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DNA tracking

Conservation à la carte

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How seal penises, elephant dung and smashed ivory are helping geneticists pinpoint the poaching of protected species


Reuters

In the mid-1990s a group of Canadians from the small city of Guelph travelled around the world in search of seal penises. Chopped into cross sections, dried and crushed as a red-brown powder, or soaked in wine with bits of plant, these were on sale in shops from Bangkok, Hong Kong and Shanghai to the metropolises of North America. There was little reason to doubt the products had at one time been attached to an unlucky pinniped. But the DNA told a different story. Every third penis bought by the researchers came not from a seal but a different creature, such as cattle, water buffalo and an animal with a similar genetic code to an African wild dog. Aphrodisiac-buyer, beware.

Geneticists have since shown that people buying animal products are often duped. Alligator is sold as turtle meat by Louisiana's wholesalers. Catfish and tilapia are served as grouper and snapper in Florida's restaurants. Similar analyses have detected protected species in the marketplace. The Canadian researchers, for example, also showed that phalluses from protected Australian fur seals were sold among those of legally hunted species. As the science improves, geneticists are learning to tell whence, as well as from what animal, the remains came. This is helping them to identify exactly where illegal poaching has taken place so that others can clamp down on it.

Samuel Wasser of the University of Washington, in Seattle, is one such genetic detective. With his academic colleagues and a workmate from Interpol, he has tracked the largest-ever seizure of contraband ivory to its source. As the team describes in this week's Proceedings of the National Academy of Sciences, its work persuaded authorities who had been convinced the tusks originated from many countries that they actually came from a single area around the Zambian savannah. Zambia's director of wildlife was replaced and its courts have begun to impose harsher sentences for ivory smugglers.

Taking to tusk

Dr Wasser's detective work started with elephant dung. This contains oodles of cells that are brushed off the walls of the intestine during digestion. He looked for 16 sections in the DNA of the cells and used what he found to build a map of African-elephant genetics. He used geographic patterns in genetic variation to estimate the likely DNA sequences of elephants from places that had not provided dung.

Next came innovations in ivory smashing. The outer layer of an elephant tusk is packed with dead cells. Because simple crushing destroys the DNA in those cells by overheating it, Dr Wasser experimented with cooling the ivory as he crushed it. He popped an ivory lump slightly larger than a pill together with a magnet into a tube with metal plugs at either end. He then immersed the whole thing in liquid nitrogen and rattled the magnet rapidly to and fro, smashing the ivory against the plugs. ,p> All 37 tusks that Dr Wasser tested matched the elephant genetics of Zambia and the region slightly outside its borders. It thus seems reasonable to assume that all the ivory in the haul, made in 2002, came from elephants shot locally. This conclusion is an embarrassment to the country, which had asked international regulators for the right to a one-off sale of its ivory stockpile just before the seizure. Zambia had asserted in its application that no more than 135 elephants had been illegally killed within its borders in a decade. Yet the researchers think that many thousands of elephants died for the seized shipment alone and more illegal ivory has since been discovered.

Elephants are not the only animals to benefit from new DNA techniques. **Mahmood Shivji** of **Nova Southeastern University** in Dania Beach, Florida, is using genetics to conserve sharks. His method is avant-garde because it eliminates the sequencing of DNA to keep the analysis cheap and quick.

Before a scrap of DNA can be sequenced, it needs to be extracted from a cell and then copied many times to create enough for experiments. Usually, to work out which species a sample came from, researchers copy a particular section of DNA and then compare the sequence to a reference library. But Dr Shivji thinks that copying different bits of DNA could also work.

In 2005 he found a short stretch of DNA for each of 14 species of shark that was unique to each one. He then developed an initiator molecule for each stretch that would make thousands of copies of that stretch if exposed to a small sample of it. The technique relies on each unique stretch of code being a different length. When the copied DNA is drawn through jelly using an electric current, the researchers can tell how long it is—and thus to which species it corresponds. By throwing all 14 initiators into a test sample, Dr Shivji can thus identify which shark species it contains.

Recently Dr Shivji has found stretches of DNA unique to subpopulations of sand tiger shark, and added them into the soup. This means he can now tell legally caught Brazilian sand tiger sharks from those protected in American waters, and can catch fibbing fishermen. The principle would work, he says, for any species with a genetic structure to its population. Elephants and seals can breathe a little more easily.