for cheetahs from 50—a number set in 1992—to 5.¹⁵⁹

The COP, at its 18th meeting in August 2019, did not formally amend Resolution 10.14. This appears due to an oversight, given that prior to and during the COP there seemed to be a general willingness amongst contracting parties to delete the quotas of Kenya and Malawi, in accordance with those parties' own requests, while leaving the other quotas unchanged.¹⁶⁰ The three parties who failed to submit a review report (Botswana, Central African Republic, Ethiopia) are given another chance to do so.¹⁶¹ A suggestion by the EU to suspend these countries' quotas until such submission was not followed by the COP.¹⁶² The COP adopted a Decision recommending all parties with leopard export quotas to 'exchange information and lessons learnt regarding the process for determining that such quotas are non-detrimental to the survival of the species in the wild'.¹⁶³ In addition, the COP requested the CITES Secretariat, in cooperation with range states and experts (and subject to the availability of external funding) to develop 'guidance that can assist Parties in the making of non-detriment findings for trade in leopard hunting trophies in compliance with Resolution Conf. 10.14'.¹⁶⁴ The COP also added the following text to Resolution 9.21 on Appendix I quotas generally, instructing the Animals and Standing Committees to:

keep under regular review (every 9 years or sooner if determined necessary) quotas for species included in Appendix I established by the Conference of the Parties. If new scientific or management data have emerged to indicate that the population of the species in the range State concerned can no longer sustain

157 CITES Doc SC70 Sum 10 (Rev 1), para 55.

158 *ibid.*

159 Esther van der Meer, *The Cheetahs of Zimbabwe, Distribution and Population Status 2015* (Cheetah Conservation Project Zimbabwe 2016).

160 See CITES Doc COP18 Com I Rec 2 (1–2). The CITES Secretariat subsequently confirmed that the COP forgot to formally adopt the amendments to Resolution 10.14, and that a footnote will be added to the Resolution's quota table, saying that 'the Secretariat believes that it was the intent of the Parties at CoP18 to remove Kenya and Malawi from this Resolution, but this was not formally agreed at the meeting' (pers. com. 11 October 2019).

161 CITES COP18 Doc. 46 (2019), Annex 3.

162 IISD Reporting Services, 'Summary of the 18th Meeting of the CITES Conference of the Parties: 17-28 August 2019' (2019) 21(101) Earth Negotiations Bulletin 11. Likewise, the EU noted during the COP that the export quotas in Resolution 10.14 'remained high' and recommended that future quota evaluations 'take account of actual harvest levels and all mortality-related information' (CITES COP18 Com I Rec 2).

163 CITES COP18 Doc 46 (2019), Annex 3.

164 *ibid.*

the agreed quota, consult with the range State in order to find a solution to any concerns raised including, if appropriate, making recommendations to amend the quota.¹⁶⁵

Change is clearly appropriate for a regime wherein ostensibly arbitrary, static and, worse, wildly inappropriate quotas have received endorsement for decades despite sustained criticism regarding the quotas' basis in reality. Moreover, as our analysis demonstrates, the way in which the CITES regime for leopard export quotas has been operating is fundamentally at odds with the basic principles of sustainable use, precaution and adaptive management.

12. WAYS FORWARD

Continuing the status quo is evidently not a satisfactory option. There are at least three alternative approaches to consider.¹⁶⁶ Although we discuss these with regard to leopards, similar considerations apply with regard to CITES quota-setting for other species.

A first option would be abandoning the current COP-appointed quota approach for leopards altogether, reverting to the default position of individual assessments and permits for hunting trophies, applying the regime of Resolutions 2.11 and 17.9. An apparent downside of this option is the increase in bureaucracy which it might entail. An increased scope for scrutiny by importing state authorities would be another, related consequence.¹⁶⁷

A second option would be to retain an approach of COP-appointed export quotas, but to modify Resolution 10.14 so as to warrant meaningful scrutiny of all quotas at every COP meeting, ensuring regular adjustment to appropriate levels, in accordance with sound adaptive management principles.

A third option would be an approach whereby the COP, instead of setting quotas, approves individual national regulatory frameworks for quota-setting, according to a uniform blueprint or set of criteria which ensure that exports reflect sustainable off-takes. Each party involved would then annually set its own export quota on this basis and communicate it to CITES. From here on, the evidentiary regime currently functioning under Resolutions 9.21 and 10.14 would apply, whereby importing state authorities are expected, in principle, to accept trophies from countries whose quota-setting frameworks have been CITES-approved. This approach could be adopted, like the second option, through amendment of Resolution 10.14. (Of course, either approach could also be applied more broadly, beyond leopards, by modifying Resolution 9.21.) This third option is likely to be significantly more effective as a safeguard and means of verifying the sustainability of trophy hunting exports than the presently applicable regime where quotas are so high and inflexible as to be virtually meaningless and, worse, seriously risk detriment. A combination of the third and second options may also be worth considering, whereby COP-appointed levels act as additional safeguards by indicating absolute quota ceilings.

165 CITES COP Resolution Conf. 9.21 (Rev COP18), para 2.

166 See also Macdonald and others (n 56).

167 See CITES COP Resolution Conf 2.11, para 1(c).

An important and recent precedent regarding the third option is the approach adopted by the 18th CITES COP with respect to black rhinoceros hunting trophies from South Africa. The fixed quota of five adult male rhinos that had been in place since 2004 was replaced by an adaptive quota of ‘a total number of adult male black rhinoceros not exceeding 0.5% of the total black rhinoceros population in South Africa in the year of export’¹⁶⁸ (which, in 2019, equalled nine animals).¹⁶⁹ As part of this adaptive approach, South Africa is expected to communicate the applicable number to the CITES Secretariat in advance of each quota period.¹⁷⁰

Whichever option is ultimately chosen, an increasingly solid consensus appears to be forming that rigorous adaptive management is the best way forward for regulating trophy hunting of leopards and many other species, including other large carnivores—both amongst experts¹⁷¹ and in (inter)governmental circles. The analysis above already demonstrated that adaptive management is firmly based on the general principles of international wildlife law—sustainable use and precaution in particular—and has well-developed roots within treaty regimes like CITES, CMS and the CBD. Adaptive management is also a central feature in a set of guiding principles on leopard management and conservation that was reportedly agreed on by SADC participants at a 2018 meeting on Southern African large carnivore management.¹⁷² The principles state, *inter alia*, that ‘well-managed sport hunting’ is an important conservation tool; that leopard utilisation should be ‘underpinned by robust science’; that monitoring is a ‘crucial component’ of adaptive management; and that it is important to factor in the ‘impact of the illegal leopard skin trade on regional leopard populations’.¹⁷³

When it comes to being rigorous, science-based, precautionary, sustainable and adaptive, the approach recently introduced in South Africa seems to hold particular promise.¹⁷⁴ Introducing similar frameworks in other range states, using a combination of intensive and extensive monitoring at appropriate scales, can be done ‘relatively cheaply’, although it will take time and ‘likely require external financial assistance’.¹⁷⁵ Another distinctive feature of the new South African approach is much easier to emulate in other range states in the short term, namely restricting all trophy hunting to male leopards that are demonstrably at least seven years of age.

168 CITES COP Resolution Conf 13.5 (Rev. COP18) para 1.

169 CITES COP18 Doc 48 (2019); see also Jeanetta Selier, ‘Supplemental Information in Support of the CITES COP18 Proposal to Amend South Africa’s Export Quota for Black Rhinoceros Hunting Trophies’ (2019) CITES Doc COP18 Inf 78.

170 Resolution 13.5 (Rev. COP18), para 3(d).

171 Rosser and others (n 70); Balme and others (n 7); Balme and others (n 9); IUCN Species Survival Commission (n 39); Peter A Lindsey and others, ‘The Trophy Hunting of African Lions: Scale, Current Management Practices and Factors Undermining Sustainability’ (2013) 8 PLoS One 373808; Nelson, Lindsey and Balme (n 101); Braczkowski and others (n 54); Ross T Pitman and others, ‘The Importance of Refugia, Ecological Traps and Scale for Large Carnivore Management’ (2015) 24 Biodiversity and Conservation 1975; Novellie and others (n 117); Strampelli and others (n 52); IUCN SSC Cat Specialist Group (n 132); Panthera (n 32).

172 Republic of Mozambique (n 118).

173 *ibid*, para 20.

174 Department of Environmental Affairs (n 144); Republic of South Africa (n 137); Panthera (n 32); Mann and others (n 135).

175 Panthera, *ibid* 4.

The available research appears to indicate that implementing these sex and age limits will minimise harmful impacts of hunting on leopard populations,¹⁷⁶ and will be 'self-regulating' in the sense that old male leopards 'are generally only present, and thus available to hunt, in healthy leopard populations'.¹⁷⁷

A science-based, precautionary and adaptive approach to quota-setting along the lines explored above could go some way to ensuring that trophy hunting of leopards and other species occurs in a sustainable manner even when the available information is spotty.

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176 Craig Packer and others, 'Sport Hunting, Predator Control and Conservation of Large Carnivores' (2009) 4 PLoS One e5941; Balme, Slotow and Hunter (n 7); Guy A Balme and others, 'Applicability of Age-Based Hunting Regulations for African Leopards' (2012) 7 PLoS One e35209; Guy A Balme and Luke Hunter, 'Why Leopards Commit Infanticide' (2013) 86 Animal Behaviour 791; Department of Environmental Affairs (n 144); Panthera, *ibid*.

177 Panthera, *ibid* 4.