Project Update: December 2018

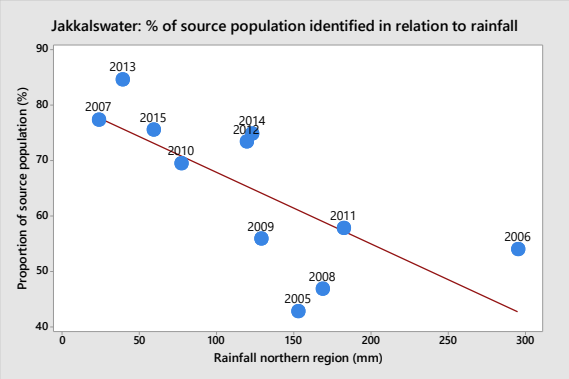
The research being conducted on mountain zebra (HMZ) in Gondwana Canyon Park (GCP) and Ai-Ais National Park is necessarily long-term in order to document age-dependent mortality in a species that may live for over 20 years in captivity. Ecological longevity is presumably less, particularly in the arid south of Namibia, but, surprisingly, this basic information is lacking for Hartmann's mountain zebra. Obtaining this knowledge remains a key objective in the project which has been underway, using intensive camera trapping, since 2005. Quantitative estimates of age-structured mortality are central to an understanding of the dynamics of this species and to long-term, evidence-based conservation management both in GCP and elsewhere. Results obtained during 2018 are consistent with the working hypothesis that the population has stopped increasing and that it is fluctuating in relation to primary production, dependent on rainfall, and, increasingly, on density dependent factors. We are still some way from determining the subtle interaction of density independent and density dependent factors, particularly as the population moves towards a balanced age structure (following protection in 1997) but, if the population remains undisturbed, this will become clearer in coming years and this remains the primary objective. The work being done in GCP/Ai-Ais is becoming increasingly well-known, partly though reporting of results in the latest IUCN Red List reassessment of Hartmann's mountain zebra (Gosling et al, 2018, in press), and I have been asked to give a plenary presentation at the International Equid Conference next year in Prague. While this plenary will deal with broader aspects on the Mountain Zebra Project, the data being collected in GCP will play a key role for the reasons mentioned above and will provide an opportunity to mention the outstanding conservation success of GCP following protection of the area in 1997; while other HMZ populations have increased under protection, none have been studied in such detail while the recovery occurred.

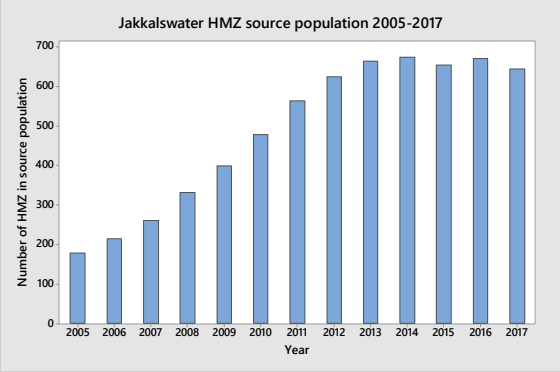
Further progress has been made over the past year in collecting data on reproduction and mortality from the established network of 17 camera traps. The approach is individual-based and the ID library, accumulated since 2005, is now up to 2,467 individuals. Of course many of these animals are now dead and, of the individuals first identified in 2005, 33% were missing 10 years later. It is also important to emphasise that these numbers refer to the *source population*, animals that range beyond GCP, mainly to the west, not the numbers present in GCP at any one time. As reported previously in more detail, the animals estimated in the GCP annual game counts (probably reasonable estimates of the numbers present at one time in the year) are on average about 56% of the source population.

In addition to inference about mortality from the disappearance of individuals, some animals are found dead and, where these corpses are photographed soon after death, the individual concerned can be identified from their stripe patterns. Such animals are photographed in a standard way to record such things are tooth wear and these records will be used to analyse age at death as a partial check on the primary technique of inferring patterns of mortality from individual records. Such animals also provide insight into social and demographic processes. For example, one male was photographed by Mathias Tsameya shortly after dying near the Geluk waterhole in December 2017. This male was ZR026m, who was first identified in 2005 when already the dominant male in a

breeding group, and thus probably at least 6 years old. After a long period with a breeding group, he lost his dominant status in a fight with another male, was injured but recovered and spent the last couple of years alone or with bachelors. If this male was at least six in 2005 he must have been at least 19 years old in 2017 so the photographs of tooth wear taken subsequently are particularly valuable. This sort of death will become more common as the population achieves a balanced age structure and the information collected will be an important supplement to data on age structure from living known individuals.

Assessing population trends need to take account of sampling variation and variation in the proportion of the population within GCP in different years. The source population of Jakkaswater is used here as an indicator: it has been sampled consistently and intensively since 2005 and its source population ranges widely across the northern and central regions of GCP. As in all parts of GCP, the proportion of this population that is present varies in relation to annual rainfall and consequent primary production. This variation is evident in the left diagram below which shows the number of individuals that are identified each year as a proportion of the number subsequently known to be alive in that year between 2005 and 2015 in relation to seasonal rainfall; the average proportion identified over these 10 years is 65%. The linear regression shown in the figure is significant (Anovar: $F = 9.53$; $p = 0.013$). The numbers known alive each year in the Jakkalswater source population are shown in the right hand figure. This bar graph uses actual numbers from 2005 to 2015 and estimates in 2016 and 2017 predicted from rainfall records, the numbers identified in these two years and the regression equation illustrated in the left figure.





These data support the hypothesis that the source population has stabilised and is now fluctuating in relation to density independent factors. The involvement of density dependence (which has already been demonstrated for birth rates) may become increasingly important as the population assumes a balanced age structure and this is the principle focus for current research.

Data collection in 2018 is not analysed in detail here because it will not be complete until further work in coming months. However, sampling has continued using all 17 cameras and 893 individuals have been identified in the whole of GCP to date, 8% of which are new.

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Reference: Gosling, L.M., Muntifering, J., Kolberg, H., Uiseb, K. & King, S.R.B. 2018. *Equus zebra* ssp. *hartmannae*. The IUCN Red List of Threatened Species 2018. In press.