



*Information and background of RhODIS  
– the Rhinoceros DNA Index System for  
African white and black rhinoceros  
C. Harper*

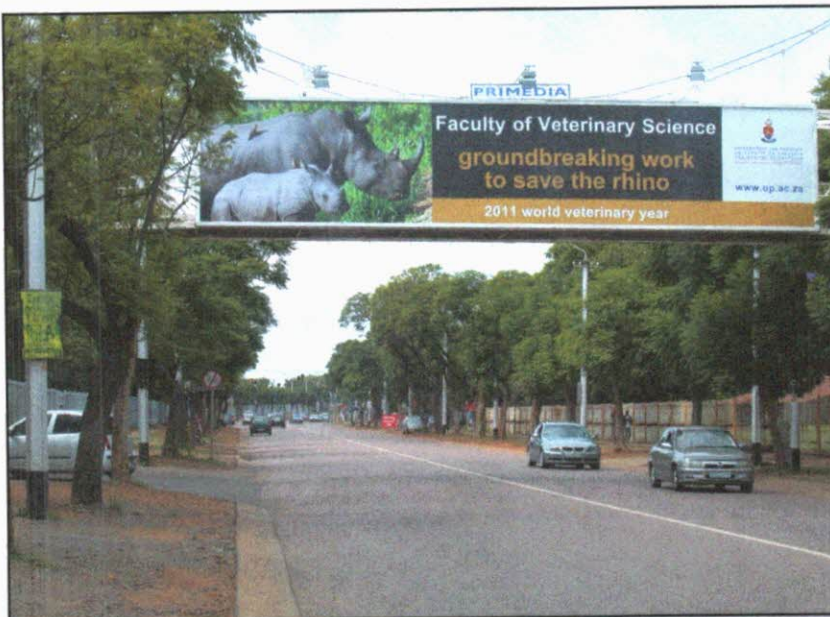
## CHAPTER 7

# Information and background of RhODIS™ - the Rhinoceros DNA Index System for African white and black rhinoceros - C. Harper

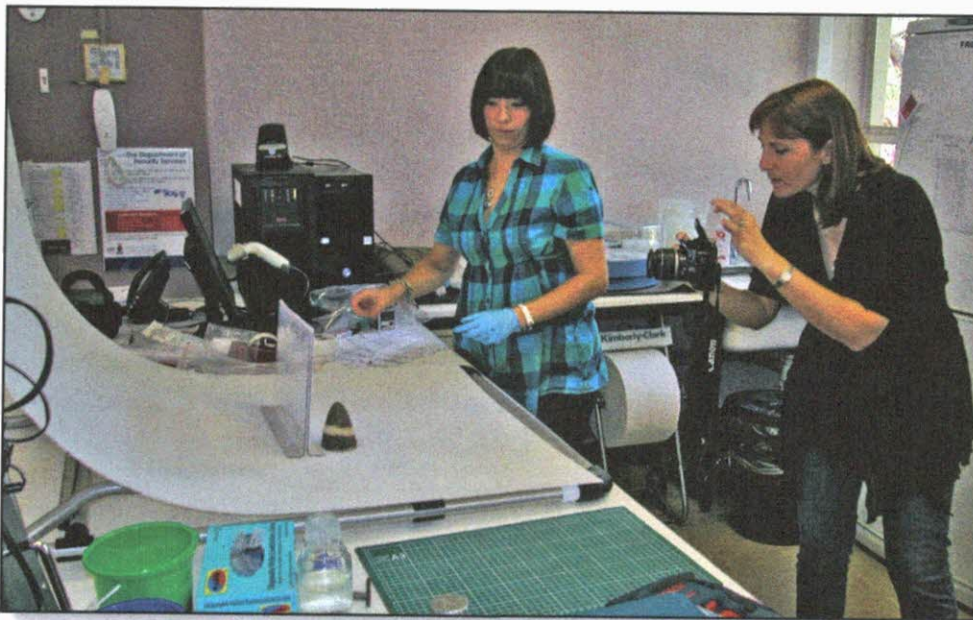
The Veterinary Genetics Laboratory (VGL) at the Faculty of Veterinary Science of the University of Pretoria at Onderstepoort has been providing a DNA profiling and parentage testing service to the horse, cattle and dog industries since 2000. The VGL performs all micro-chipping and DNA testing of Thoroughbred horses for the National Horseracing Authority of South Africa and handles over 12 000 samples per year of various species. The VGL is self-funded and all staff salaries, equipment and overheads are covered by service income. All additional income or profit is channelled into genetic based research projects and worthwhile programs.

In 2006 the VGL identified a need to develop expertise in animal forensic testing and approached the Trace Wildlife Forensic Network in the UK. A Wildlife DNA Forensic course was held collaboratively with Trace in 2007 and during this course a project was launched collaboratively between the members of Trace, the VGL representing the University of Pretoria and the University of Wales, Bangor, to develop a system to identify individual rhinoceroses from horn samples. The horn and blood samples from individual white rhinoceroses were supplied by SANParks as part of a registered SANParks project. The project was completed successfully and the data on the white rhinoceros were published in 2009 as part of a PhD thesis of a student from the University of Wales, Bangor. A poster reporting the successful

outcome of the project was presented as a report to SANParks at the Savanna Science Network Meeting in Skukuza in March 2010, by the VGL, on behalf of the collaborators and PhD student. A paper that describes the development of the sex test using the zinc finger locus was published jointly by the collaborators on the original project in 2010.



The horn DNA profiling method has subsequently been validated and optimized. The number of loci used in the original test has almost doubled and the horn DNA extraction method has been re-assessed and now uses the latest technology available for human forensic DNA extraction. This method is now used routinely in the VGL to individually identify rhinoceros horns from stockpiles, for security purposes and to link recovered horns to individual poaching cases, thereby linking a horn trafficker to a poaching incident or a poacher caught with horns in his possession with the carcass of an individual rhinoceros. The success of this method has led to the conviction and one-year sentence of Donald Allison, an antique dealer from the UK who attempted to smuggle two rhinoceros horns from a deceased zoo rhinoceros to China. In this case, DNA extraction was performed in the UK by Trace and the profile testing was done by the VGL. It has also led to the conviction and subsequent sentencing to 10 years imprisonment of Xuang Hoang, a Vietnamese man who tried to smuggle rhinoceros horns that included horns from a poached rhinoceros. The horns were linked through DNA testing by the VGL. Two Mozambican citizens were also sentenced to a total of 16 years in prison after being apprehended in the Kruger National Park with rhinoceros horns in their possession. The horns were linked with DNA to a carcass previously found poached in the park.



*Dr. Cindy Harper recording photographic data of a horn in the laboratory*

The value of this method is escalating with increasing numbers of rhinoceros DNA profiles being added to the database weekly. Each poaching incident currently being investigated has as part of its standard operating procedure, the collection of samples for DNA testing. This provides the opportunity to link not only the horns, if recovered within the country of origin, but also outside of the country including the consumer countries, as well as linking weapons, clothing and other objects used in the crime to a specific poaching incident. This provides the forensic evidence for conviction and harsher sentencing. To date, over 400 rhinoceros poaching cases have been submitted to the VGL for DNA analysis and this process is ongoing.

A further advantage of this system includes the tracking of individual animals from the point of capture in the national parks to the farm where the animal is destined. Each movement thereafter requires a permit from the Department of Environmental Affairs at a provincial level and the taking of a DNA sample for identification is a condition for a permit. Rhinoceros horns recovered from poaching incidents and following stock pile theft can also be identified, and if added to the database previously can be returned to the legal owner. Animals found at locations other than specified on issued permits will also require investigation.

The principle of the RhODIS™ database is based on the CODIS system of human DNA profiles of the FBI, hence the name. The main aim of this database is the forensic application of matching recovered horns to poached rhinoceros carcasses. RhODIS™ is a single secure database that is populated with DNA profile data of individual rhinoceroses produced under stringent quality compliant laboratory conditions in the VGL. Any laboratory wishing to upload to the database in future, would have to comply with all quality requirements and pass regular proficiency tests to ensure the integrity of the data. Under RhODIS™ this laboratory system will be produced and be made available as required. An external laboratory will act as the reciprocal proficiency testing laboratory of the VGL to ensure data integrity. A recent collaboration between Kenya in the form of KWS (Kenya Wildlife Service) and Jomo Kenyatta University of Agriculture and Technology, which included a training visit by three representatives from these organizations to the VGL, represents the first step in the expansion of the program to another laboratory.

Additional benefits of this database include population management through genetic population analysis. This analysis will be provided as an additional benefit of RhODIS™ to owners that request it. The RhODIS™ system allows the owner of an animal/s or samples to maintain ownership of the samples and data derived from these samples. Samples and data may not be given to any other owners, submitters, researchers or individuals without the original owner's permission. An evidentiary agreement when submitting samples will simply mean that all DNA profiles added to the RhODIS™ database will be subject to forensic interrogation as part of the investigation of poaching cases and movement of rhinoceros and rhinoceros horns. Application to use data for specific research may be made to the RhODIS™ management committee and this will be considered and granted only after consultation with the owners of the samples. It is hoped that this centralized system will ensure that questions regarding rhinoceros genetics are answered and that the answers are provided to the people on the ground directly and within a reasonable time or at regular intervals as required.

The stringent quality requirements of RhODIS™ have extended to the collection of field samples to ensure that the integrity of any data used in court cannot be questioned. This has been done by the development and distribution of a RhODIS™ sample collection kit. The kit has been developed in collaboration with the SAPS Forensic Science Laboratory in Pretoria and the Environmental Crime Investigating Unit of SANParks. The kit contains blood tubes, sample bottles for tissue and horn shavings, a disposable scalpel, drill bit, gloves pre-labelled with bar-coded labels and packed in a sealed container. A form describing how the kit should be used and providing space to write the information that is required for the database is included with the container in a sealed forensic evidence bag. A second unsealed bag is also included to return the container with samples, completed form and used or unused items. Data are

captured from the form at the laboratory, samples are processed and used items disposed or de-contaminated and re-packed to reduce costs. The kits are packed by the VGL. Thousands of these kits have been produced and distributed since January 2011 to investigators from the provinces and SANParks, private owners, farm managers, police officers and veterinarians in South Africa as well as many other African rhinoceros range states.



*Taking DNA samples from a horn in the laboratory*

The RhODIS™ database has grown to include over 5000 animals from South African black and white rhinoceroses from national parks, provincial parks and private sector as well as rhinoceroses from Namibia, Zimbabwe and Kenya and continues to grow. The database also includes samples from rhinoceros horn stockpiles. The RhODIS™ database has been used as a forensic tool to support investigation of several poaching incidents in the Kruger National Park, provincial parks and on private land. These investigations are ongoing. Another aim of RhODIS™ is to train the local environmental management inspectorate (EMI), rangers, veterinarians, police investigators, members of the Department of Environmental Affairs, prosecutors and magistrates on the system of DNA testing of wildlife and rhinoceros specifically, the crime scene investigation

process, the prosecution of wildlife crime and general information on the rhinoceros and its value to the African continent. This training has extended to training members of the Kenyan Wildlife Service to perform routine sampling and handle poaching incidents in Kenya as part of the capacity building project. Thus far EMIs, police officers and other people representing most provinces in South Africa that are involved in rhinoceros cases and DNA sampling of rhinoceroses have been trained in several courses held in the Kruger National Park, Onderstepoort, Pilanesberg National Park, Limpopo Province, Eastern Cape, KwaZulu-Natal and Swaziland. Informative talks and presentations that describe the RhODIS™ project in terms of the aims and context and further highlight the devastating effect that poaching is having on the rhinoceros population, also form part of the project and schools and other organizations have been addressed as part of this initiative.

RhODIS™ is proof that the capacity and expertise exists within Africa to protect and manage our wildlife heritage using sophisticated techniques. Africa is the only continent on which megafauna still survive and it is the responsibility of Africa's citizens to ensure that these animals remain a part of the natural landscape for future generations and protect them from the onslaught of foreign enemies. The rhinoceros has become a symbol of this struggle, a flagship species that evokes emotional support and empathy from all that deal with it, its quiet strength, a gentle giant that has become the object of insatiable human greed and cruelty.

**RhODIS Sample Submission Form A**  
(Rhinoceros animal sample collection)

<b>Live / Hunt / Poach RhODIS number</b>				Date Collected			
CAS Number (Poaching)				Police Station: CAS			
<b>Animal Information</b>							
<b>Animal ID / Name</b>			<b>Ear Tag Number</b>		<b>Microchip nr 1 (Body)</b>		Placement
<b>Microchip nr 2 (Body)</b>				Placement			
<b>Age</b>	Old	Adult	Subadult	Juvenile	Calf		
<b>Sex</b>	Male			Female			
<b>Species</b>	White			Black			
<b>Horn Information (If horns are removed – please complete a separate horn form for each horn and follow the instructions provided on that form for handling each horn)</b>							
<b>Front Horn</b>		<b>Microchip Number</b>		Placement	Sample collected		
Circumference (cm)		Length front (cm)		Length Back (cm)			
<b>Back Horn</b>		<b>Microchip Number</b>		Placement	Sample collected		
Circumference (cm)		Length front (cm)		Length Back (cm)			
<b>Sample Information</b>							
<b>Type</b>		<b>Number of each sample type</b>			<b>Ear Notch</b>		
Blood	EDTA	Serum	Heparin	Left ear	Right ear		
Toenail				Other			
Tissue							
Horn				Tail Hair			
<b>Outer Bag number Kit</b>			<b>Outer Bag seal intact</b>			<b>Hunted</b>	
<b>Poaching case</b>							
<b>Inner Bag number Kit</b>				<b>Live rhino</b>			
<b>Permit number</b>				<b>Dehorned</b>			
<b>Owner Information</b>							
Owner	Farm	Tel number	Cell number	Email address			
<b>Area Information</b>							
<b>Area / Town</b>			<b>Coordinates</b>			<b>Province</b>	
Lat (S)			Long (E)				
Additional information				Scene Diagram (poaching case)			
Veterinarian name (the veterinarian signature is not required unless he/she is the person taking / responsible for the samples – in that case the veterinarian must act as authorized person and sign accordingly)							
Authorized Person name (if not veterinarian)			Authorized Person signature			Date	

