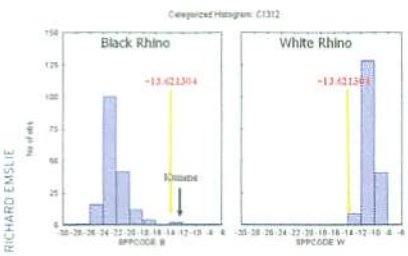
You **are** what you **eat**

Rhino horns or parts of rhino horns or shavings are sometimes recovered in police and wildlife authority busts. It would be of great use to the authorities if they knew the species of horn recovered, and where the recovered horn came from.

Richard Emslie
Scientific Officer
IUCN SSC African Rhino Specialist Group

The African Rhino Specialist Group (AfRSG) has been working on a project to make horn identification possible. Browsing black rhino eat different plants to grazing white rhino, and these plants have different carbon photosynthetic chemical pathways. In addition, different parks have different underlying geologies, soils and climates and in turn different habitats and plant species composition. On the basis of "you are what you eat", one can expect horns of black and white rhino and horns from different parks to have different chemical "fingerprints" and the term "rhino horn fingerprinting" refers to attempts to develop methods to identify species and sources of horns based on their chemical composition.

The AfRSG built upon earlier pioneering work by Julia Lee-Thorp and co-workers and has been able to develop a simple chemical forensic test to determine with 99.6% predictive accuracy if recovered horn comes from a white or black rhino. A simple decision-rule has been developed by Portsmouth University Dept of Computer Science and Software Engineering's Dr Max Bramer. If the carbon^{13}:carbon^{12} isotope ratio (expressed in a standardised delta notation format $Đ^{13}C$) value is less than -13.621304 one can conclude the sample comes from a black rhino, but if the value is greater than this figure, the horn is more likely to be from a white rhino. As the figure shows there is virtually no overlap in $Đ^{13}C$ values between the two species, except for a few, but not all, black rhino horns from the very arid Kunene area of Namibia (which have carbon isotope ratios which overlap with those in the extreme tail of the range for white rhino horns). However in the majority of cases one can conclude the species with absolute certainty.



Practical test - Using the above Figure and decision rule (see text above) supposing that the $Đ^{13}C$ values for three samples of horn were:-
1) -8.8
2) -20.2
3) -13.0

What species of rhino most likely produced them and how confident can you be you are right?

I have been summoned to appear as an expert witness in two South African court cases where it was possible using carbon isotope ratios to show that the horns concerned quite clearly came from a black rhino. Doing so enables prosecutors to argue in aggravation of sentence if the accused is convicted.

The initial work by the AfRSG to build statistical models to determine the source of rhino horn from its fingerprint, and subsequent additional analyses by Dr Raj Amin of the Zoological Society of London has been promising. However, the results showed that more work was needed. The AfRSG therefore sought and obtained additional samples to try to develop source-determination models using bigger sample sizes.

The chemical analyses of these additional samples were originally scheduled to be undertaken by the private company in South Africa that analysed the earlier

Scientists are trying to develop a finger-printing process to ID individual species and locations.

AfRSG samples. After several difficulties and delays, the AfRSG gave up on this company in exasperation, but fortunately around this time, while taking part in discussions to develop an introductory forensics course for South Africa's new Environmental Management Inspectors (the Green Scorpions), I made contact with Gerhard Vermuelen, chief forensic analyst at the South African Police Services' (SAPS) forensic laboratory in Pretoria, who originally trained as an organic chemist.

A very useful meeting followed in Pretoria in April 2007 to discuss further development of horn fingerprinting. I attended this meeting along with Gerhard, Raj, the Commander of the Materials Analysis sub-section of the SAPS (Roger Dixon, who usefully is also a geologist), a SA Police consultant developing statistical analysis methods for gold profiling, and Phillip Randall of P-Cubed (expert in protein analysis invited to attend by SAPS).

I am pleased to report that in October 2007 we were informed that the project had been given official SAPS approval. The involvement of SAPS' forensic lab in this project to further develop and evaluate fingerprinting methods is excellent news. We now have people undertaking the analyses who have a real vested interest in developing a successful technique, and should the source-determination methods ever be developed to a level they can be used in court, it would be ideal for a specialist police scientist from an accredited forensic lab to present the results.

Following the link up with SAPS we also now plan to use some additional new analyses in the hope of improving species and source determination and perhaps