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Equus zebra ssp. hartmannae, Hartmann's Mountain Zebra

Assessment by: Gosling, L.M., Muntifering, J., Kolberg, H., Uiseb, K. & King, S.R.B.



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Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Mammalia	Perissodactyla	Equidae

Taxon Name: *Equus zebra ssp. hartmannae* Matschie, 1898

Parent Species: See [Equus zebra](#)

Common Name(s):

- English: Hartmann's Mountain Zebra
- French: Zèbre de Hartmann, Zèbre de montagne de Hartmann
- Spanish: Cebra de Hartmann

Taxonomic Notes:

Groves and Bell (2004) investigated the taxonomy of the Mountain Zebras and concluded that the Cape Mountain Zebra (*Equus zebra zebra*) and Hartmann's Mountain Zebra (*Equus zebra hartmannae*) are distinct, and suggested that the two would be better classified as separate species, *Equus zebra* and *Equus hartmannae*. However, in a genetic study that included 295 Mountain Zebra specimens, Moodley and Harley (2005) found no evidence to regard the two taxa as anything more than different populations of a single species. They concluded that the Cape Mountain Zebra and Hartmann's Mountain Zebra should remain subspecies. Therefore, no taxonomic changes since 2004 have been made.

Assessment Information

Red List Category & Criteria: Vulnerable A3bcd [ver 3.1](#)

Year Published: 2019

Date Assessed: May 15, 2017

Justification:

This subspecies is listed as Vulnerable (VU A3bcd) due to the probability of a future population reduction of at least 30% within the next 33 years (three generations) if further severe droughts occur. While the population has increased in recent years, Hartmann's Mountain Zebra (HMZ) remain at threat from another catastrophic drought as this would probably result in mortality across their range, but particularly of a high proportion of zebras on private farms and freehold conservancies. Over 3,500 HMZ are killed annually under license (data from 2008-2012, Shapi 2014, CITES trade statistics). At the moment this appears sustainable, but changing climatic conditions combined with over-harvesting could quickly cause this species to become threatened again. We have not been able to carry out a detailed analysis of the impact of the early 1980s drought but recommend that this should be done if sources can be identified. It is important to fully understand that the current population is more vulnerable than it may appear from its numbers alone and that we should learn the lessons of past droughts to plan conservation measures for a sustainable future.

There has been a significant population increase and range expansion over the past 13 years since the previous assessment, when it was listed as VU C1. The main omission in this assessment is an estimate

of the total numbers on commercial farms. In this assessment, we follow the precedent of Novellie *et al.* (2002) in not extrapolating from the numbers recorded by farmers in their questionnaire returns. Our main grounds for this omission include the lack of statistical rigour in the estimates and the fact that such animals are at higher levels of risk than other sectors of the national population, particularly during droughts when priority is given to livestock. The overall increase described here is probably in part a long term response to under-population (in relation to carrying-capacity) following the severe drought of the early 1980s which decimated both livestock and wildlife. In areas where the main predators (lions and spotted hyenas) are absent because of previous or current removal to protect livestock, numbers have increased by around 20% per annum, close to the theoretical maximum. Where there are intact predator communities (as for example in Etosha NP) numbers have also increased but there are no details of trends. On commercial farms the annual increase was probably lower reflecting higher levels of consumptive use.

Management intervention may also have affected growth in numbers, notably through the creation of a network of communal conservancies in a large area of mountain zebra habitat in the north-west and re-introduction of HMZ to these areas. In addition much effort has been devoted to the creation of large conservation areas which have made some progress toward reduced fencing, notably the Greater Fish River Canyon scheme in the south of Namibia which includes the Ai-Ais part of the Ai-Ais Richtersveld Transfrontier Park, and the Greater Namib Sossusflei Landscape scheme which includes the important HMZ population of the Namib-Naukluft NP.

Previously Published Red List Assessments

2008 – Vulnerable (VU)

<http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T7958A12876477.en>

1996 – Endangered (EN)

1990 – Vulnerable (V)

1988 – Vulnerable (V)

1986 – Vulnerable (V)

Geographic Range

Range Description:

Hartmann's Mountain Zebra (HMZ) primarily occupy the escarpment region of western Namibia that runs north-south along the entire length of the country and which form the boundary between an arid coastal plain (which includes the Namib Desert in the south and the Skeleton Coast in the north) and a wetter inland plateau. At its northern end, the subspecies' distribution extends into southern Angola and 263 were estimated in the Iona National Park in a 2003 survey (Kolberg and Kilian 2003). At the southern end of its distribution the subspecies extends into northern South Africa including the Richtersveld part of the Ai-Ais-Richtersveld Transfrontier Park, however numbers in the Richtersveld are very small and there is a need to establish the reasons for this (possibilities include historical over-hunting, competition with livestock, inadequate habitat) before considering introduction from southern Namibia to create, or restore, a viable subpopulation.

Published accounts of HMZ distribution (Joubert 1973, Penzhorn 2013) refer to four subpopulations

namely: (1) from Kunene Region southwards to the Ugab River and eastward to the Outjo District, (2) the Erongo Mountains, (3) the escarpment from the Swakop River southwards to the Naukluft Mountains and eastward along the Kuiseb and Gaub drainages into the Khomas Hochland, and (4) the Fish River canyon and Huns Mountains near the Orange River in the south. There is some evidence for these distinctions in the distribution map in Novellie *et al.* (2002). However current information suggests that the three northern 'subpopulations' are essentially continuous. This may be due to significant population expansion or from under-sampling in some areas (especially where there are low levels of commercial farm questionnaire returns). The extent to which the Hunsberg/Fish River sub-population in the south is separated needs further investigation.

A veterinary fence that bisects the north-western Namibia range has historically proven to be a significant movement barrier as was documented during the 1980-82 drought when hundreds of HMZ carcasses were collected along the fence. However, more recent unpublished evidence has demonstrated that Hartmann's zebra move across the fence at certain permanent gaps and may also use breaks created by rivers or elephants. The overall genetic implications of the veterinary fence are unknown but could be significant.

As noted previously (Novellie *et al.* 2002) the current range of HMZ differs from the historical range in Namibia, partly because of the widespread establishment of artificial water sources which allow this water-dependent subspecies to occupy habitat that was previously unsuitable.

In South Africa, HMZ are currently established in three conservation areas: Richtersveld and Augrabies National Parks and Goegap Provincial Nature Reserve (Novellie *et al.* 2002). They have also been introduced outside of their natural distribution range in the Western Cape, Eastern Cape, North West and Free State provinces.

Country Occurrence:

Native: Angola; Namibia; South Africa

Population

The status and distribution estimates for HMZ used in this assessment are the latest available as of December 2014; most data used were collected or coordinated by the Ministry of Environment and Tourism, Namibia. The time of estimates for different parts of the range and different types of land holding are variable; where more recent estimates are lacking this is in general due to lack of resources. The dates for each estimate are given where the data are presented. We have not attempted to extrapolate earlier estimates (for example using the overall increasing national trend) and so some values are probably underestimates.

NAMIBIA

There are a number of areas of Namibia where data on HMZ have not been recorded. Some of these are in habitat which would be expected to be suitable for this species and further surveys are needed to determine whether or not they are present.

HMZ occur in at least seven National Parks and Game Reserves that comprise the state protected areas in Namibia. They may also occur in small numbers in additional protected areas such as the Skeleton Coast NP where 30 animals were recorded during a wider survey in 2014 (Craig and Gibson 2014).

There are a number of large privately-owned nature reserves in HMZ habitat which generally support non-consumptive ecotourism activities. They all maintain networks of artificial water holes which increase their value for HMZ.

Currently, 83 communal conservancies have officially been registered on state communal land incorporating over 250,000 Namibians (12% of Namibia's total population) spanning roughly 16 million hectares or 19.4% of the country's total land surface (NACSO 2014). Of these 83 conservancies, 36 are in the north-west Kunene region where the majority of HMZ on communal land persist. These conservancies support 44,105 inhabitants and their total area is 58,976 km². As part of efforts to promote wildlife populations in these conservancies there have been re-introductions including 594 HMZ between 1999 and 2013 sourced from Etosha NP, the Hobatere tourist concession area and the Naukluft NP. Annual road counts are carried out by conservancy members, supporting non-governmental organizations and Ministry of Environment and Tourism staff to estimate the status and trends for various species including HMZ. About 32% of the total area of the conservancies are not sampled due to inaccessibility and air surveys suggest that about 16% of the population may be in these areas. Seventeen of the Kunene communal conservancies recorded HMZ in the June 2014 annual ground counts. Results from the road counts are summarized each year by the Namibian Association of Community Based Natural Resource Management (CBNRM) Support Organizations (NACSO), an association comprising nine NGOs and the University of Namibia. Combined with regular monitoring data, the counts are used as a basis to set offtake levels for each conservancy comprising trophy hunting, 'shoot and sell', 'own use' and live capture for sale. It should be emphasized that, while the communal conservancies also contain substantial populations of livestock, they are unfenced and that, collectively, they form the largest landscape scale conservation area for HMZ and thus allow large-scale movements to patchy food.

Three state-administered concession areas exist in areas of good HMZ habitat in the north-west communal lands. These concession areas are leased out to the neighbouring conservancies exclusively

for non-consumptive tourism which are in turn sub-leased to private sector tourism operators. Unlike the communal conservancies these areas only support livestock during extreme drought situations.

The numbers of HMZ on commercial farms potentially comprise a large part of the total national population. Some of these farms are game farms but most have mixed livestock and wildlife. In the past, their numbers have been assessed using responses to a national questionnaire organised by the MET and the values provided are assessments based on the landowners' experience and opinion. While these assessments are probably often quite accurate they do not have the validity of scientifically-based estimates and they are potentially subject to bias where landowners are aware that their estimates will likely affect their permitted off-take quota. In addition, only a proportion of the farmers respond to the questionnaires and it is not known if this proportion is representative. Barnes and de Jager (1996), adopted the convention of assuming that wildlife were half as abundant on the farms of questionnaire non-responders as responders. However this is difficult to justify because of the large variation in the proportion of responders (19 to 61% in the surveys reported by Novellie *et al.* 2002) which seems unlikely to reflect changes in animal abundance. Because of these uncertainties, extrapolated estimates of the numbers on commercial farms were not included in the previous national assessment (Novellie *et al.* 2002).

The frequency of response to the latest questionnaire was substantially lower than in previous years. There are just over 4,000 commercial farms in Namibia and, of these, responses were obtained for 523 (in 357 responses; a number that is lower because of multiple ownership) to a questionnaire in 2012 about wildlife on their farms. The area of the responding farms was 28,855 km² out of 392,532 km², a sampling intensity of 7.35% and a total of 8,941 HMZ were reported on the 523 farms. Because of this low sampling intensity, and because of the potential for sampling bias if the farmers responding tend to have more wildlife on their farms, we follow the precedent of Novellie *et al.* (2002) in presenting only the numbers estimated by the farmers that responded to the questionnaire. This value is 8,941 mountain zebra, which in a sampled area of 28,855 km² yields a mean density of 0.31 mountain zebra per km². We are aware that this is probably a serious underestimate of the number on commercial farms and it is widely believed that the population is much larger.

An important caveat when considering animals on commercial farms and freehold conservancies is that not all are part of a national panmictic population. Many animals on farms move relatively freely though fences and interbreed with animals outside, while others are confined to 'game camps' and do not interact with other animals. This is partly a result of the type of fencing: game camps are often enclosed by game fences which genetically isolate the animals within, while animals that share farms with cattle are enclosed by fences that are more permeable. The number of mountain zebra held under these two conditions, which dictate whether they are part of the national population in a genetic sense, is currently unknown although we believe that the proportion that is genetically isolated is a minority. Finally, we emphasise that while there are probably more HMZ on commercial farms than reported here, the vulnerability of these animals in times of drought may be significantly higher than animals in other types of landholding where there is a lower level of conflict with livestock. These differences in conservation status under different land use practices are fundamental to HMZ conservation management and will be discussed below.

Overall national estimate: The numbers of HMZ in each type of land holding comprising the national population are summarised in Table 1 in the Supporting Information. The national total is 44,712 at an

average density of 0.45 per km². This is certainly an underestimate because inadequate sampling precludes proper estimation of the numbers on private farms and freehold conservancies.

In Namibia the proportion of mature individuals in the population was based on data collected by Gosling *et al.* (unpublished): out of 818 animals in the Gondwana Canyon Park population, 593 (72.5%) were adults (3 yrs old and above): 377 females of which 271 (71.9%) are adults; 442 males of which 322 (72.9%) are adults. 'Adults' refers to physiological not breeding status. However, males don't breed until they obtain harems at about 6 years of age, and there are only 225 of these males which are 69.9% of the 322 physiologically adult males and 50.9% of the 442 male total. All of the adult females are of breeding age and so the total number of breeding adults is 271 (females 3yrs and above) + 225 (males 6 yrs and above) = 496. We therefore calculate that 61% of the population are mature individuals. A previous age structure given by Joubert (1974) for a sample of HMZ shot on Khomas Hochland farms is more heavily skewed towards young animals, but this population was under severe hunting pressure and may not be typical nowadays.

Using the criterion of physiological maturity, rather than that of behavioural breeding status, the total number of mature individuals in Namibia is thus 32,416 mature individuals (72.5 % of 44,712).

SOUTH AFRICA

The total formally protected population in 2004 was noted as being 80 collectively in Augrabies National Park (25 individuals), Richtersveld National Park (30 individuals) and Goegap Nature Reserve (25 individuals) (Friedmann and Daly 2004, M. Smit unpubl. data). The subpopulation in Goegap Nature Reserve has since doubled (69 individuals in 2015; M. Smit unpubl. data), while that of Augrabies Falls National Park has increased to 208 individuals in 2016 (Bissett *et al.* 2016). A current subpopulation estimate for the Richtersveld National Park is unavailable. While estimates for subpopulations on private land were unknown in the previous assessment, it is estimated that there are currently at least 570 Hartmann's Mountain Zebra on private land in the Northern Cape. This is based on both data from the permit office of the Department of Environment and Nature Conservation (DENC) where 305 individuals were moved between private properties (2009– 2013, M. Smit, unpubl. data), and data from a nationwide survey on wildlife ranching (2014; A. Taylor unpubl. data). The permit data and the ranch data are non-overlapping as they represent different localities. Subpopulations dependent on direct intervention are not considered wild, if they would go extinct within 10 years without intensive management (IUCN Standards and Petitions Subcommittee, 2014). As such, a preliminary analysis to determine which private subpopulations can be considered wild, revealed that 64-95% of individuals on private land are eligible for inclusion in the assessment (N = 21 properties, A. Taylor, unpubl. data), which means 364-542 privately owned Hartmann's Mountain Zebra are eligible for inclusion in this assessment. Private subpopulations are inferred to be increasing along with the expansion of the wildlife ranching industry.

Mature population structure is inferred from demographic data from Mountain Zebra subpopulations in both the Western Cape and Goegap Nature Reserve, which corresponds to 67% (based on average numbers of mature individuals in both breeding and stallion herds; C. Birss, unpubl. data) and 91% (of 47 individuals in Goegap, there are 43 adults, one sub-adult and three juveniles; M. Smit unpubl. data) respectively. To compensate for variation between areas, we used a mature population structure of 75%. More research is needed to establish the accurate proportion of mature individuals across subpopulations. Thus, overall the total mature and wild population size in the assessment region, based

on available data, is at least 592–724. The generation length for *Equus zebra* overall has been estimated as 11 years by Pacifici *et al.* (2013). Over three generations (1980–2013), the subpopulation at Goegap Nature Reserve (the only site with long-term data available) has increased significantly (from 6 to 69 individuals) in total or 6.2% on average per year. Similarly, the subpopulation on Tswalu Kalahari Private Game Reserve has increased from 65 in 2005 to 203 in 2014 at a growth rate of 11.6% per year (C. Kraft unpubl. data); and the subpopulation on Auwabes Falls National Park has increased from 8 in 1996 to 208 in 2016 (Bissett *et al.* 2016). While the total population size in 2009 is unknown, as long-term data are unavailable, it seems likely there have been > 250 mature individuals over the last five years (IUCN Standards and Petitions Subcommittee 2014), especially seeing as in 2002 there were already a reported estimate of 279 Hartmann's Mountain Zebras in the Northern Cape (Novellie *et al.* 2002).

ANGOLA

A recent survey conducted by the Ministry of Environment and Tourism of Namibia in Iona National Park (Kolberg and Killian 2003) found an estimated subpopulation size is 263, or 191 mature individuals.

GLOBAL POPULATION SIZE

Based on most recent survey data available, the global population size is 191 mature individuals in Angola, 592–724 in South Africa, and 32,416 in Namibia, equating to about 33,265 HMZ range-wide.

The general consensus amongst conservationists, landowners and others in Namibia is that HMZ numbers have increased steadily since the population was decimated during the severe droughts of the early 1980s. Mortality of wildlife and livestock at that time was over 90% as a consequence of a combination of low rainfall and human intervention (e.g. Owen-Smith 2010). The impact of the drought should be explored in more detail because such droughts will almost certainly occur again and such events may be crucial both for conservation management of this species and for assessing their conservation status and long-term viability.

The largest sector of the population may live on commercial farms but we are not yet in a position to estimate their numbers or population trends reliably. The quality and potential bias of the questionnaire-based data available have been discussed above. Novellie *et al.* (2002) provide data uncorrected for sampling intensity (questionnaire returns) for 1972, 1982, 1992 and 1997 and their data suggest an increasing trend. Barnes and de Jager (1996) analyse part of the same data presented by Novellie *et al.* and show a similar increase between 1972 and 1992. In addition to the effect of climate on allowing populations to recover after the 1980/81 drought it is believed that there has been significant and progressive changes in the behaviour of farmers in response to legislative changes conferring wildlife utilization rights in the 1970s. Lindsey *et al.* (2013) documented an increase in wildlife populations on farms that had previously been devoted to livestock, which appeared to be directly linked to the financial benefits from the development of consumptive and non-consumptive wildlife practices that became possible under the new legislation.

The number of communal conservancies has increased steadily, particularly in the north-west, and wildlife numbers have increased as well. As in the case of freehold farms legislative changes giving wildlife utilization rights to communal conservancies had a direct and beneficial impact on wildlife populations because of changes in the behaviour of local communities, for example by providing improved access to water and by re-introductions. Wildlife population trends in communal conservancies are estimated using annual road counts that are carried out annually in a standardized

fashion and are analyzed using DISTANCE software. The results suggest a steady increase followed by stabilization or reduction 2011-2014. The main methodological problem is that a significant part of the area and suitable habitat for many target species under investigation (about 30%) is inaccessible to sampling due to the rugged terrain. This leads to some uncertainty about the cause of the recent stabilization/reduction. It may be that under recent dry conditions a part of the population moves to the inaccessible mountainous areas so that the stabilization/reduction may be due to movement rather than mortality and/or reduced fecundity under dry conditions. This can only be resolved by improved sampling and more detailed population ecology.

Population trends are also available for some of the large private protected areas. For example, systematic annual game counts have been carried out in Gondwana Canyon Park (GCP) in the south of Namibia and adjoining the Ai-Ais National Park. As in the north-west, numbers show substantial increase but these data must be treated with caution. Before this Park was established in 1997, the area was devoted to small stock farming with HMZ reduced to small numbers. After the Park was established fences were removed and water sources were improved and made available for wildlife and numbers of HMZ increased. There is a degree of permeability in the fence between GCP and the Ai-Ais National Park to the west, and so the increase in numbers may be partly due to immigration, as animals are attracted to permanent water sources, and partly to intrinsic increase. Some short-term changes, such as that between 2012 and 2013 are too large to be due to intrinsic increase alone. But, even with this caveat, the long term trend suggests a substantial increase in the size of the population.

The increase between that reported for 1997/1998 by Novellie *et al.* (2002) and that reported here requires careful consideration. Novellie *et al.* report a minimum of 25,059 HMZ compared with our estimate of 44,712. The number recorded from commercial farms declined between the previous and latest estimate but this appears to be mainly because the frequency of questionnaire returns from landowners declined from 19% to 7%. Excluding commercial farms (that is considering only state protected areas plus communal lands) Novellie *et al.* report a total of 10,052 (data from Table 3.4 in Novellie *et al.*, 2002) in comparison with our estimate of 35,846 (which is a conservative estimate). The reasons for this difference may be a combination of significant population growth during a period of high rainfall, the creation of new protected areas (the private parks and the expanding communal conservancies) and perhaps sampling procedures. All comparable areas increased between the two sampling periods with some populations such as those of Gondwana Canyon Park and NamibRand Nature Reserve appearing in the record for the first time in the present review.

The only population that showed just a small increase is that of the Naukluft extension of the Namib-Naukluft NP which increased by only 13% between the estimates in 1998 and 2013. This mountainous area, which was created as a protected area for HMZ in their key escarpment habitat, remains the focus of the largest and most-important sub-population of HMZ in Namibia. The most recent estimate for this area was 2,643+/-452 while the adjacent lower altitude Ganab section of the Namib-Naukluft NP was estimated to contain 8,441+/-940. The Naukluft extension estimate was probably an underestimate and the Ganab estimate an overestimate, but an overall figure of around ten thousand seems realistic. Thus, overall, there appears to have been a significant population increase and expansion following a population decline during the extreme drought of the early 1980s. This increase has occurred over a period where the population has been subjected to relatively low levels of consumptive offtake and high rainfall. However it must be emphasized that the conservation prospects are strongly dependent on future rainfall and also that the response to drought will probably be radically different between the

different types of land use identified in this report. Most animals, and especially those parts of the national population that share land with livestock, may be almost as vulnerable to catastrophic decline under future droughts as they were in the early 1980s.

For further information about this species, see [Supplementary Material](#).

Current Population Trend: Increasing

Habitat and Ecology (see Appendix for additional information)

Most mountain zebra in Namibia occupy the escarpment region, that is, the mountainous zone that runs from north to south, between an inland plateau to the east and the coastal desert to the west (Joubert, 1974; this report). Part of the reason for this distribution is that mountain zebra are water dependent and these mountains contain large numbers of springs that provide water throughout the dry times of year. As people have installed artificial water sources in other areas, by accessing underground water reserves, mountain zebra have expanded their range into new, sometimes lowland, areas (Novellie *et al.* 2002).

Mountainous areas are used as refuges, particularly in areas where they are hunted. But their mountain living adaptations, in particular their small, rapidly growing hooves, show that this habitat preference was established before they came into contact with people. In areas with human disturbance, either current or in the recent past, mountain zebra typically rest at high altitudes and descend to feed at night. In Gondwana Canyon Park, they often graze down drainage channels at night and return to higher levels during the daytime (Gosling, unpublished report). If disturbed when grazing on lower hill slopes or on plains, they often run towards high ground regardless of the location of the source of disturbance. In areas where there has been no shooting or other types of persecution for a number of years, and where artificial water sources are provided, they spend more time in plains habitats. However, even when living mainly in a plains habitat, where available, they prefer to be near hills or mountains and their seasonal movements tend to follow such features.

Mountain zebra are specialist grazers and browse only when forced to do so (Penzhorn 2013). Like most equids they are bulk, roughage feeders and so need to consume large daily quantities. They show seasonal movements with some individuals moving between summer and winter ranges and others staying in the same area. At the start of the annual summer rains, usually in November or December, mountain zebra sometimes move in large numbers on to lower altitude green flushes (eg Joubert 1972). A physiological study suggest that their digestive efficiency and water requirements are similar to those of horses (Joubert and Louw 1976). There are no detailed studies of feeding in HMZ comparable with those on CMZ by Grobler (1983). Grobler's observation show that CMZ are specialist grazers that select only a subset of the grass species available and that they prefer to feed at higher levels in the sward, sometimes selecting seed heads. Penzhorn (1982) reported that CMZ make use of dwarf shrub foliage in the winter months but this was not seen by Grobler in the Mountain Zebra National Park. One of us (Gosling, pers ob) has observed HMZ browsing the leaves of *Catophractes alexandri* in Etosha NP even though grass was available nearby.

Like Cape mountain zebra, the typical social structure is one of small harems comprising an adult stallion and one to three mares and their dependent foals and juvenile offspring; non-breeding groups consist primarily of bachelors, but sometimes include young fillies (Penzhorn 2013).

Movements between spatially separate ranges in different seasons have been recorded in some areas, and in others seasonal movements without a clear separation of seasonal ranges have been seen. The fact that some animals move long distances to separate ranges under particular ecological circumstances (when they are free to do so) means to me that HMZ should be regarded as a migratory species.

Systems: Terrestrial

Use and Trade

Article 95(l) of the Namibian Constitution provides the legal and policy framework for sustainable utilization of the natural resources in Namibia. It stipulates that the State shall actively promote and maintain the welfare of the people by adopting policies which include the maintenance of ecosystems, the essential ecological processes and biological diversity of Namibia and the utilization of living natural resources on a sustainable basis for the benefits of all Namibians. All uses of natural resources in Namibia are guided by this Constitutional provision.

The Nature Conservation Ordinance 4 of 1975 provides the basis for consumptive and non-consumptive utilization of wildlife resources, including HMZ in Namibia. Before the enactment of the Nature Conservation Ordinance, wildlife was seen as in competition with livestock and had no economic value. The Ordinance provided rights to benefit from wildlife resources to the freehold landowners. As wildlife thus gained economic value, recoveries in numbers were observed immediately. For example, the wildlife proportion of biomass on freehold land increased from 8% in 1972, to 18% in 1992 and to 29% by 2009 (Lindsey, 2011). The Nature Conservation Ordinance was amended in 1996 to confer similar user rights over wildlife to the communities living on state land. To obtain rights to benefit from wildlife resources, communities were required to establish conservancies. Similarly, wildlife on the communal land bounced back in great numbers resulting in these areas becoming a strongholds of wildlife outside formally protected areas.

Because of its (near) endemic status in Namibia and the fact that it was heavily utilized for its skin and persecuted to reduce competition with livestock, HMZ was declared a Specially Protected Species under the Nature Conservation Ordinance.

Consumptive utilization of HMZ is allowed through appropriate regulations and a permit system. Permits issued by the Ministry of Environment and Tourism are required for any form of consumptive use in Namibia. The permit system aims to ensure that HMZ utilization is sustainable and has no detrimental effect on the long-term survival of the species. 'Shoot and sell', trophy hunting and 'keep and sell' (live capture) are the different forms of HMZ utilization currently permitted in Namibia. No export of live animals is allowed.

The permit system aims to ensure that the utilization of HMZ is sustainable and all removals are recorded. The permits that involve permission to harvest HMZ are (1) for a landowner's own use, that is for the individual or communities own consumption and not for sale, (2) for 'shoot and sell' permits, whereby HMZ are hunted for the sale of meat and/or skins. These permits aim to ensure that owners and communities gain financial benefits from sustained use and conservation. And (3) permits are issued for trophy hunting. Trophy hunting takes place on registered hunting farms, in registered

commercial and communal conservancies and within defined concessions in some National Parks. Trophy hunting is always under the supervision of a qualified professional hunter. When a landowner applies for a permit he/she must submit figures to show that there are sufficient numbers present that the population's capacity to persist is not damaged. The landowner's assessment is then checked by MET field staff before a permit is issued. Finally, where HMZ have been introduced into an area in which they did not previously occur, the landowner can apply to remove them entirely.

The number of HMZ shot as trophies was 1,820 in 2008 and 1,064 in 2009 (van Schalkwyk *et al.* 2010). The mean number of Hartmann's Mountain Zebra harvested per annum in Namibia (2008–2012) was 3,538 (Shapi 2014), which is not predicted to impact population growth negatively. The number of HMZ killed illegally is not known however 6.2% of freehold farms reported losses over one recent year due to poaching (Lindsey 2011).

HMZ is listed on Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). CITES regulates the international trade of endangered species. Species on Appendix II are not threatened with extinction but may become so unless trade is controlled and regulated (www.cites.org).

Threats (see Appendix for additional information)

HMZ remains at risk of catastrophic decline under future droughts, as experienced in the early 1980s. The effects of drought and extreme weather on small populations has been documented for Przewalski's Horse (*Equus ferus przewalskii*) in Mongolia (Kaczensky *et al.* 2011), and is currently affecting Grevy's Zebra (*E. grevyi*) in Kenya (B. Low-MacKaye pers. comm. 2017).

Possible hybrids between mountain zebra and plains zebra (*E. quagga burchelli*) have been reported for some years in the Otjovasandu area of Etosha NP where the two species overlap. Recent analysis of faecal DNA (Pauline Kamath pers. comm.) using microsatellite markers in samples of 21 of each species from Otjovasandu supports both hybridization and introgression. However, we do not know if this is part of a normal hybrid zone or if it is an artifact, perhaps caused by the boundary fence artificially keeping the two species in closer contact throughout the year than would be the case if mountain zebra were free to move westward. Hybridisation is also reported between the HMZ and donkeys in Angola (P. vaz Pinto unpublished data).

Conservation Actions (see Appendix for additional information)

Since HMZ need to move flexibly over very large distances in response to spatial and temporal variation in rainfall and primary production, very large areas that are connected and support suitable HMZ habitat are needed if viable populations are to survive. The importance of the unfenced communal conservancies in Kunene as the largest landscape scale conservation area for the species has already been mentioned. In addition, under a GEF-funded NAM-PLACE Project five landscape initiatives were established in Namibia that meet many of these needs. These projects aimed to ensure that protected landscape conservation areas were established, that land uses in areas adjacent to existing Protected Areas were compatible with biodiversity conservation objectives and that corridors are established to allow movement and thus sustain the viability of wildlife populations. There are five such landscape schemes in Namibia and of these two are particularly relevant to HMZ conservation, the Greater Sossusvlei-Namib Landscape (GSNL) and the Greater Fish River Canyon Landscape (GFRCL). NAM-PLACE funding came to an end in 2016 but the landscape approach is generally supported by the Ministry of

Environment and Tourism and there is a good prospect that it will receive recognition under emerging national legislation. The GSNL project is still underway under the aegis of the Greater Sossusvlei-Namib Landscape Association and, while in future the current full extent of the GFRL is less certain, funding to continue the initiative is currently being sought.

The GSNL in south-western Namibia covers some 5,730 km² and includes the Namib-Naukluft National Park, the NamibRand Nature Reserve and adjoining landholdings. One aim is to create corridors through the north-south fence to the east of the Namib-Naukluft NP that will allow seasonal east-west movements of mountain zebra that are essential for their survival in dry conditions. The GFRLC is 7,621 km² in size and includes the Ai-Ais National Park and the Gondwana Canyon Park; it is at the interface of karroo and, to the south, succulent karroo habitats. The GFRLC adjoins the Richtersveld National Park (in South Africa) and thus forms the northern part of the Ai-/Ais/Richtersveld Transfrontier Park. Mountain zebra are almost or completely absent from the Richtersveld NP but any plans to reintroduce them should await the results of research to determine the reasons for this situation. There may also be natural recolonization as animals cross the Orange River from southern Namibia (the river is not a barrier when its level falls in the dry season) and there are large numbers of mountain zebra close by in the Namibian parts of the Transfrontier Park.

Both the GSNL and the GFRLC contain healthy populations of mountain zebra and these will tend to expand if the aims of the landscape schemes to provide large-scale movement are successfully implemented. There will then be a scientific and practical need to define how these populations are limited and what if any management intervention will be needed.

In South Africa, this subspecies is well conserved in three formally protected areas (Goegap Nature Reserve, Augrabies Falls National Park and Richtersveld National Park). The recent expansion of Goegap Nature Reserve (from 24,000 ha to 40,000 ha) further enables it to support a much larger number of Hartmann's Mountain Zebra. Legislation must confine the subspecies to its natural distribution range in the Northern Cape to avoid hybridisation with other zebra taxa in the future, and to establish an in situ, self-sustaining population within the natural range.

Conservation recommendations:

- The outstanding question is about the numbers and conservation status of HMZ on commercial farms and freehold conservancies. If the questionnaire survey is to remain the main assessment instrument on commercial farms, research on reporting bias and its effects on population estimation and checks from air surveys or other conventional techniques are needed.
- There is a need for more regular surveys that have more comprehensive coverage to obtain better information about numbers and range of this nationally important species.
- There is a large amount of information obtained under the MET permit system that is currently only available by paper extraction. In view of the importance of this resource for conservation management, we recommend that these data should be stored in digital form for more efficient retrieval.
- HMZ populations depend on large scale movements in relation to ephemeral, patchy food production and water availability and current efforts to achieve large fenceless areas are supported. Management and land-use planning requires a regional perspective to ensure that critical habitat is not fragmented and movement corridors for HMZ are maintained.

- There is a need for basic research on HMZ movements in relation to spatial properties of their food supply to determine their spatial ecological requirements and the effect of human-constructed barriers such as roads and various types of fences.
- There is a need for basic research to determine what limits HMZ populations under a variety of ecological conditions, including the presence and absence of particular predators and access to foraging areas at various scales.
- There is a need for improved applied models of population dynamics under varying ecological circumstances (including presence and absence of spotted hyenas, lions and wild dogs) to inform management intervention.
- Where possible the reintroduction of lions and spotted hyenas should be attempted since it is known that these predators may limit zebra populations elsewhere and their presence may thus reduce the need for management intervention. Candidate areas for such reintroduction (or enhancement in the case of spotted hyenas) include the Ai-Ais-Richtersfeld Transfrontier Park.
- The work by Moodley and Harley (2005) on genetic structuring of the HMZ population should be extended to better inform translocation of HMZ following live-capture operations. Where possible, the genetic structure of naturally occurring populations should be respected.
- Given the excess of males removed by trophy hunting, we would encourage the targeting of bachelor males where possible since selective removal of breeding group stallions may reduce population genetic fitness.
- Introduced populations of HMZ within the range of CMZ in RSA should be removed as soon as possible.
- The relatively high populations of HMZ reported here are probably in part the result of a number of relatively wet, productive years. In drought years there is pressure from livestock owners and others to reduce HMZ numbers. Any conservation strategy should thus be long term and should aim to accommodate, and anticipate, these relatively short-term events and focus on the long-term genetic and demographic viability of HMZ populations.
- Detailed research on hybridization between mountain zebra and plains zebra (*Equus quagga burchellii*) is urgently required. In the meantime, the precautionary principle suggests that reintroduction using mountain zebra or plains zebra from the Otjovasandu area of Etosha NP, and other areas where hybridization is suspected, should be discontinued.
- A comprehensive survey to better understand human-HMZ relationships amongst local people on both communal and commercial lands would contribute novel insights into conflict mitigation and improve the effectiveness of management intervention particularly land-use planning.

Credits

Assessor(s): Gosling, L.M., Muntifering, J., Kolberg, H., Uiseb, K. & King, S.R.B.

Reviewer(s): Moehlman, P.D. & Novellie, P.

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External Resources

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Appendix

Habitats

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Habitat	Season	Suitability	Major Importance?
2. Savanna -> 2.1. Savanna - Dry	-	Suitable	-
3. Shrubland -> 3.5. Shrubland - Subtropical/Tropical Dry	-	Suitable	-
4. Grassland -> 4.5. Grassland - Subtropical/Tropical Dry	-	Suitable	-

Threats

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Threat	Timing	Scope	Severity	Impact Score
11. Climate change & severe weather -> 11.2. Droughts	Ongoing	-	-	-
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 2. Species Stresses -> 2.1. Species mortality		
2. Agriculture & aquaculture -> 2.3. Livestock farming & ranching -> 2.3.2. Small-holder grazing, ranching or farming	Ongoing	-	-	-
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion		
5. Biological resource use -> 5.1. Hunting & trapping terrestrial animals -> 5.1.1. Intentional use (species is the target)	Ongoing	-	-	-
	Stresses:	2. Species Stresses -> 2.1. Species mortality		

Conservation Actions in Place

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Conservation Actions in Place
In-Place Research, Monitoring and Planning
Action Recovery plan: No
Systematic monitoring scheme: Yes
In-Place Land/Water Protection and Management
Conservation sites identified: Yes, over part of range
Occur in at least one PA: Yes
Percentage of population protected by PAs (0-100): 11-20
Area based regional management plan: No

Conservation Actions in Place
Invasive species control or prevention: Not Applicable
In-Place Species Management
Harvest management plan: Yes
Successfully reintroduced or introduced benignly: Yes
Subject to ex-situ conservation: Yes
In-Place Education
Included in international legislation: Yes
Subject to any international management/trade controls: Yes

Conservation Actions Needed

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Conservation Actions Needed
3. Species management -> 3.1. Species management -> 3.1.1. Harvest management
3. Species management -> 3.1. Species management -> 3.1.2. Trade management

Research Needed

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Research Needed
1. Research -> 1.2. Population size, distribution & trends
1. Research -> 1.5. Threats
2. Conservation Planning -> 2.1. Species Action/Recovery Plan
3. Monitoring -> 3.1. Population trends
3. Monitoring -> 3.4. Habitat trends
0. Root -> 4. Other

Additional Data Fields

Distribution
Estimated area of occupancy (AOO) (km ²): 299161
Continuing decline in area of occupancy (AOO): No
Extreme fluctuations in area of occupancy (AOO): No
Estimated extent of occurrence (EOO) (km ²): 554598

Distribution
Continuing decline in extent of occurrence (EOO): No
Extreme fluctuations in extent of occurrence (EOO): No
Continuing decline in number of locations: No
Extreme fluctuations in the number of locations: No
Population
Number of mature individuals: 33265
Continuing decline of mature individuals: No
Extreme fluctuations: No
Population severely fragmented: No
No. of subpopulations: 4
Continuing decline in subpopulations: No
Extreme fluctuations in subpopulations: No
All individuals in one subpopulation: No
Habitats and Ecology
Continuing decline in area, extent and/or quality of habitat: No
Generation Length (years): 11
Movement patterns: Full Migrant
Congregatory: Congregatory (year-round)

The IUCN Red List Partnership



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