# On the use of the IUCN status for the management of trophy hunting

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**Abstract**

***Context.*** Whether trophy hunting is beneficial or a threat to the conservation of species is an open and hotly debated question. The International Union for Conservation of Nature (IUCN) is in charge of assessing the need for species protection at the global scale and providing a useful guide for sustainable exploitation and conservation. Consideration of the IUCN status in wildlife management and its consequences on the attractiveness of trophy-hunted species remains to be quantified.

***Aims.*** The present study investigated the link between the IUCN status of the trophy species and its exploitation in 124 taxa. We expected that the number of trophies should be inversely correlated with the IUCN vulnerability status across species.

***Methods.*** Using the database of the Safari Club International, one of the largest hunting associations worldwide, we investigated the effect (1) of the first status attribution and (2) of an upgrade of the IUCN status on the number of trophies recorded by the Safari Club International, by comparing the average number of trophies 5 years before and after a status change.

***Key results.*** First, we found that the status attributed by the IUCN in a given year had no effect on the number of recorded trophies during the following 5 years. Second, upgrading the IUCN status led to an important decrease in the number of recorded trophies for most species (75%), except for the most vulnerable ones (African elephant, *Loxodonta africana*; banteng, *Bos javanicus*; lelwel hartebeest, *Alcelaphus buselaphus lelwel*; European bison, *Bison bonasus*).

***Conclusions.*** Our results suggest that although a protective IUCN status lowers the exploitation of the moderately threatened species, hunting pressure on the most threatened one increases instead. The findings support the possibility of an anthropogenic Allee effect (AAE), i.e. a disproportionate exploitation of the rarest species.

***Implications.*** The highly profitable exploitation of rare species could have harmful consequences, unless appropriate management actions and protection rules are enforced.

**Additional keywords:** hunting club, protection measures, threat, wildlife management.

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## Introduction

Trophy hunting consists of shooting animals to collect trophies such as horns, antlers, skulls, tusks or teeth (or in many cases the whole head), usually for the purpose of display. This growing activity currently concerns hundreds of taxa, mostly large mammals (Milner *et al.* 2007), is omnipresent in the world, and generates huge incomes (Lindsey *et al.* 2007). Trophy hunting has been beneficial to the preservation of several species (Leader-Williams *et al.* 2005; Frisina and Tareen 2009; Lindsey *et al.* 2009). If well managed, trophy hunting has a great potential for conservation because of the large amount of money it generates (Leader-Williams *et al.* 2005; Leader-Williams 2009; Lewis and Alpert 1997). Trophy hunting is a vital activity for the well being of local people in several countries

(Lindsey *et al.* 2007) and for the maintenance of wildlife-suitable habitat. For example, the novel establishment of private ranches in South Africa leads to the replacement of agricultural lands by more natural habitats. Such land-use shifts have been beneficial for several species, such as white rhinos (*Ceratotherium simum*; Cousins *et al.* 2008; Frisina and Tareen 2009).

However, other examples have shown that, when ill-managed, trophy hunting can cause the decline of lion (*Panthera leo*) and leopard (*Panthera pardus*) populations (Loveridge *et al.* 2007; Packer *et al.* 2009, 2011). Additionally, the recently demonstrated attractiveness of rarity for humans suggests that trophy hunting could be a threat to already fragile species (Courchamp *et al.* 2006; Johnson *et al.* 2010; Palazy *et al.* 2011, 2012; Prescott *et al.* 2011). Case studies demonstrating either population recovery

success or failure in relation to trophy hunting remain scarce (Frisina and Tareen 2009; Packer *et al*. 2011). Consequently, the question arises of whether trophy-hunted species are properly managed and, in particular, whether the most fragile species are sustainably harvested. One way of answering this question involves analysing the hunting bags of species harvested for their trophy with varying vulnerability level.

The widespread media coverage of species decline (Myers and Knoll 2001; Raven 2003) has led to the emergence of various organisations that aim to identify and protect threatened species. The IUCN is certainly the most famous for its reliability, comprehensiveness and usefulness in terms of conservation decisions (Collar 1996). This organisation is in charge of collecting and compiling information on population sizes, trends, distributions and threats (Baillie *et al*. 2004). This huge task involves classifying species in six classes of increasing extinction risk. The role of the IUCN is restricted to the attribution of the appropriate vulnerability status and does not include any remit to take appropriate conservation measures. The species vulnerability ranking, nevertheless, offers a reliable guide for conservation planning (Baillie *et al*. 2004; Rodrigues *et al*. 2006; Plumptre *et al*. 2007; DeMatteo and Loiselle 2008). Under the reasonable assumption that wildlife managers use the IUCN information as an index of species threat level, we could expect that species status should be taken into account for controlling wildlife harvest for trophy hunting, with fewer hunted individuals for more threatened species. Indeed, there are several criteria for a species to be classified as threatened by the IUCN, in particular, a low population count, which should, in theory, lead to restrictions on exploitation quotas. However, to our knowledge, the effect of IUCN statuses on trophy-hunting intensity has never been assessed.

In the present paper, we used the IUCN status as a proxy of species' rarity and the annual number of recorded trophies for a given species as a measure of the intensity of trophy hunting. We tested whether IUCN protection status has any effect on the number of recorded trophies. Under the hypothesis that wildlife managers and/or governments take IUCN protection status into account to ensure that threatened species are harvested in a sustainable way, we predicted that the number of trophies collected should be inversely correlated with the IUCN vulnerability status across species, with the most threatened species being the least hunted. We also predicted that upgrades in vulnerability status should be followed by a decrease in the number of trophies collected, so that increasingly vulnerable species should become less hunted.

## Materials and methods

### Data sources

The IUCN red list database provided the status under which each of the trophy-hunted species has been classified since its creation (the first red data book was edited in 1966; Thornback and Jenkins 1982). Among the species targeted by trophy hunting, we selected the 124 taxa (species and subspecies) whose trophies have been listed in the SCI record book between 1970 and 2011 (Table 1, Appendix 1). We distinguished between the attribution of an IUCN status (i.e. the transition from non-assigned to a definite status) and the transition between two vulnerability statuses

**Table 1. Composition of the dataset used, including family and International Union for Conservation of Nature (IUCN) status of the species in Year 2011**

| Family | Least concern | Near threatened | Vulnerable | Endangered |
|---|---|---|---|---|
| Bovidae | 54 | 13 | 13 | 5 |
| Cervidae | 11 | 0 | 4 | 0 |
| Felidae | 2 | 1 | 2 | 0 |
| Suidae/Tayassuidae | 7 | 0 | 0 | 0 |
| Ursidae | 2 | 0 | 1 | 0 |
| Other | 6 | 1 | 2 | 0 |

(i.e. from one definite status to another definite status). Indeed, when the threat status changes from '*Data deficient*' to '*Vulnerable*' for example, it does not mean that the species status has deteriorated during the intervening period. It rather means that additional information has been collected which is now sufficient to assess the status of the species. This is qualitatively different from, for example, a change from '*Near threatened*' to '*Endangered*'.

Although the CITES is an independent institution that collects data on trophy hunting at the international level, we could not use data recorded by this organisation because only a small group of species of our dataset (less than 25% species) had regular entries in the CITES trade database. Hence, the trophy trade has only been followed in the long term for a few of them. The information on the total number of individuals legally harvested for their trophy per species and per year would have been ideal variable for our purposes, but this information was not available. To circumvent these difficulties, we used an original approach, taking advantage of the great wealth of data collected by the SCI (for the use of SCI data, see Lewis and Alpert 1997; Wilkie and Carpenter 1999; Johnson *et al*. 2010; Palazy *et al*. 2012). The SCI has compiled all the hunt data declared by its members since 1971 (www.scirecordbook.org, verified April 2012). For each hunt, a large quantity of information is registered, including the member's name, the date, the location and the trophy score (i.e. given in points, which is assessed with an official measurement manual and considers both trophy size and shape). This record book is intended to be an official and reliable information source as a professional trophy measurer validates each trophy score. In the record book, trophies are classified in several categories according to the animal's population origin. Indeed, the SCI makes a difference between trophies collected in the natural range of the species and where it has been introduced. For our purpose, the hunting pressure on exotic species is not of interest. Hence, we removed all the trophies that belong to individuals categorised as 'non-indigenous' or 'introduced' from the database used for the present analyses. We removed the species categorised as 'estate' for the same reason. The SCI record-book data cannot be used as an estimation of the annual number of trophy animals hunted *per se* because not all trophy hunters are SCI members. In addition, SCI members record only their most remarkable trophies, so do not provide data for all the trophies they collect. However, the method of trophy listing has been standardised and regular since 1971 and should thus be a reliable index of any trends over time in the intensity of

exploitation and, therefore, provides a useful source of data for investigating the correlation between these trends and changes in the IUCN status (Appendix 1). To use this variable, we made the reasonable assumption that the perception of trophy hunters towards what they would consider as remarkable trophy is a constant in time over the study period. We then studied the effect of IUCN status on the number of records over a 10-year period. We assumed that the temporal trend and relative variation in the number of trophies recorded by the SCI reliably reflects the temporal trend and relative variation in the total number of harvested trophies worldwide.

### Data analyses

We first summed the number of lines in the record book (one line per trophy record) per year per species and obtained the annual number of records per species. Inter-specific analyses of the time series were made possible by a classical standardisation (centre and scale) of this variable. We first checked for the non-independence among species-specific data points by using the Abouheif test (Pavoine *et al.* 2008) on a taxonomy-based tree. We performed this test on the total number of trophies annually recorded per species over the study period.

We then investigated the general pattern of the temporal trend in the number of trophies recorded between 1970 and 2011 by using generalised linear models (GLMs) and generalised additive models (GAMs; Hastie and Tibshirani 1986) to obtain smoothed curves for graphical support. We next added the hunt location to the model by using the broad classification system of the SCI database in which hunts are pooled by continent (e.g. Africa, Europe, Asia, America, South-Pacific) to test for the occurrence of differing trends in the number of trophies over time among large-scale regions. Subsequent analyses were conducted on the 'detrended' number of recorded trophies because the number of recorded trophies increased over time (Grosbois *et al.* 2008). The 'detrended' variable was obtained by correcting the number of trophies for the time trend observed for each region. Therefore, we extracted the residuals of the model with the standardised number of recorded trophies as the response variable, and the time, the region and their interaction as the explanatory variables. The use of this procedure should allow us to determine whether an increase in the number of trophies is due to a global increase in the number of trophies over time or to the IUCN status changes.

In a second step, we used the non-parametric Kruskal–Wallis statistic to test for an effect of the initial status attributed to a given species on the temporal trend in the number of recorded trophies of that species. Our first prediction was that there should be a decrease in hunting pressure in the following years when the initial status attributed indicated species vulnerability. The IUCN status for a given species was the predictor variable. The response variable was the difference in the average number of trophies hunted over the 5 years before and over the 5 years following a change of the species IUCN status. In practice, we calculated the average number of trophies recorded after the change minus the average number of trophies recorded before the change. Our second prediction was that a change towards a more protective IUCN status should subsequently decrease the number of hunted animals. We used the same method to test both predictions. In a

few cases, a new status was attributed to the species for a period of less than 5 years (21 of 140 observed changes). If the status was altered after 4 years instead of 5 years (corresponding to 13 cases), we analysed the 4 years before and after the change. If a status was given to the species for only 2 years and then changed again (the eight remaining cases), we considered only the subsequent status. For example, for the white rhinoceros whose first status, '*Conservation dependent*', was attributed in 2000 and was then changed to '*Near threatened*' in 2002, we ignored the '*Conservation dependent*' status. All analyses were run using the R 2.12 statistical package (R Development Core Team 2009).

### Results

We did not detect any phylogenetic signal in the average number of trophies recorded per species (Cmean = $0.021 \pm 0.485$; $P = 0.29$). Hence, taxonomy has no impact on the number of recorded trophies among taxa. We, therefore, used standard statistical procedures to analyse our data.

The standardised number of recorded trophies markedly increased with time over the study period ($F_{1,5180} = 1618.7$, $P < 0.001$) and this temporal trend significantly varied among the five continents (interaction term between location and time: $F_{5,5180} = 12.05$, $P < 0.001$); however, the general patterns were similar (Fig. 1). The increase was sharp until 1985, then less marked until 2000. The number of trophies recorded appeared to have decreased slightly over the past decade.

We first expected a decrease in the number of records when the initial status attributed indicated that the species in question was threatened. We did not detect any statistically significant effect of the attribution of an IUCN status on the number of trophy records (multiple Kruskal–Wallis test comparison, $\chi^2 = 7.07$, d.f. = 4, $P = 0.13$; Fig. 2). Among species, the average difference between the number of recorded trophies, standardised and corrected for the effect of time, after and before status attribution was positive ($\Delta N_c = 0.14$, CI 95% = [0.05;0.21]).

According to our second hypothesis, we expected to find a decrease in the number of trophies recorded following an upgrade in the IUCN vulnerability status. We found that upgrading the status had a statistically significant effect on the number of trophies collected the following years (multiple Kruskal–Wallis test comparison, $\chi^2 = 8.71$, d.f. = 2, $P = 0.01$; Fig. 3). The average difference between the number of recorded trophies, standardised and corrected for the effect of time, after and before the status upgrade was negative ($\Delta N_c = -0.627$, CI 95% = [–0.93;–0.33]). In agreement with the IUCN protection-status hypothesis, the attribution of a higher IUCN vulnerability status was followed by a decrease in the number of recorded trophies for 75% of the studied species. However, for the other 25%, involving an upgrade to the status 'endangered' (i.e. species with the highest perceived rarity), the trend in the change of the number of recorded trophies was in the opposite direction ($\Delta N_c = 0.214$, CI 95% = [–0.12;0.55]). Using the raw data instead of the detrended number of trophies led to qualitatively similar results (Appendix 2).

### Discussion

Assuming that the information provided by the IUCN on species-protection needs is used by biodiversity managers, including
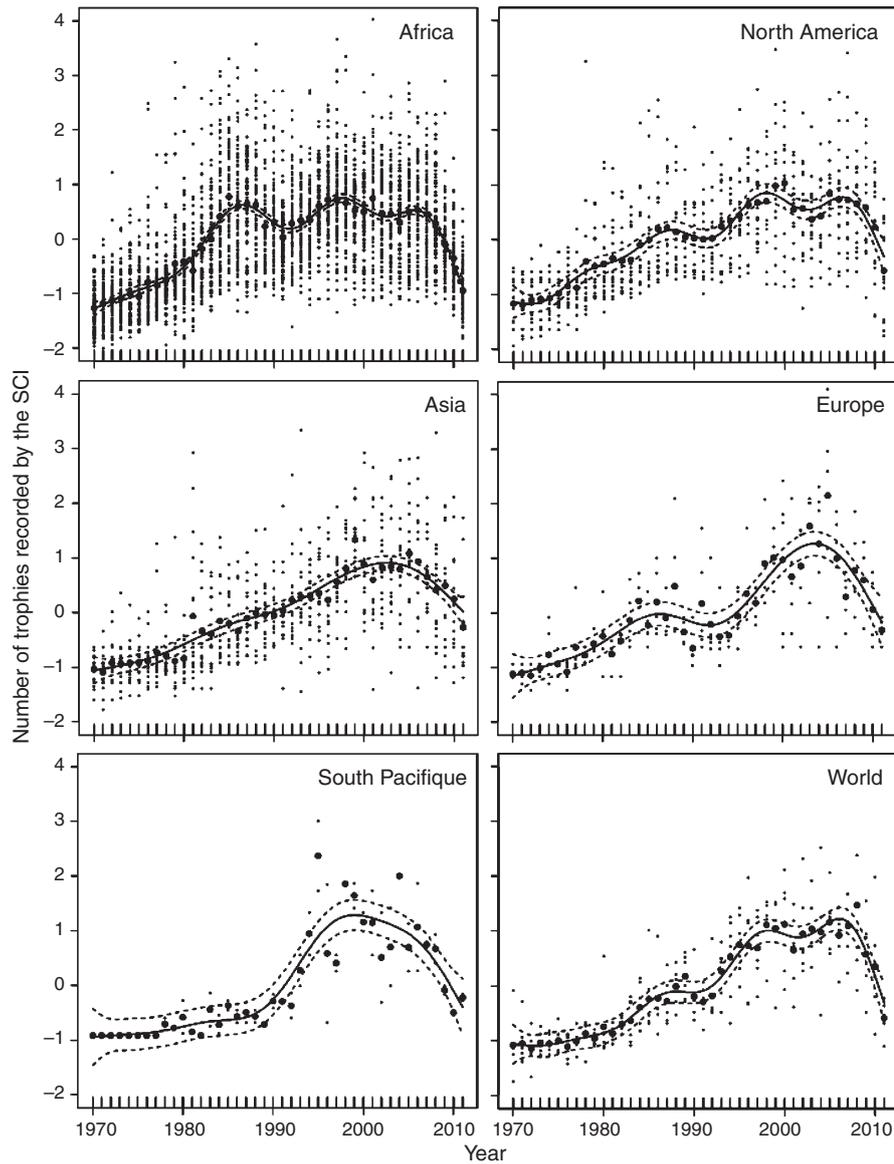
**Fig. 1.** Time trend of the number of recorded trophies in the Safari Club International database, standardised (centred and scaled) per species in each large hunting region. Small black points are the annual number of recorded trophies for a given species. Large black dots represent the average number of trophies recorded each year. The black line was obtained with a generalised additive model.

managers of trophy-hunted species, we expected to find (1) a lower number of animals hunted when they are initially described as threatened and (2) a decrease in the number of trophies after the vulnerability status has been upgraded. Contrary to our expectations, we found no statistical support for our first hypothesis of an effect of vulnerability-status attribution. In contrast, we found general support for our second hypothesis of an effect of vulnerability status upgrade for the majority of species, except for '*Endangered*' species. Our results, thus, suggest that the IUCN's recommendations are not systematically given full consideration when regulating trophy-hunting intensity for species protection. The AAE (i.e. the disproportionate valorisation and exploitation of rare species

by humans; Courchamp *et al.* 2006) could provide an explanation for this counterintuitive effect of IUCN status for the most threatened species.

As a conservation policy, we expected a decreasing number of trophies to occur along the gradient of extinction risk. However, the attribution of an IUCN status had no significant effect on the number of trophies recorded in the SCI (Fig. 2). Generally, our results showed that upgrading the IUCN status for a given species leads to a corresponding decrease in the number of trophies recorded for most species (Fig. 3). Indeed, the number of recorded trophies decreased for all 12 species that were upgraded to '*Near threatened*' or '*Vulnerable*'. These results illustrated that a reduction in trophy-hunting activity occurs in
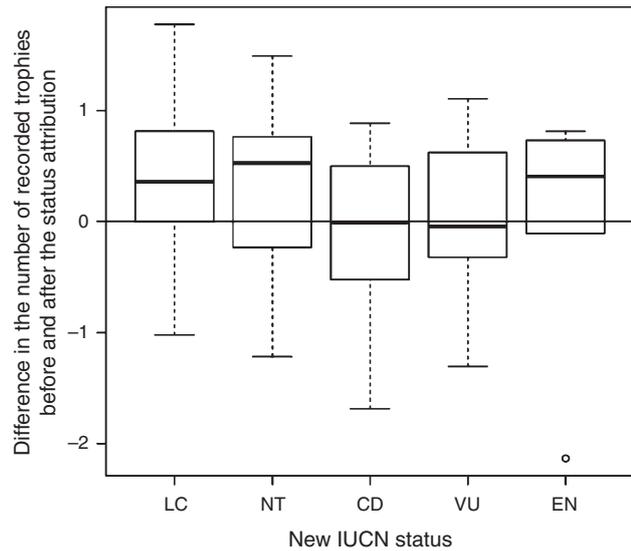
**Fig. 2.** Average difference between the mean number of recorded trophies in the Safari Club International database during the 5 years preceding and the 5 years following the attribution of the initial International Union for Conservation of Nature (IUCN) vulnerability status (after accounting for the increase in the total harvest over time per region). On the *x*-axis is represented the status attributed to the species, with an increasing extinction risk from left to right (LC for '*Least concern*', with 40 taxa; NT for '*Near threatened*', with 12 taxa; CD for '*Conservation dependent*', with 44 taxa; VU for '*Vulnerable*', with 23 taxa; EN for '*Endangered*', with five taxa). A negative difference means that the average number of trophies recorded after the change is lower than the average number of trophies recorded before the status attribution, which means that classifying the species to the *x* status (given on *x*-axis) leads to a decrease in the number of trophies recorded. The black thick lines in the boxes represent the median number of recorded trophies under this IUCN status. The lowest point in the '*Endangered*' category corresponds to the mountain nyala, *Tragelaphus buxtoni*.

**Fig. 3.** Average difference between the mean number of recorded trophies in the Safari Club International database during the 5 years preceding and the 5 years following an upgrade of the International Union for Conservation of Nature (IUCN) vulnerability status for a given species (after accounting for the increase in the total harvest over time per region). On the *x*-axis is represented the status to which the species has been upgraded, with an increasing extinction risk from left to right (NT for '*Near threatened*', with three taxa; VU for '*Vulnerable*', with nine taxa; EN for '*Endangered*', with four taxa). A negative difference means that the average number of trophies recorded after the change is lower than the average number of recorded trophies before the change, meaning that classifying the species to the *x* status (given on *x*-axis) leads to a decrease in the number of recorded trophies. The black thick lines in the boxes represent the median number of recorded trophies under this IUCN status.

response to increasing concern over a given species. The IUCN's information is thus correctly used in trophy-hunting management for these species. However, it is noteworthy that for species identified as '*Endangered*', we obtained the opposite pattern; namely, the number of recorded trophies was stable or increased after the status change for the four species that were upgraded to '*Endangered*' (Fig. 3). The '*Endangered*' status indicates the most vulnerable species according to the IUCN's criteria of classification. Our results thus point out shortcomings in species-conservation system. As in most conservation-biology topics, the amount of data available for the most threatened species are rather limited. Despite the generality of our result being therefore questionable, the four species upgraded to '*Endangered*' showed the very same absence of reduction in hunting bags which is a rather unexpected response for their conservation (Fig. 3). These results do not mean that the most vulnerable species will be inevitably driven to extinction by trophy hunting; however, this possibility should be brought to the attention of managers. An AAE would occur only if the management measures are not appropriately chosen or enforced (e.g. respect of scientifically established quotas, cautious attribution of the land-use rights, and focus on prevention of illegal hunting).
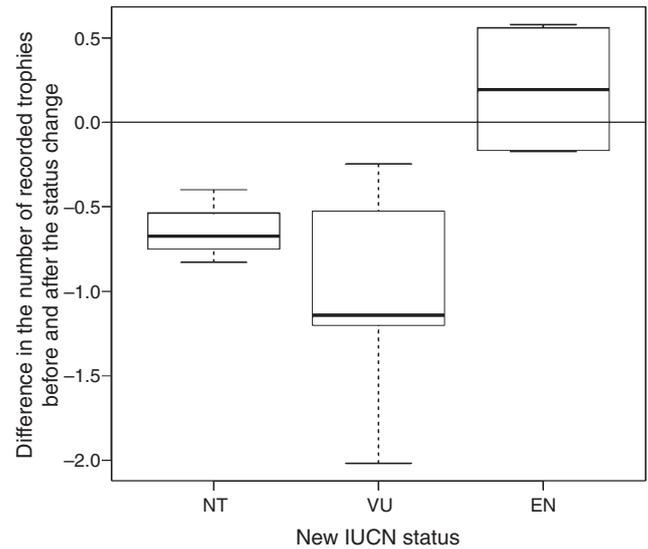
One should keep in mind when interpreting these results that the large amount of information provided by the SCI is only suitable for a macroscopic study and is not representative of more local or regional conservation policies, where species may be locally abundant. Our conclusions could thus be different at a finer scale such as the country or population level. Moreover, we could not test for stability in the rate of return of the information over time (i.e. that the proportion of kills that are recorded in the database is temporally constant) because there are no available estimates for the global trophy harvest in the SCI over years. However, our study highlighted several points that improve our understanding of the link between vulnerability status and trophy hunting.

There are no examples of species extinction as a result of trophy hunting (Mysterud 2012). On the contrary, there are a few documented examples of declining populations that have recovered as a result of the appropriate use of the considerable income generated by well managed trophy hunting (Frisina and Tareen 2009). However, our results suggested that IUCN status is only partially taken into account in the global management of species that are hunted for their trophies. The outcomes of our study, as well as those of some other studies (Johnson *et al*. 2010; Palazy *et al*. 2011, 2012; Prescott *et al*. 2011), are sufficiently indicative to advise caution on behalf of decision-makers in the planning of management programs for the rarest species.

## Acknowledgements

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**Appendix 1.    Number of trophies recorded and International Union for Conservation of Nature (IUCN) status changes over the study period for the 124 species included in the analysis**

Ntrophies is the total number of recorded trophies in the Safari Club International between 1970 and 2011. Status changes give the first status attribute for each species and the status upgrades. NA = non-assigned. IUCN statuses classified from the lowest to the highest extinction risk are: LC= '*Least Concern*', NT = '*Near threatened*', CD = '*Conservation dependent*', VU = '*Vulnerable*', EN = '*Endangered*'

| Species | Common name | Ntrophies | Status changes |
|---|---|---|---|
| *Acinonyx jubatus* | Cheetah | 62 | NA→VU |
| *Aepyceros melampus* | Impala | 4435 | NA→CD→LC |
| *Alcelaphus buselaphus caama* | Cape or red hartebeest | 2410 | NA→CD→LC |
| *Alcelaphus buselaphus cokei* | Coke hartebeest | 340 | NA→CD→LC |
| *Alcelaphus buselaphus lelwel* | Lelwel hartebeest | 274 | NA→CD→EN |
| *Alcelaphus buselaphus major* | Western hartebeest | 209 | NA→CD→NT |
| *Alcelaphus lichtensteini* | Lichtenstein hartebeest | 970 | NA→CD→LC |
| *Alces alces* | Moose | 1691 | NA→LC |
| *Alligator mississippiensis* | American alligator | 309 | NA→LC |
| *Ammotragus lervia* | Aoudad or barbary sheep | 22 | NA→VU |
| *Antidorcas marsupialis* | Springbok | 2959 | NA→CD→LC |
| *Antilocapra americana* | Pronghorn | 3010 | NA→LC |
| *Antilope cervicapra* | Blackbuck | 287 | NA→VU→NT |
| *Axis axis* | Axis deer | 258 | NA→LC |
| *Bison bison* | American bison | 785 | NA→CD→NT |
| *Bison bonasus* | European bison | 90 | NA→VU→EN→VU |
| *Bos javanicus* | Banteng | 249 | NA→VU→EN |
| *Bubalus bubalis* | Water buffalo | 1002 | NA→EN |
| *Canis lupus* | Gray wolf | 444 | NA→VU→LC |
| *Capra aegagrus* | Bezoar or Persian ibex | 2211 | NA→VU |
| *Capra caucasica* | Caucasian tur | 171 | NA→EN |
| *Capra cylindricornis* | East Caucasian tur | 191 | NA→VU→NT |
| *Capra ibex* | Alpine ibex | 141 | NA→LC |
| *Capra nubiana* | Nubian ibex | 57 | NA→EN→VU |
| *Capra pyrenaica* | Spanish ibex | 1204 | NA→NT→LC |
| *Capra sibirica* | Asian ibex | 690 | NA→LC |
| *Capreolus capreolus* | European roe deer | 711 | NA→LC |
| *Cephalophus callipygus* | Peters duiker | 167 | NA→NT→LC |
| *Cephalophus dorsalis* | Bay duiker | 127 | NA→NT→LC |
| *Cephalophus harveyi* | Harvey red duiker | 62 | NA→CD→LC |
| *Cephalophus monticola* | Blue duiker | 504 | NA→LC |
| *Cephalophus natalensis* | Natal red duiker | 441 | NA→CD→LC |
| *Cephalophus nigrifrons* | Black-fronted duiker | 19 | NA→NT→LC |
| *Cephalophus rufilatus* | Red-flanked duiker | 272 | NA→CD→LC |
| *Cephalophus silvicultor* | Yellow-backed duiker | 107 | NA→NT→LC |
| *Ceratotherium simum simum* | Southern white rhinoceros | 450 | NA→NT |
| *Cervus elaphus* | Wapiti or maral or red deer | 2624 | NA→LC |
| *Cervus nippon* | Sika deer | 361 | NA→LC |
| *Cervus timorensis* | Rusa deer | 297 | NA→LC→VU |
| *Cervus unicolor* | Sambar | 104 | NA→LC→VU |
| *Civettictis civetta* | African civet | 120 | NA→LC |
| *Connochaetes gnou* | Black wildebeest | 1707 | NA→CD→LC |
| *Connochaetes taurinus* | Wildebeest | 3868 | NA→CD→LC |
| *Crocodylus niloticus* | Nile crocodile | 489 | NA→VU→LC |
| *Crocuta crocuta* | Spotted hyena | 662 | NA→CD→LC |
| *Dama dama* | European fallow deer | 976 | NA→LC |
| *Damaliscus dorcas dorcas* | Bontebok | 666 | NA→VU→NT |
| *Damaliscus dorcas phillipsi* | Blesbok | 3148 | NA→CD→LC |
| *Damaliscus lunatus jimela* | Topi | 437 | NA→CD→LC |
| *Damaliscus lunatus lunatus* | Tsessebe | 1045 | NA→CD→LC |
| *Gazella dorcas* | Dorcas gazelle | 108 | NA→VU→NT→VU |
| *Gazella granti* | Grant gazelle | 1165 | NA→CD→LC |
| *Gazella soemmerringi* | Soemmerring gazelle | 181 | NA→VU |
| *Gazella subgutturosa* | Goitered gazelle | 302 | NA→NT→VU |
| *Gazella thomsoni* | Thomson gazelle | 698 | NA→CD→NT |
| *Hemitragus jemlahicus* | Himalayan tahr | 988 | NA→VU→NT |

(*continued next page*)

**Appendix 1.**   (*continued*)

| Species | Common name | Ntrophies | Status changes |
|---|---|---|---|
| *Hippopotamus amphibius* | Common hippopotamus | 701 | NA→LC→VU |
| *Hippotragus equinus* | Roan antelope | 808 | NA→CD→LC |
| *Hippotragus niger* | Sable antelope | 1352 | NA→CD→LC |
| *Hydropotes inermis* | Chinese water deer | 169 | NA→VU→NT→VU |
| *Hylochoerus meinertzhageni* | Giant forest hog | 91 | NA→LC |
| *Kobus ellipsiprymnus ellipsiprymnus* | Common or ringed waterbuck | 1935 | NA→CD→LC |
| *Kobus kob kob* | African kob | 321 | NA→CD→VU |
| *Kobus leche kafuensis* | Kafue flats lechwe | 466 | NA→VU |
| *Kobus leche leche* | Red lechwe | 519 | NA→CD→LC |
| *Kobus vardoni* | Puku | 631 | NA→CD→NT |
| *Leptailurus serval* | Serval | 145 | NA→LC |
| *Litocranius walleri* | Gerenuk | 668 | NA→CD→NT |
| *Loxodonta africana* | African elephant | 569 | NA→VU→EN→VU |
| *Madoqua kirki* | Kirk dik-dik | 656 | NA→LC |
| *Mazama gouazoubira* | Gray-brown brocket deer | 298 | NA→LC→DD→LC |
| *Mazama pandora* | Yucatan gray-brown brocket deer | 37 | NA→LC→DD→VU |
| *Muntiacus reevesi* | Reeves muntjac | 209 | NA→LC |
| *Nesotragus batesi* | Bates pygmy antelope | 48 | NA→NT→LC |
| *Nesotragus moschatus* | Suni | 360 | NA→EN→CD→LC |
| *Odocoileus hemionus* | Mule deer or black-tailed deer | 2701 | NA→LC |
| *Odocoileus virginianus* | White-tailed deer | 2959 | NA→LC |
| *Oreamnos americanus* | American mountain goat | 879 | NA→LC |
| *Oreotragus oreotragus* | Klipspringer | 961 | NA→CD→LC |
| *Oryx beisa callotis* | Fringe-eared oryx | 337 | NA→CD→VU |
| *Oryx gazella* | Gemsbok | 1910 | NA→CD→LC |
| *Ourebia ourebi* | Oribi | 836 | NA→CD→LC |
| *Ovibos moschatus* | Greenland muskox | 829 | NA→LC |
| *Ovis ammon* | Argali | 937 | NA→VU→NT |
| *Ovis canadensis* | Bighorn sheep | 1121 | NA→CD→LC |
| *Ovis dalli* | Dall sheep | 1348 | NA→LC |
| *Ovis gmelini* | Mouflon or urial | 850 | NA→VU |
| *Ovis nivicola* | Snow sheep | 269 | NA→CD→LC |
| *Ovis vignei* | Urial | 333 | NA→VU |
| *Panthera leo* | African lion | 1804 | NA→VU |
| *Panthera pardus* | Leopard | 1758 | NA→VU→LC→NT |
| *Pelea capreolus* | Vaal rhebok | 576 | NA→CD→LC |
| *Phacochoerus aethiopicus* | Warthog | 2408 | NA→LC |
| *Potamochoerus larvatus* | Bushpig | 639 | NA→LC |
| *Potamochoerus porcus* | Red river hog | 77 | NA→LC |
| *Procapra picticaudata* | Tibetan gazelle or goa | 97 | NA→NT→LC→NT |
| *Puma concolor* | Cougar or mountain lion | 1338 | NA→LC→NT→LC |
| *Rangifer tarandus* | Reindeer or caribou | 1689 | NA→LC |
| *Raphicerus campestris* | Steenbok | 1822 | NA→LC |
| *Raphicerus melanotis* | Cape grysbok | 447 | NA→CD→LC |
| *Raphicerus sharpei* | Sharpe grysbok | 481 | NA→CD→LC |
| *Redunca arundinum* | Common reedbuck | 1240 | NA→CD→LC |
| *Redunca fulvorufula chanleri* | Chanler mountain reedbuck | 76 | NA→NT→VU |
| *Redunca fulvorufula fulvorufula* | Southern mountain reedbuck | 952 | NA→CD→LC |
| *Redunca redunca* | Bohor reedbuck | 657 | NA→CD→LC |
| *Rupicapra pyrenaica* | Alpine chamois | 526 | NA→CD→LC |
| *Rupicapra rupicapra* | Pyrenean chamois | 751 | NA→LC |
| *Sus scrofa* | Feral boar | 755 | NA→LC |
| *Sylvicapra grimmia* | Bush duiker | 2772 | NA→LC |
| *Syncerus caffer* | African buffalo | 3521 | NA→CD→LC |
| *Taurotragus derbianus gigas* | Central African giant eland | 434 | NA→VU→LC |
| *Taurotragus oryx oryx* | Cape eland | 1670 | NA→CD→LC |
| *Tayassu pecari* | White-lipped peccary | 211 | NA→LC |
| *Tayassu tajacu* | Collared peccary or javelina | 1021 | NA→LC |
| *Tragelaphus angasi* | Common nyala | 1923 | NA→CD→LC |
| *Tragelaphus buxtoni* | Mountain nyala | 188 | NA→EN |

(*continued next page*)

**Appendix 1.**  (*continued*)

| Species | Common name | Ntrophies | Status changes |
|---|---|---|---|
| *Tragelaphus euryceros euryceros* | Western bongo | 420 | NA→NT |
| *Tragelaphus imberbis* | Lesser kudu | 530 | NA→CD→NT |
| *Tragelaphus scriptus* | Bushbuck | 4433 | NA→LC |
| *Tragelaphus spekii* | Sitatunga | 670 | NA→NT→LC |
| *Tragelaphus strepsiceros* | Greater kudu | 5012 | NA→CD→LC |
| *Ursus americanus* | Black bear | 820 | NA→LC |
| *Ursus arctos* | Brown bear | 1991 | NA→LC |
| *Ursus maritimus* | Polar bear | 185 | NA→VU→CD→VU |

**Appendix 2.    Results of the analysis on the standardised number of recorded trophies (without detrending for the effect of time)**
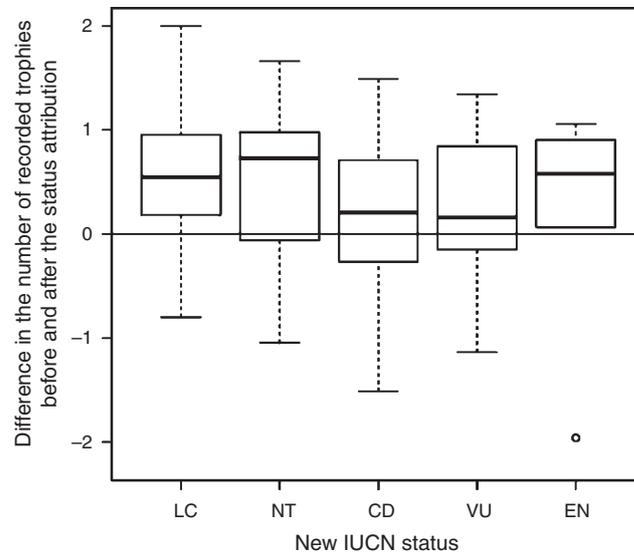


**Fig. A1.**    Average difference between the mean number of recorded trophies in the Safari Club International 5 years after and 5 years before the attribution of the first International Union for Conservation of Nature (IUCN) vulnerability status (multiple Kruskal–Wallis test comparison, $P > 0.05$). On the *x*-axis is represented the status attributed to the species, with an increasing extinction risk from left to right (LC for '*Least concern*', with 40 taxa; NT for '*Near threatened*', with 12 taxa; CD for '*Conservation dependent*', with 44 taxa; VU for '*Vulnerable*', with 23 taxa; EN for '*Endangered*', with five taxa). A negative difference means that the average number of trophies recorded after the change is lower than the average number of trophies recorded before the status attribution, which means that classifying the species to the *x* status (given on *x*-axis) leads to a decrease in the number of trophies recorded. The black thick lines in the boxes represent the median number of recorded trophies under this IUCN status. The lowest point in the '*Endangered*' category corresponds to the mountain nyala, *Tragelaphus buxtoni*.
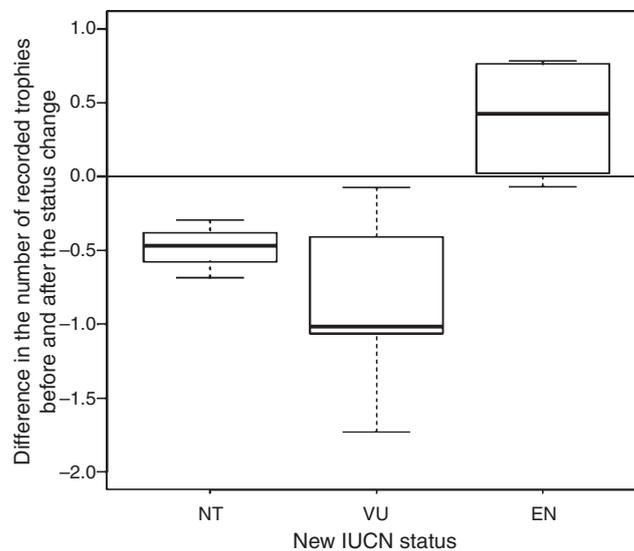


**Fig. A2.**    Average difference between the mean number of recorded trophies in the Safari Club International 5 years after and 5 years before upgrading the species to a higher International Union for Conservation of Nature (IUCN) vulnerability status (multiple Kruskal–Wallis test comparison, $P = 0.01$). On the *x*-axis is represented the status to which the species has been upgraded with an increasing extinction risk from left to right (NT for '*Near threatened*', with three taxa; VU for '*Vulnerable*', with nine taxa; EN for '*Endangered*', with four taxa). A negative difference means that the average number of trophies recorded after the change is lower than the average number of trophies recorded before the change, meaning that classifying the species to the *x* status (given on *x*-axis) leads to a decrease in the number of trophies recorded. The black thick lines in the boxes represent the median number of recorded trophies under this IUCN status.