Swara 10 (4), 30-31 (1987)

Retracing the history of the Ngorongoro lions

by Craig Packer and Anne E. Pusey

The present-day population of Lions in the Ngorongoro Crater could all be descended from a group of only 6-15 lions. Anyone who has photos of lions taken in Ngorongoro during the 1960s might be able to help researchers establish if this is indeed the case - and consequently if the lions have been subject to the harmful effects of excessive inbreeding

The Ngorongoro Crater provides a remarkable setting for Tanzania's richest ecosystem. Sheer walls 300-600 metres high form a nearly perfect circle surrounding the grassy plains of the crater floor. The crater is only about 15 kilometres across but contains the highest density of resident game anywhere in Africa. Outside the confines of the crater are highland forest to the east and grassland to the west. The highlands sustain far less game than the crater: only buffalo occupy the forest in any numbers and most of these move into the crater during the rains. The crater is a virtual paradise, but it is a very small and isolated paradise.

Most of Africa's national parks and game reserves have become artificial islands. Consequently the animals within them have recently been constrained to live in small isolated populations. An important result of such fragmentation and isolation is that the less common species will inevitably be subject to the harmful effects of excessive inbreeding. Unlike most other parks. Ngorongoro has always been isolated and so the consequences of that isolation should already he apparent. In contrast, most other parks have only recently become isolated, and the problems for their populations may not he apparent for several decades.

Ngorongoro has long been famous for its abundant and extremely tame lions. We are trying to trace the history of these animals back to 1959 in order to learn the extent to which they have been subject to inbreeding. The first scientific study of the crater lions was begun in 1970 but because of the lions' unusual tameness, extensive data may be available over the decade prior to this. Close-up photographs taken by tourists in the crater during 1959-1969 Could provide essential information that we can use to reconstruct the composition of the lion population prior to our long-term records.

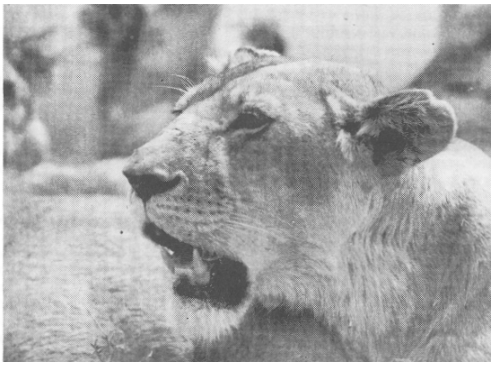
Although our knowledge of that period is scanty, it is sufficient to suggest that a reconstruction is both feasible and potentially very important. The crater first became accessible to tourist vehicles in 1959. In that year, the population was estimated to be about 60 lions. It remained at that level until 1962 when record rainfall led to an almost un-believable plague of *Stomoxys* biting flies. Henry Fosbrooke, the Conservator of the crater at the time, reported that these flies literally bled the lions to death. He saw a number of obviously emaciated lions who had climbed trees or squeezed themselves into hyena holes in order to escape the blood-sucking pests. The debilitated lions started taking cattle and several were killed by angry Maasai (who were allowed to live in the crater at that time). The lion population had crashed to only 6-15 survivors by May 1962, either as a result of infection carried by the flies or because of an extreme loss of blood.

What happened next is not yet clear and we are writing, this article in order to seek your help in recording the lions' history. Over the next seven years the population steadily increased. This may have been due either entirely to the reproduction of those few survivors of the plague. or to considerable immigration from surrounding areas. Fosbrooke reported that some of the increase was due to immigration, but the immigrants could have been animals that had only temporarily left the crater and thereby fortuitously avoided the *Stomoxys* plague. We now know that young lions (particularly young males) will indeed leave the crater because it is saturated with hostile adults. It would not be surprising for such animals to return to the crater floor once the population level there had been substantially reduced.

The population had returned to its former level by the time a Canadian scientist, John Elliott, began his intensive study in 1970. Elliott could recognise all of the crater lions individually and found that the population remained fairly constant at 70 during his three-year stay. However, when Jeanette Hanby and David Bygott resumed intensive study of the crater lions in 1975, the population had jumped to 100. We succeeded the Hanbygotts in 1978, and the crater population has varied from 85 to 115 ever since.

The increase in lion numbers in the early 1970s coincided with a change in policy toward the crater's Maasai tribesmen. At this time the Maasai were no longer allowed to reside on the crater floor. Because the location of two of their manyattas had been very close to what later became crucial refuges for two of the lion prides, it is possible that the departure of the Maasai liberated these areas for the lions.

Many lions have distinctive ear notches.



Each lion has a unique pattern of whisker spots.

A striking feature of our long-temp records on these animals is that all of the lions that have bred in the crater over the past decade were themselves born there. Although many crater lions apparently leave the caldera (and two crater males became resident in one of our Serengeti prides, 70 km away), no lions have successfully entered from outside. This isolation means that the crater lions have little opportunity to mate with unrelated partners. Most wild animals (including the lions of the Serengeti) prefer mates who are not their close relatives, but will mate incestuously if they have no choice. The current generation of breeding adults in the crater are almost all the sons, daughters or grandchildren of one 'coalition' of six males. These six resided in every pride other than the pride in which they were born for most of the period between 1974 and 1986. They were finally evicted from their last pride in November 1986 by six of their sons.

We do not vet know the precise family relationships of the original six, but from our extensive studies we do know that such large male groups are invariably composed of brothers or cousins. Since it seems that history may be about to repeat itself with the start of the reign of the younger six, it is highly likely that in previous times 'the lion's share' of the breeding was similarly done by only a few males. Of course, the crater lions are even more inbred if the current population is entirely descended from the 6-15 survivors of the *Stomoxys* plague.

Because of our background information on the frequency of inbreeding in the crater lions, we felt it was necessary to examine their genetics and reproductive performance. We collected blood samples from lions in the crater and a similar number of specimens from lions in the Serengeti. The Serengeti contains a far larger lion population (which we estimate to number over 3,000) and our comparable studies there show that close inbreeding is far less frequent in the Serengeti than in the crater.

The samples were examined for variation in blood enzymes by Dr Stephen J. O'Brien. O'Brien heads the Laboratory of Viral Carcinogenesis at the National Cancer Institute in the USA but is better known among wildlife biologists for his studies of cheetah and pandas. His analysis confirmed our suspicions: the crater lions were found to have 40 per cent less genetic variability than their Serengeti counterparts. A loss in gene variability is one of the major adverse effects of inbreeding.

We then asked O'Brien and a team of reproductive physiologists, Dave Wildt and Mitch Bush from the National Zoo in Washington, to examine the two lion populations. Inbred strains of domesticated mammals generally show a loss in reproductive capability and Wildt and Bush's work showed that there was a similar loss in the crater lions. Compared to males from the Serengeti population. Ngorongoro males had a higher proportion of defective sperm and lower levels of testosterone. However, these differences so far appear to be too small to have an adverse effect on the crater males' fertility.

It is extremely important for us to have a more accurate picture of the level of inbreeding that the crater lions have undergone. If the population was indeed reconstituted from the 6-15 survivors then the population has already gone through the worst effects of a Genetic bottleneck and no further loss in gene variability or reproductive performance may occur. However, if the recovery in the crater population between 1962 and 1969 was largely due to immigration then most of the deleterious effects of inbreeding may have accumulated in only the last 10-15 years, and the consequences may become much more severe. Inbred strains of domesticated animals are established sufficiently often to be a common breeding technique, but most inbred lines fail because the lines go extinct. Repeat this phenomenon for almost all of the predators and any of the rarer species in Africa's national parks, and it is clear that active management of the genetics of those populations may be necessary to prevent widespread local extinctions.

If you visited the crater between 1959 and 1969 (or know someone who did) and took photographs of the lions, we may be able to incorporate your sightings into our long-term records. We are able to recognise individual lions from close-ups of their faces. Each lion has a unique pattern of whisker spots and many have distinctive ear notches (see illustrations). If your photos show the sides of the lions faces or a front view of their ears, then we would very much like to examine them. We will of course return all materials, but would prefer slides or negatives so that we can make our own prints. If you have prints but are reluctant to part with them even temporarily, a good photocopy would still be helpful. Again, we need photos taken any time from 1959 to 1969, and we need to know the approximate date they were taken (it is enough to specify the year of your visit, but the month and year would he best). If we can get enough photos, we will be able to reconstruct the precise changes in the population each year

and thus solve the riddle of how the crater lions recovered from the *Stornoxys* plague. We will report our findings in a future issue of *Swara*.

If you live in East Africa, please send materials (with your return address) to:
Serengeti Lion Project
c/o P.B. Allen Box 41190
Nairobi, Kenya

If you live in Europe or the USA. please send them to:
C. Packer & A.E. Pusey
Department of Ecology and Behavioral Biology
University of Minnesota
318 Church St. SE
Minneapolis, MN 55455 USA

Craig Packer and Anne E. Pusey are both Assistant Professors at the university of Minnesota and every year spend six months in Tanzania and the remaining six months in the US. They both came to Tanzania in the early 1970's to do graduate research projects at Gombe National Park: Anne's PhD from Stanford University was on the chimpanzees there; Craig's PhD from Sussex University was on the baboons. After a short research project on Japanese monkeys in Japan, they returned to Tanzania in 1978 to take over the lion project, which they would like to keep going indefinitely.

NOTE in 2004: *Our photographic appeal was remarkably successful, building a solid foundation for our subsequent research in Ngorongoro Crater. But this part of the project is now complete, and we do not need any further photographs.*