Project Update: March 2015

Good progress has been on individual-based monitoring of mountain zebra populations with continuous feedback to those responsible for conservation management. I collaborate with local conservationists in five main study areas throughout Namibia but this short update will focus on Gondwana Canyon Park (GCP), a 1,260 km^2 semi-desert area adjacent to the Ai-Ais-National Park (Ai-Ais NP) that includes the spectacular Fish River Canyon in southern Namibia. GCP is a privately owned park which was formed in 1997 from land previously devoted to small-stock farming. The park now underpins a highly successful ecotourism enterprise which provides major employment and career opportunity for local people and in which the mountain zebra population is a flagship for the recovery of the natural environment. It is also part of a wider landscape conservation project, the Greater Fish River Landscape project, which recognises that conservation management in such arid environments can only take place at a very large scale that allows natural movement in relation to unpredictable, localised rainfall.

The northern part of Gondwana Canyon Park, a 569 km^2 area, has been continuously monitored since 2005. Because of the advantages of individual-based approaches in conservation ecology, I started work with camera traps at water holes and established a photographic library of individual mountain zebra. Stripe patterns are as distinctive as human fingerprints and initially I recognised animals in new photos by simply comparing them with the library. But as zebra numbers increased in the park due to protection, I was forced to consider a more efficient system of individual recognition and eventually developed a way of numerically coding stripes so that animals in new photos could be identified using these codes and a sorting function in a spreadsheet. Final identity must be confirmed by visual comparison (as in the case of fingerprints) but this coding system enormously reduced the time needed to identify an individual – or suggest that it was new. Over the years the number of individual mountain zebra identified in the northern part of GCP has steadily grown to 1,052. But not all of these are still alive and not all are in the park at any one time (see below). In 2014, the latest complete year of intensive camera trap sampling, 687 individual mountain zebra have been identified to date (more photographs remain to be analysed!). These animals represent the 'source population', the animals that use the northern part of GCP at some point in the year and move freely outside it in response to rainfall variation. But they are only the 'catchable' element of this population, the animals that leave identifiable photographs at camera traps. The 'uncatchable' element include young foals that often avoid the melee of competition at water holes and adult animals that are part of the population but remain outside the area during the year in question. Quantifying the size of the catchable and uncatchable proportions of the population is important in order to give conservation managers up-to-date information about numbers. Unfortunately the uncatchable element can only be estimated when the foals and absent adults mentioned are detected in future years but we can look at past results to get a reasonable estimate. So, for example, we can assume that the data for 2012 are nearly complete. In that year 535 individuals were actually identified. In addition, the 'uncatchable' foals born in the year and adults outside the area during 2012 have mostly been detected in subsequent years and back-projected. In 2012 these inferred 'uncatchables' totalled 299. The total in 2012 is thus 834 and the animals that were actually identified in the year (535) were 64% of the source population. If this same proportion

applies in other years, then the 687 individuals identified in 2014 are the catchable element of a source population of about 1,073 mountain zebra.

While the mountain zebra in the north of GCP are now quite familiar, the animals in the south of the ark, some 40 km away, are less well known. One key question for the current phase of the study is the extent of interchange between the north and the south or whether the southern animals are mainly linked to the Ai-Ais National Park particularly since the Fish River Canyon is close to the west. To explore these matters three cameras were installed next to water holes in a 225 km² area in the extreme south of the park in June 2014 and have been monitored continuously ever since. At the time of writing (February 2015) 404 individuals have been identified and added to an ID library. If the catchable element of the population is about 64%, as in the north of GCP, then these 404 animals would be part of a source population of about 631 mountain zebra; and the total of the two areas would be about 1,704. But these calculations are very preliminary, particularly since we are only beginning to understand movements between GCP and the Ai-Ais NP. In addition there is a central area in GCP which has been under-sampled to date. We plan to start camera trapping this area during 2015 and should soon have information about the entire park. Not all of the animals from the central area will be new since many form part of the source population for the northern and southern study areas and the additional information on these animals will be particularly interesting.

Movement is a key part of mountain zebra conservation ecology and, ground counts carried out by park staff have shown striking variation in numbers in the south. For example, numbers in this part of the Park more than doubled between 2012 and 2013, an increase that is too great to be explained by breeding. When we started work in the south of GCP, we were thus particularly interested to know whether such variation was caused by movement to and from the Ai-Ais Park in the west or by internal movement within GCP. We approached this by checking what proportion of the 404 animals were already known from the long-term study area in the north, some 50 kms away. In the event, 398 (98.5%) out of the 404 southern animals were new which is consistent with the idea that much of the variation in numbers in the south of GCP is due to east-west movement. Only six (1.5%) out of 404 were known from the north which suggests a partial barrier to north-south movement. The most likely obstacle is an area of relatively flat open habitat about 20 km across just to the north of the southern study area. Mountain zebra do use such areas for grazing but they prefer to stay close to hills or mountains which they use as daytime refuges and are reluctant to stay in open areas. Out of the six animals from the north, four were males, one a female and one has not yet been sexed. This pattern is consistent with the sort of male-biased dispersal that is common amongst mammals with polygynous mating systems and suggests that these sexually selected behaviours (particularly movements linked to competition between males and searching for mates) may help maintain gene flow between widely separated parts of the species range.

Long term individual records are also starting to provide the kind of survivorship data that will be needed to carry out detailed modelling of population viability. Most of the population in northern GCP has been born since the study started and about 60% of the animals detected in camera trap photos are now of known age. As these animals are observed over the years it becomes possible to identify the main periods of mortality and

analyse these patterns in relation to environmental factors, especially rainfall. Preliminary analysis suggest that the highest mortality of young animals occurs at 2 or 3 years of age when they are dispersing from their birth groups and that such mortality is highest in dry years. However, mountain zebra are a long-lived species and cannot be easily aged in the field after 2 years of age and so the most difficult information to obtain is about mortality of older animals. But some information is accumulating. For example, 67 animals were estimated from appearance to be over 2 years old when first seen in 2005 and of these 43 were still alive in 2014. So just over a third of this group of adults have died over 9 years giving an average annual mortality rate of about 4%. This low death rate is probably due to the facts that mountain zebra had been reduced to far below carrying capacity when the land was farmed before 1997 and that many of the group are probably still relatively young. In addition, the two main predators of zebra, lions and spotted hyena were exterminated by people in the years before the park was established. Hopefully, hyenas will eventually return to GCP (one brown hyena has been photographed by a camera trap) but this seems to be a slow process.

Mountain zebra numbers appear to have increased steadily since a remnant population was protected by the formation of GCP in 1997. Annual counts have increased by over 20% per annum on average and the animals are generally in good condition, even in the late dry season, and so do not appear to have reached carrying capacity. However numbers in GCP can only be understood as part of the wider, and potentially much larger, population including that in the Ai-Ais NP. How big is this population and what factors limit its numbers? The movements between GCP and Ai-Ais NP require further study but are probably driven by some, as yet unknown, relationship with the dry season water supply in the national park, presumably the remaining pools in Fish River itself, and the relative availability of food there. These thoughts, together with information on the movement of known individuals emphasise the importance of maintaining, and hopefully increasing, open systems that allow mountain zebra to move freely across the boundary between GCP and the Ai-Ais NP and across borders with other friendly neighbours, in response to variation in rainfall and grazing. The Greater Fish River Canyon Landscape project (which is now up and running with GEF funding under the Ministry of Environment and Tourism) provides a vital framework for these movements on which healthy mountain zebra populations depend.

Photo 1: Mountain zebra are water-dependent and identity, condition and reproduction can be continuously monitored using camera traps at water holes. The left hand animal is ZR122f (zebra/right side/number/sex) who was already an adult (over 2 years old) when first identified in 2006 and has been seen every year since. Photo: Morris Gosling.

Photo 2: Mountain zebra habitat in the southern region of Gondwana Canyon Park. The horizontal rock face in the distance is a part of the walls of the spectacular Fish River Canyon within the Ai-Ais National Park. Photo: Morris Gosling.

Photo 3: Mountain zebra have increased steadily in Gondwana Canyon Park since they came under protection when this protected area was established in 1997. Photo: Morris Gosling.