



# SWFS NEWS

Inside this edition: Student Outreach • Outwitting Poachers • SWFS Certification

## Rhino Forensics to Expand to Meet International Needs

*TRAFFIC*

Wildlife forensic scientists from around the world met at a workshop in South Africa in June to discuss the technical development of DNA forensics for investigating illegal poaching and trade in rhinoceros.

The workshop, funded by USAID through the Wildlife-TRAPS Project and the WWF African Rhino Programme, brought together scientists, enforcement officers and investigators from source, transit and consumer countries of rhino horn. Various branches of South Africa's Police Service were represented, as was the country's Department of Environmental Affairs (DEA).

Since the rhino poaching upsurge in Africa started in 2008, over 5,000 rhinos have been poached across the continent. "The reach of the transnational organized criminals behind the poaching has extended to all major

rhino range States, undermining rhino conservation successes achieved over the last two decades; threatening both African rhino species if increasing poaching levels cannot be brought under control" said Dr Richard Emslie from the IUCN SSC African Rhino Specialist Group.

One of the aims of the workshop, organized jointly by the University of Pretoria's Veterinary Genetics Lab (VGL), TRAFFIC, WWF and TRACE Wildlife Forensics Network, was to coordinate rhino forensics at an international level. Scientists from Malaysia, Thailand, Vietnam, Indonesia, Hong Kong, South Korea, South

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The workshop took scientists and enforcement officers to a rhino crime scene in Kruger National Park, allowing them to see two poached rhinos. Photo © Simon Robertson



# Welcome from the SWFS President

Dear SWFS Members,

Welcome to the second issue of SWFS News. Our first publication in January was well received, so we're looking to continue with the newsletter and keep our membership informed of what's happening in the world of wildlife forensic science. As usual there is a lot going on and I'm sure we've not captured it all, but please enjoy reading and as always, consider contributing to future editions.

From a personal perspective, the past six months have flown by. It's now a year since our Missoula meeting and therefore only another twelve months until Edinburgh 2017! Plans are in full swing, we hope to have a conference website up soon and the local team are really looking forward to hosting the Society's first meeting in Europe.

Related to this I was fortunate enough to have the opportunity to attend a European non-human forensics meeting in Prague in April, where I met a lot of like-minded scientists working together to support the development and application of standards and new techniques. Sounds familiar? Have a look at the article on page 5.

The SWFS board has recently voted to develop a new Technical Working Group (TWG) to replace SWGWILD and we hope this process will be completed by the end of the year. Dr Lucy Webster, head of the UK wildlife DNA forensics lab at SASA, will chair the TWG, which is planning to meet in the autumn to finalise its terms of reference and discuss future activities.

The Society is also gearing up to be represented at the upcoming CITES Conference of the Parties (CoP17) happening in Johannesburg, South Africa, at the end of September. This gathering of over 180 national CITES delegations happens every three years and involves around 2,500 delegates from

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## Welcome from the SWFS President

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government and non-government organisations discussing illegal wildlife trade issues for two weeks. SWFS will have a presence on a wildlife forensics exhibit stand as well as featuring in a special lunchtime forensics event organized by TRACE and UNODC. Our own Laurel Neme (SWFS member and newsletter editor) will be covering the CITES CoP17 and its side events for National Geographic. Email her at [Laurel@Laurelneme.com](mailto:Laurel@Laurelneme.com) if you're going to be there and she'll find time to meet up and hopefully cover some of our events. For more information on CITES, check out the article by John Sellar and Jonathan Bardzo in this issue (p.16).

As many of you will know, in the past six months we've also received the sad news that Bob Anderson passed away in February. Bob was a great supporter of SWFS, culminating in his hosting the 2015 meeting in Missoula, which remains a great source of happy memories. To honour his contribution to the Society, after consultation with his family, we will be naming the student bursary award for SWFS meeting attendance as the Bob Anderson Scholarship. John Sellar wrote an eloquent tribute to Bob, which he shares with us on page 6.

Finally, thanks again to all of the contributors and the SWFS news production team for creating another great newsletter.

Regards,

Rob Ogden

## Upcoming Meetings of Interest



Sandton Convention Centre  
Johannesburg, South Africa  
September 24 - to October 5, 2016

[https://cites.org/eng/cop17\\_deadline\\_observers](https://cites.org/eng/cop17_deadline_observers)



Wildlife Disease Association  
65th International Conference  
July 31 - August 5, 2016

Hosted by Cornell University  
at Greek Peak Mountain Resort  
Cortland, New York, USA  
[www.wda2016.org](http://www.wda2016.org)



International Society  
for Forensic Genetics (ISFG)  
27th International Congress 2017  
Seoul, South Korea  
August 28 – September 1, 2017  
[www.isfg2017.org](http://www.isfg2017.org)

## Letter from SWFS Director of Communications

Good day everyone –

I hope you enjoy our second SWFS newsletter. There is lots of good information for you to read and ponder. I hope you discover new things and perhaps will be inspired to write something for us yourself that we can include in the next edition. We would like this newsletter to be a communication between our members and anyone with an interest in wildlife forensics. We are trying to facilitate this communication between our members world-wide through this newsletter.

What is communication anyway? To me, communication is not just the exchange of information but also requires reciprocation or dialogue. I hope we can provide useful information and, in return, receive comments and additional articles for future publications from our readers.

In this electronic age, communication is facilitated to a great extent through the internet. There are lots of great resources at our fingertips today. One such source comes to me weekly as a news update from TRAFFIC. You can sign up to receive this weekly update at the Traffic web site “either drop Richard Thomas, Global Communications Coordinator, a line Email: richard.thomas@traffic.org Tel: +44 1223 331981 or contact traffic@traffic.org”. In one recent update I found a link to “The World Wildlife Crime Report 2016” available from United Nations Office on Drugs and Crime at this link - [http://www.unodc.org/documents/data-and-analysis/wildlife/World\\_Wildlife\\_Crime\\_Report\\_2016\\_final.pdf](http://www.unodc.org/documents/data-and-analysis/wildlife/World_Wildlife_Crime_Report_2016_final.pdf).

The World Wildlife Crime Report takes stock of the present wildlife crime situation with a focus on illicit trafficking of specific protected species of wild fauna and flora, and provides a broad assessment of the nature and extent of the problem at the global level. This is a great example of available information relevant to the work we do every day.

We want this newsletter to be likewise relevant. We hope you will find it interesting and informative. You can submit items to any of the board members but your first point of contact should be me, Brandt Cassidy at bcassidy@dnasolutionsusa.com. I look forward to expanding this mode of communication so we can continue to be connected in between our society meetings. I am looking forward to seeing everyone in Edinburgh Scotland in 2017. Till then - Keep it wild!

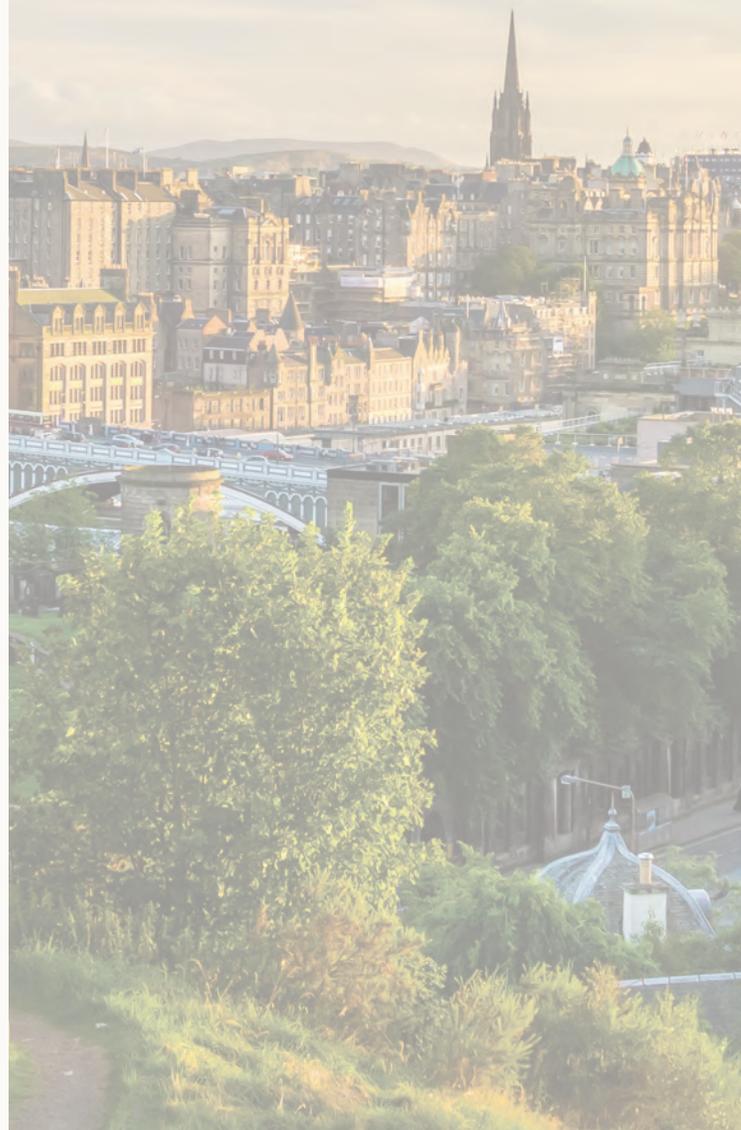
-- Brandt Cassidy



**4th INTERNATIONAL MEETING  
EDINBURGH, UK • 2017**

**June 5-9, 2017**

**Website Coming Soon**



# SWFS Links Up With European Colleagues in Prague

by Rob Ogden

There aren't too many people in the world that do what SWFS members do for a living, but there are some. The European Network of Forensic Science Institutes (ENFSI) has a dedicated Animal, Plant, and Soil Traces working group (APST). As well as the ENFSI-APST group having an equally impressive set of acronyms to those of SWFS and SWGWILD, it also represents scientists with similar interests, although largely focusing on human victim crime.

In April this year, on behalf of SWFS, I attended their annual meeting in Prague, capital of the Czech Republic. The event was attended by around 45 participants from over a dozen different countries in and around Europe. The focus of the group, which has been running since 2010, is on the identification of non-human biological and soil trace evidence. Presentations included work on genetics, chemistry (analysis of biological and physical samples), palynology (pollen), mycology (fungi) and parasites (mites). In addition there was plenty of discussion on issues of quality assurance that sounded very familiar to conversations with SWFS colleagues operating in similar fields.

The social side of the meeting benefitted from having a free bar at the venue that opened at lunchtime, so finding common areas to discuss was not difficult,

despite at least ten native languages being on display. It became clear to me that the ENFSI-APST has a lot of complementarity with SWFS; members have varying levels of experience in non-human forensics, there are a lot of efforts to establish minimum standards and encourage continuous improvement, and most people enjoyed a drink or three. The chair of the group, Irene Kuiper from the Netherlands Forensic Institute, agreed, "the ENFSI APST group has a lot in common with SWFS so it was good to learn about the Society and what it's trying to achieve in wildlife forensics. We are looking forward to collaborating on common issues in the years to come."

One aspect of possible collaboration was in the development of a publication for non-human forensic case studies, validation reports, protocols, reference materials and other documents; all essential to the work of forensic scientists but often beyond the scope of the academic press. The ENFSI-APST is considering options for an open access journal to address this issue and as a Society we'll be considering whether or not SWFS could have a role to play.

We'll hopefully get to meet many of these European colleagues at the SWFS 2017 meeting in Edinburgh, although I'm afraid the beer won't be quite as cheap!

The ENFSI Animal Plants and Soil Traces group meeting in Prague, attended by SWFS president, Rob Ogden.



# All Those Who Care for Wildlife Should Mourn Today: A Tribute to Bob Anderson

By John M. Sellar OBE FRGS

Originally posted on LinkedIn on January 29, 2016. Reprinted with permission

I received some terribly sad news this morning. It concerned the passing of a man whom I had had the honour, privilege and utter pleasure to know for many years. I have no particular claim or right to prepare a eulogy for this person but I trust his relatives and close friends will forgive me if I go ahead and do so regardless.

Bob Anderson was a criminal trial attorney in the U.S. Department of Justice, and had been for a long time. He maybe wasn't particularly well-known outside the relatively limited circle of those whose job it is to bring to justice the criminals who seek to exploit the natural resources of the Earth or those individuals and companies who don't care if they damage it. But he certainly deserved to be.

It would be difficult to identify anyone who, over the course of their career, did more in this field and who demonstrated such remarkable commitment and dedication. His efforts were recognized, by the Dept. of Justice, several times. Indeed, the last time I saw Bob, he was on his way to Washington D.C. to be honoured yet again. I think he, in common with most law enforcers and prosecutors, liked his work to be acknowledged but that certainly wasn't what motivated him. Bob believed in the Rule of Law and was dedicated to bringing down those who tried to escape it.

There was no better example of his attitude than the words incorporated into the 'signature' at

the end of every email he wrote – "Law without enforcement is just advice."

For many years, he was a representative of the United States of America on the INTERPOL Wildlife Crime Working Group and that was where we first met. Bob served the Group faithfully for a long time and it was primarily because of health problems that he, in recent years, engaged in less international travel. Which was a real shame, as he also did excellent work raising the profile of wildlife trafficking and in sharing his prosecuting experience and expertise with the judiciary of many nations around the world.

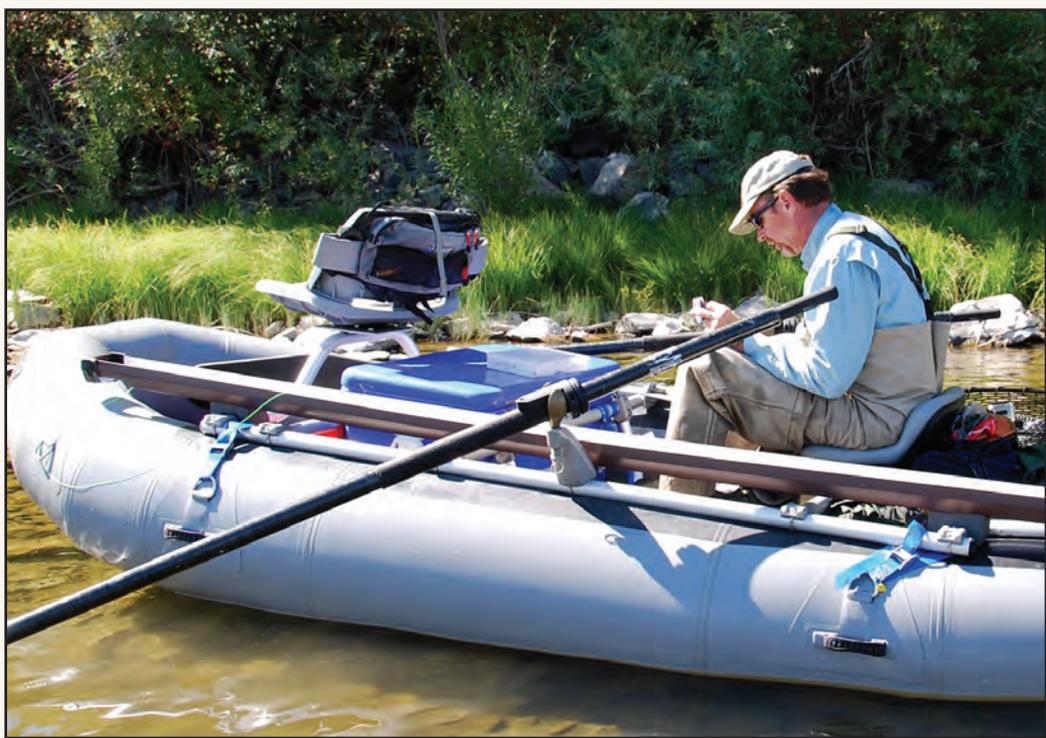
I don't know what it is but there are times in life when you encounter someone and immediately recognize them as a kindred spirit. That's how it was for Bob and I. We might not see each other, or speak together, for

months at a time. And yet, the next time it was as if we'd only parted company the previous evening. That was how it was when my wife and I spent a couple of nights with him, at his home in Montana, in early autumn last year.

My wife hadn't met Bob before, although she'd heard plenty about him from me, and within hours they were buddies. I would defy anyone not to like Bob Anderson. The following day, he took me fly-fishing, floating downstream on his RIB along one of his State's beautiful rivers. It was something he'd been pestering me to join him in doing for many, many years, and

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Bob at his happiest, enjoying the outdoors. Photo courtesy of John Sellar.



## A Tribute to Bob Anderson

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it was an absolute delight to finally accept his invitation.

It was one of those days, which all anglers have experienced, where the conditions appeared to be perfect. Bob insisted on guiding the boat whilst I threw out the line until my arm ached. Every so often, we anchored and waded; Bob spotting fish and offering casting advice. He was a very fine angler and an expert instructor/guide. Twice, I hooked into fish but they both escaped the net.

Finally completely exasperated with me, Bob asked for the rod. He cast and he cast, he got out of the boat, he waded, and he cast even more. He changed the flies again. Still nothing, not the slightest nibble.

My goodness, how I loved teasing him that at least I had managed to hook fish. The day ended with neither of us having landed even the smallest of trout. But it was a day I shall never forget. One reason it's so memorable is that Bob felt greater disappointment as we drove home that evening, for me, than I did. He was a man who was truly generous of spirit. The

photograph that heads this post was taken that day and shows Bob, very patiently, tying yet one more fly in the vain hope that I might catch a fish. Just one example, among countless others, of his desire to help colleagues and friends.

It was typical of Bob that, in the months since, he sent me a number of emails with images of his successes on subsequent days' fishing. But that was also his way of getting back at me for making him very jealous, about five years ago, when I emailed him a photo of me fighting a 100lb tarpon, and subsequently bringing it to the side of, but not into, a boat off the Florida Keys.

Bob and I came from different judicial backgrounds. His office was the courtroom, whilst mine was the street. I have come across several

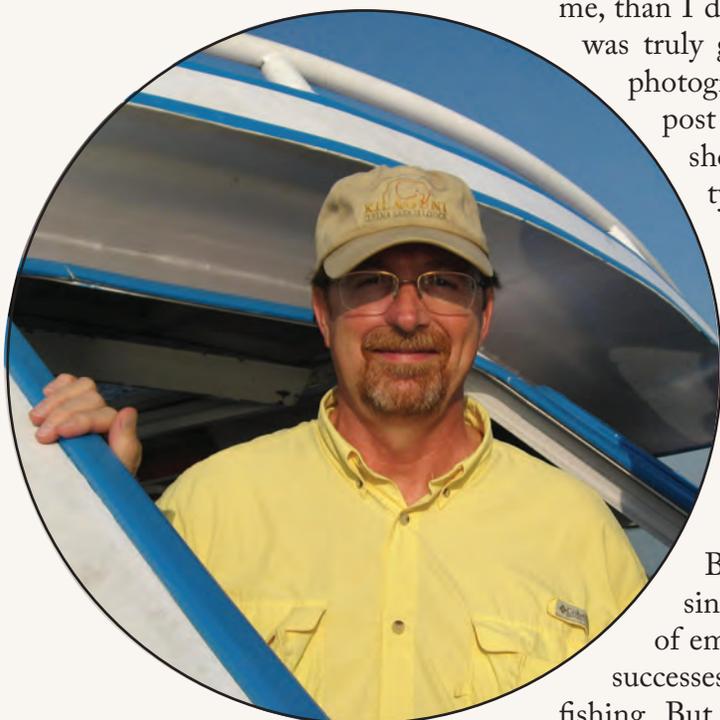
prosecutors who look down on those with the badge. Bob was never, ever a member of that group. He realized that success resulted from teamwork. He grasped every opportunity to get involved in investigations and cases at an early stage and to support the badge-wearers and carriers. He recognized that the enforcement official of today is, like he was, a true professional. This is why his passing will be mourned so very deeply by Special Agents and Inspectors, serving and retired, in (especially) the U.S. Fish and Wildlife Service.

However, he also relished the banter which he and I used to engage in, with each playing Devil's Advocate to the other's suggestion that the role of cop or prosecutor was the more important. It was an illustration of his friendship that, no matter how provocative I became, he never took offence and consistently gave as good as he got. We both learned from those debates. And I treasured his dry and sometimes wicked sense of humour, which aligned so easily with my own.

We exchanged emails just a few weeks ago. I sent him images from a beach on the west coast of Scotland where sections of his all-time favourite film, 'Local Hero' were shot. Bob, of course, called it a movie, would have written favorite, and would have been disappointed had I not mocked him for doing both. He could quote line after line from the script, and did so as our emails passed back and forth.

Bob had had quite a hard upbringing and, aside from being

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Bob Anderson on Brailian Federal Police boat in Manaus, Brazil. Photo courtesy of Laurel Neme.

Late morning, we arrived above shallow rapids where fish were rising, literally dozens and dozens of them. Whatever I did, and regardless of the different flies Bob tied to the end of the line, there wasn't a single take.

# A Tribute to Bob Anderson

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a highly successful prosecutor, had talents or sides to him that may not have been widely-known or appreciated.

- He had a regular spot on a local radio station, where he delighted in being a 'DJ' and sharing his pleasure in music. He also loved to play the guitar.
- He gave off-duty time to help law students at his local university.
- At one point in his early working life, he was fluent in Mandarin. When we were once together at an INTERPOL meeting in Beijing, I noticed that he clearly understood some of the conversations which were taking place around us and I asked why he wasn't joining in. He said that he was rather hesitant to do so and went on to explain that his mastery of the language had been put to use during his service in the U.S. Navy. He said that if he provided any further detail, he'd have to kill me! (He did, and didn't.)
- Bob was appointed as Chief of Enforcement in the CITES Secretariat in the mid-1990s (although the post didn't have that title then). For various reasons, he resigned and returned to the States after a fairly short period of time. He told me, more than once, that being unable to continue in Geneva was one of his greatest regrets in life.

Although you would never have guessed it from the way he looked, behaved or just plain lived life, Bob



Bob Anderson on a panel at INTERPOL Wildlife Crime Working Group meeting. Photo courtesy of Laurel Neme.

did not enjoy good health. He had very significant congenital heart problems and had suffered at least two major medical 'episodes' that I know of; either of which could well have proved fatal. I know nothing about the employment conditions for US federal employees but I'd be astonished if some form of ill-health pension would not have been available to him. It is a measure of the man that it seemingly never entered his mind to give up the work which he believed so passionately in.

However, I do know that he was looking forward to a relatively imminent retirement and said how much he envied the life I now live, with the opportunity to be one's own man and pick and choose what one accepts or declines. It is so awfully and terribly tragic he will not see that stage of his life. Bob had so very much more to give and intended to give it unhesitatingly.

It is my understanding that Bob, on several occasions, was encouraged to move to DoJ headquarters in D.C. but always declined, even though it would have brought promotions. His fondness for the outdoors would not let him leave his beloved Montana. It is an illustration of the regard in which he was held that management apparently allowed him to be based there, even though most of such specialist prosecutors work out of Washington.

I offer my sincere and heartfelt condolences and sympathies to his relatives, colleagues and friends and especially to his daughter.

Wildlife law enforcement and prosecution has just lost one of its finest champions. The world has lost a true gentleman and a very fine man. I am stunned over the loss of someone I was really, really proud to call a friend. But what I shall miss most is that he was good enough to look upon me as a friend.

## Rhino Forensics to Expand to Address International Needs

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Delegates visited a rhino crime scene in Kruger National Park. © Dr Cindy Harper

Africa, Kenya, Botswana, Namibia, Netherlands, United Kingdom, Australia, Czech Republic, and India, including many SWFS members, attended the meeting to learn more about the issues on the ground, and about RhODIS®, the current rhino DNA profiling and database system, developed by VGL.

Workshop delegates and all African rhino range States supported the development and use of standardized global forensic rhino DNA methods, to support species identification as well as individual sample matching.

According to Dr Cindy Harper, Director of VGL, a major output of the meeting was that it detailed the requirements of a simplified method to facilitate the sharing and roll out of an improved RhODIS® compatible analysis system to multiple laboratories across the world that can become the international standard capable of producing comparable DNA profiles, which can be loaded

onto a global database.

“While the RhODIS® system is already a proven tool for the investigation of rhino poaching cases and has been used in a number of prosecutions; the refinement and roll out of a recognized international forensic rhino DNA standard should positively support enforcement action and investigation of trade routes at an international scale,” she said.

Dr Joseph Okori, leader of WWF’s African Rhino Programme, noted the critical role of the global forensic community to combat rhino crime and said that DNA analysis is starting to help improve knowledge of trade routes and inform other aspects of rhino management.

Nick Ahlers, who manages the Wildlife-TRAPS Project for TRAFFIC and IUCN, said “another aim of this workshop was to build relationships between different scientists from countries important in the illegal rhino horn trade, and

we’ve certainly achieved this given the positive feedback by the range, transit and consumer countries that have participated this week.”

But the impacts of this workshop extend beyond rhinos. While poaching threatens to wipe out rhinos, it “is also devastating local communities through associated criminality, violence and theft,” said Dr Sara Carlson, a Biodiversity and Natural Resources Specialist at USAID. “DNA forensics is a critical tool in the fight against wildlife crime and the outcomes of this workshop are likely to have impacts beyond rhinos to other species involved in the illegal wildlife trade.”

Delegates also saw a demonstration of the eRhODIS data collection app and how versions of these apps in other languages could be developed in future.

They also visited a rhino poaching crime scene in Kruger National Park, where participants saw two poached rhinos whose horns had been savagely hacked off with an axe. The park loses about two rhinos a day to poaching, and both black and white rhino populations in the park appear to have started to decline.

“This really brings home the reality of the rhino horn trade and justifies our recent transfer of 14 seized rhino horn samples to the South Africa Government for RhODIS DNA testing to aid enforcement,” Dr Jeffrine Rovie, from the National Wildlife Forensic Laboratory in Malaysia, said.

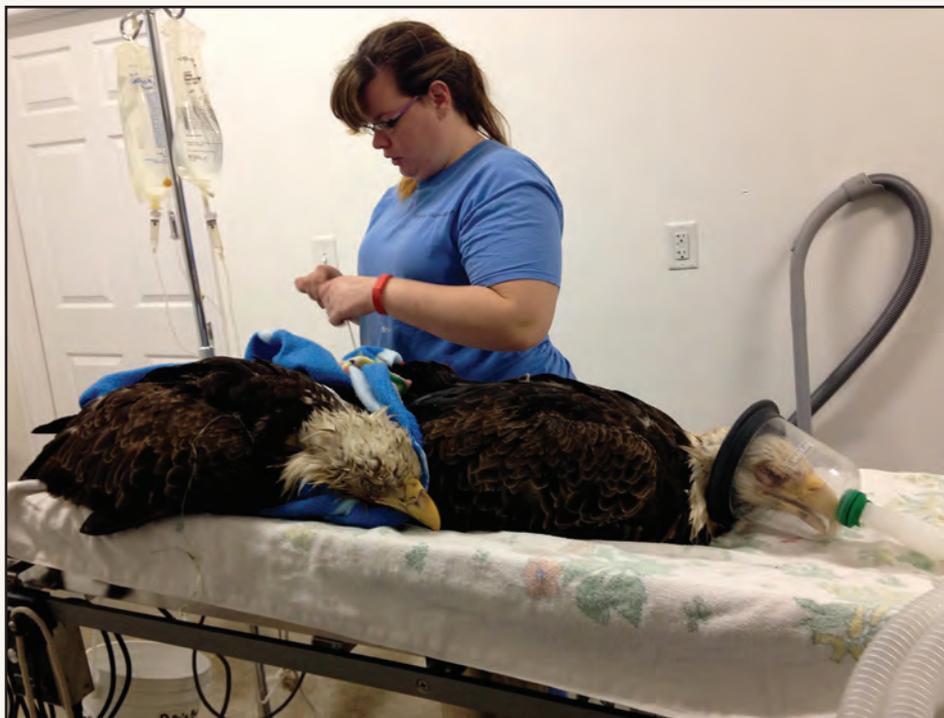
It is that type of collaboration and support, fostered by this workshop, that is needed to help the rhinos.

# Invisible and Deadly: Carcasses of Euthanized Animals Can Kill Scavenging Wildlife and Pet Dogs

by Ngaio Richards, Trent Bollinger, and Alice Whitelaw

Large and small animal veterinarians have several euthanasia options at their disposal, but the barbiturate drug sodium pentobarbital is considered one of the most humane and effective for horses, livestock and companion animals. This drug also has a lengthy history of unintentional secondary animal poisonings, with incidents of debilitation and mortality leading right up to the present. These poisonings are generally inadvertent, and prevention can be significantly enhanced by raising awareness in the public and within the veterinary community. In this regard, game wardens and wildlife officers can play a prominent role in education and outreach.

In Canada and the US, reports of scavenger poisonings, including eagles, ravens, bears, martens, fishers, lynx and otters first emerged in the late 1980s. In 1988, for example, a single cow carcass poisoned 29 bald eagles in British Columbia. In 1999, two bald eagles and five golden eagles perished in Colorado after feeding on two euthanized mules. In 2007, a bald eagle in the Yukon died of pentobarbital toxicity after scavenging a euthanized dog at a landfill. Similarly, in 2008, at least 4 bald eagles and 1 crow died after scavenging on euthanized horses in southern British Columbia. In that same year a bald eagle in Sault St. Marie, Ontario was diagnosed with pentobarbital contaminated meat in its crop - though it recovered with treatment. In 2010, two dogs in Wyoming fed on the partially buried carcass of a horse that had



Eagles incapacitated by sodium pentobarbital receive medical care. Photo by Michelle Whitfield of the Animis Foundation

been euthanized two years prior. One of the two dogs died, and another dog, who belonged to the owner of the horse (and had been seen scrounging by the carcass before it died) was later found buried nearby. Also in 2010, a dog out for a walk on a beach in New York State was incapacitated after eating a fragment of what turned out to be the blubber of a stranded juvenile humpback whale that was euthanized on site two weeks before. Last year, two bald eagles died in Florida and a dozen or more turkey vultures were harmed in California. Captive animals at zoos, breeding and rehabilitation facilities have also succumbed after being provided with tainted meat. Also last year, a tiger, a wolf and a cheetah all died

at a sanctuary in Nevada after they were fed meat later determined to have been that of a euthanized horse.

These cases provide just a snapshot of incidents across North America. Known occurrences may not necessarily have been recorded in the relevant databases. Likewise, verbal reports with convincing circumstantial evidence but no samples for testing also exist. Indeed, we believe that sodium pentobarbital poses a greater threat to scavenging animals anywhere it is used in the world than is currently being acknowledged.

Cases of barbiturate poisoning are generally inadvertent, arising

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# Invisible and Deadly: Sodium Pentobarbital Danger

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due to lack of information. With this in mind, the US Food and Drug Administration added a warning label to euthanasia solutions containing sodium pentobarbital in 2003, several years after initial reports of mortality started coming in. Although an administering veterinarian could be held liable and face penalties if found negligent, it is ultimately the owner's responsibility to correctly and safely dispose of a euthanized animal. The FDA warning label reads: This product is toxic to wildlife. Birds and mammals feeding on treated animals may be killed. Euthanized animals must be properly disposed of by deep burial, incineration, or other method in compliance with state and local laws, to prevent consumption of carcass material by scavenging wildlife. But companion animals, especially

dogs, can be poisoned too and this is not mentioned on the label. The term 'deep burial' is also vague and misleading. For example, a mother bear and her cubs scavenging at a landfill site were poisoned after unearthing a carcass thought to have been thoroughly covered up. When an animal is euthanized in the winter or early spring, the inconvenience and added expense of bringing in specialized digging equipment may deter owners from burying carcasses.

Livestock carcasses can also be incinerated, but rendering is NOT a viable solution because residues are not destroyed by this process. Researchers at Oklahoma State University have been looking at whether certain methods of composting help degrade sodium pentobarbital in horse carcasses,

and are finding that residues may persist for over a year. So while this valuable line of research into safe disposal and burial methods is yielding useful results, the long-term persistence of these residues still needs to be addressed.

Regional/municipal carcass disposal laws (when they exist) and regulations that protect wildlife vary considerably across North America. In the US and Canada, a wildlife poisoning incident caused by improper disposal of a euthanized (or otherwise harmfully medicated) animal carcass may violate several laws, including the Migratory Bird Treaty Act, the Bald and Golden Eagle Protection Act and the Endangered Species Act. The US Fish and Wildlife Service has the authority to investigate and prosecute suspected violations. Individual states, provinces and territories also have legal recourse. For example, turkey vultures that die in California after consuming euthanized animals are also protected by the California Fish and Game Code.

The rancher in Colorado thought he was doing a good deed by leaving out the carcasses of his two euthanized mules for scavengers to dispose of. When he realized that he had instead poisoned several bald eagles and golden eagles, he and the attending veterinarian contacted the authorities. They were each fined \$10,000 for violating the Migratory Bird Treaty Act and the Endangered Species Act, among others, which perfectly illustrates why few people are likely to notify the authorities and claim responsibility for a



An eagle incapacitated by sodium pentobarbital near a garbage dump. Photo by Michelle Whitfield of the Animis Foundation

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# Invisible and Deadly: Sodium Pentobarbital Danger

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mortality incident even if they had no intention of poisoning wildlife.

The types of incidents we've described are inherently preventable. Yet they continue. Standardized carcass safety disposal protocols tailored specifically to the realities and tenacity of sodium pentobarbital residues and to the seasonality of the region are needed, factoring in disposal alternatives such as mandatory incineration during months when the ground is frozen or hard packed. While these parameters are established, prevention is essential. Game wardens, conservation officers and other wildlife agents have a key role to play in safeguarding our scavengers and pet dogs, helping people avoid penalties and informing the public and veterinarians whenever an opportunity arises. As a respondent in the field, you may also be called to a scene of wildlife mortality. Keep in mind the time of year – carcass tissues thaw and become



An eagle incapacitated by sodium pentobarbital receives medical care. Photo by Michelle Whitfield of the Animis Foundation

more available to scavengers in the late winter and early spring, which also coincides with a general scarcity in food resource. Another way of telling that a bird has been poisoned by sodium pentobarbital is its proximity to a euthanized livestock or companion animal that has been scavenged, especially in or near a landfill. That said, it can take some time for poisoning to take hold so poisoned scavengers may also be found nowhere near a carcass. Affected animals will look sluggish or be drifting in and out of consciousness. The good news is that even comatose animals can recover if they are provided with the necessary care in time either for manual removal of the contaminated food item or for help clearing the drug from their system. Sick wildlife should be taken to qualified rehabilitation facilities and dead wildlife should be taken to appropriate veterinary diagnostic facilities for treatment and analysis, respectively. As a preventative measure, other forms of humane euthanasia should be considered

when there is the potential for scavenger exposure to carcasses, bearing in mind that lethal tools such as lead shot are also toxic to scavengers.

To our knowledge, the number of animals that have succumbed to secondary sodium pentobarbital poisoning throughout North America has never been tallied, and we believe the actual extent of this issue is masked by under-reporting. Over the coming year we will be casting a wider net to find as many cases as possible from the last decade to better assess the magnitude of this issue. If you have any questions or would like to provide case information for our review, please contact Dr. Ngaio Richards: [ngaio@workingdogsforconservation.org](mailto:ngaio@workingdogsforconservation.org).

*Ngaio Richards and Alice Whitelaw work with Working Dogs for Conservation, Montana USA. Trent Bollinger works with Canadian Wildlife Health Cooperative (Western College of Veterinary Medicine, University of Saskatchewan) Saskatoon*



Circle photo: An eagle incapacitated by sodium pentobarbital recovers. Photo by Michelle Whitfield of the Animis Foundation

## SPOTLIGHT ON

### Kim Frazier, Wyoming Game and Fish Wildlife Forensic and Fish Health Laboratory



#### What is your current position and what does it entail?

**KF:** I'm currently the Forensic Program Manager for the Wyoming Game and Fish Wildlife Forensic and Fish Health Laboratory. I've been in this position for 11 years. Prior to that, I was the Forensic Analyst for 6 years. My main duties are as a practitioner, with very little research. My lab performs forensic analysis on approximately twelve different species and we do forensic analyses for ten states. Our main analyses include species identification, gender identification, matching or minimum number of animals. We also do quite a few carnivore-human interaction cases. All of the cases we receive in the lab are from law enforcement officers.

#### How did you first get involved in wildlife forensics?

**KF:** I guess you could say I kind of stumbled into it.

#### What was your first impression of wildlife forensics?

**KF:** I loved it. It was quite overwhelming at first, but I have had a great mentor throughout my entire career, Dee Dee Hawk.

#### What has surprised you most about working with wildlife forensics?

**KF:** I'm surprised by the diversity of the field- I'm also continuously surprised at the time and money people will invest to illegally harvest an animal, timber etc. and the total disregard some humans have toward animals.

#### What do you find most challenging about wildlife forensics?

**KF:** Again, I have to say it is the diversity of the field. We work with a huge variety of species and each lab is unique in regards to the species they work with and the questions that they are answering.

#### What most motivates you to do what you do?

**KF:** I think it may be the challenge; to be presented with unknown samples and to be able to piece them together to determine a species, gender or number of animals present.

#### What were you doing before you began your current position?

**KF:** I have pretty much been in this field since I graduated from college.

#### Tell me about some of the people you've met while working in wildlife forensics.

**KF:** I have met many wonderful and passionate people while working in

this field. I think that practitioners in this field are a very unique group of scientists. We have come together on many occasions and donated large amounts of our personal time to ensure that we and others in our field are practicing the best science we can. Any time I have needed advice I could always count on help, especially from the people at the USFWS Forensic Lab in Ashland Oregon.

#### Where did you grow up?

**KF:** In Green River, Wyoming: Population ~12,500, 272 miles west of Cheyenne Wyoming, 190 miles south of Jackson, Wyoming, or 169 miles north east from Salt Lake City, Utah.

#### What was it like to grow up in Green River, Wyoming?

**KF:** I suppose it was like any other small town and I couldn't wait to leave.

#### Where did you go to college?

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## Spotlight on Kim Frazier

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**KF:** University of Wyoming in Laramie Wyoming for my B.S and University of Florida in Gainesville Florida for my M.S.

### **What might someone be surprised to know about you?**

**KF:** That I am an awesome karaoke singer (just kidding).

### **The interest in wildlife forensics seems to be growing. Why do you think that is?**

**KF:** I think it has to do with publicity of high profile poaching cases and an increase in the need for wildlife forensics.

### **What do you think will change about wildlife forensics over the next five years?**

**KF:** I'm hoping that we will have a set of standards that all wildlife forensic labs can adhere to. I also think the field is going to keep growing and diversifying with new technology and an expanding need.

### **What do you do when you aren't working?**

**KF:** I like to spend most of my time outside. I enjoy mountain biking, rafting and skiing. I'm also an avid reader and have been known to binge watch a few shows on Netflix.

### **What's next for you in your work? What are you looking forward to?**

**KF:** I'm working on my aquatic animal health inspector certification and am looking forward to completing it.

## New Genetics Staff at USFWS National Fish and Wildlife Forensic Laboratory

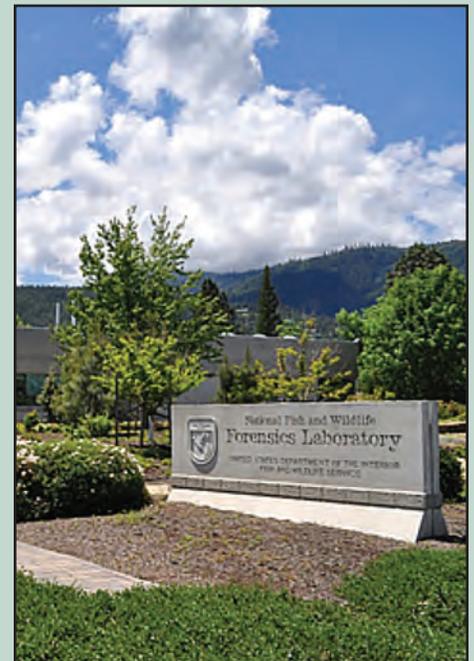
*By Mary Burnham Curtis*

The Genetics Section of the USFWS National Fish and Wildlife Forensic Laboratory would like to welcome two new staff members, Molly C. Schmelzle and Hope R. Draheim.

Molly Schmelzle joins us as a Forensic Laboratory Technician fresh from her Masters Degree completion with Dr. Andrew Kinziger at Humboldt State University. Her thesis project involved occupancy modeling to compare eDNA to traditional population abundance assessment methods for tidewater gobies. Molly will be in charge of general laboratory maintenance and forensic laboratory support.

Hope Draheim joins us from the Pacific States Marine Fish Commission, where she has been conducting Next Gen sequence analysis on salmonid fishes. She earned her Masters from the Haig Lab at Oregon State University, and her Ph.D. from the Scribner Lab at Michigan State University, where she studied landscape genetics of North American black bears. Hope will be working on Next Generation sequencing research and application of Next Generation techniques to wildlife forensic genetic analyses.

Welcome Hope and Molly!!



The USFWS National Fish and Wildlife Forensic Laboratory

# New SWFS Program Matches Students and Lab Research Needs

*By Chris O'Brien*

The Society for Wildlife Forensic Science (SWFS) is excited to announce the start of a new research program that aims to engage students and assist labs with research needs.

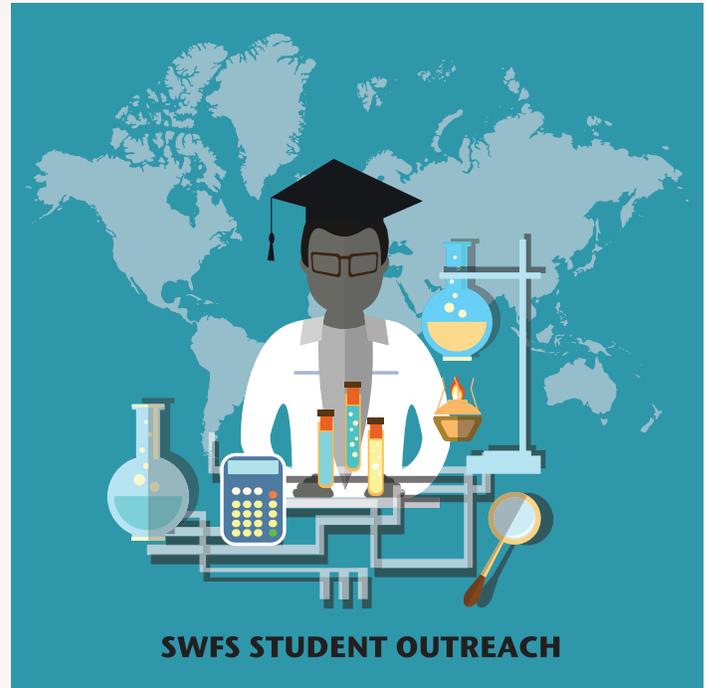
The SWFS Student Outreach Program was launched in late June of 2016. It is being managed by the newly appointed Coordinator of the program, Dr. R. Christopher O'Brien of the University of New Haven's Center for Wildlife Forensic Research, whose role is to oversee the progression of research as specified below.

The program aims to provide a central point of contact for the exchange of research ideas and needs between students, mentors, and laboratories. This collaboration will be done with transparency and scientific rigor. With the purpose of instilling effective partnership, the application process allows for a successful match of a researcher with an idea and possibly a mentor and/or laboratory.

## The process to join the program is as follows:

- The student/researcher/intern will submit an application to the program that will be catalogued and filed. A similar process will be conducted for labs or individuals that have research ideas that need to be carried out.
- A student will then be matched to a research idea by the coordinator based on the information provided.
- If the student is in need of a mentor, a mentor will be matched to the student based on the information provided in both the student's and the mentor's applications.
- After all the necessary matching takes place, each party will be notified and it will then be left up to each party to determine how the research will take place.

All research will be conducted with the end goal of a publishable paper or a thesis (at the cost of the student/university or lab). One stipulation of participation in the program is that the research will be monitored



by SWFS for scientific rigor and ethics. Further, the Society must be acknowledged in the publication that results from the research. Upon completion of the work, a copy of the final publication and/or thesis will be housed within the Society, and if necessary, the Society will have access to the raw data. If the project is funded through a private company, the said company will reserve the right to disseminate the information, as they deem necessary.

For this program to succeed, we need the assistance of all of the members of SWFS and their associated laboratories. If you are a student and are interested in conducting research that is immediately applicable to the wildlife forensic realm, please fill out an application and submit it. If you are an academic institute, please consider assisting in the process by applying to be a supervisor for either your students or other individuals looking to do research. Further, anyone or any lab that has research needs, please consider using this program as your source of student researchers.

If you have any questions please contact Chris O'Brien at [SWFSStudentOutreach@gmail.com](mailto:SWFSStudentOutreach@gmail.com) or find more information and applications on the SWFS website.

# CITES and Forensics

## Introduction

Many wildlife forensic scientists will, either occasionally or regularly, become involved in cases relating to violations of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Indeed, the expertise of such scientists will often be essential in both the investigation and prosecution of CITES-related crime. However, the complexities of the Convention mean that it may be relatively easy for forensic staff, investigators and prosecutors, themselves, to inadvertently contravene its provisions.

This article is intended to encourage those connected with jurisprudence to act prudently and

to help them to avoid any action that might put evidence into question, particularly in relation to its transportation.

## CITES and its provisions

A number of misunderstandings exist about what CITES does, and does not, do. For instance, although it is very much based upon concerns relating to conservation, its function is as an international trade treaty. Its ultimate aim is to ensure that trade in wild animals and plants does not negatively impact their wild populations. Consequently, its focus is on those species that are affected by international trade. It is not designed to help species that are threatened mainly by other factors, such as climate change or habitat loss. Neither is it an animal welfare convention.

The very word 'trade' can also lead to confusion.

Most of us think of that as referring to commerce, but in CITES the term is not used in this way. Its definition of the term 'trade' is "export, re-export, import and introduction from the sea", and it is these cross-border movements that are of such significance for forensics.

Of equal importance is what will be moved across borders. The Convention uses the term 'specimen' to indicate what is subject to controls, and it is essential to understand what that word means too. This is how the word 'specimen', as used in the Convention, is defined:

by John Sellar and Jonathan Barzdo



(i) any animal or plant, whether alive or dead;

(ii) in the case of an animal: for species included in Appendices I and II, any readily recognizable part or derivative thereof; and for species included in Appendix III, any readily recognizable part or derivative thereof specified in Appendix III in relation to the species; and

(iii) in the case of a plant: for species included in Appendix I, any readily recognizable part or derivative thereof; and for species included in Appendices II and III, any readily recognizable part or derivative thereof specified in Appendices II and III in relation to the species.

At this point, we should consider particular elements of the definition. Firstly, take 'part or derivative'. It is the inclusion of these words that obliges the law enforcement community to deal with the literally hundreds of different forms that trade in animals and plants can take. For instance, search as you might through the Appendices of CITES, you will never come across the word 'caviar'. But, because all species of sturgeons and paddlefish are listed in the Appendices, any trade in their eggs (caviar) is regulated.

Secondly, the word 'specified' is significant. A practical example in



Traditional Chinese medicine containing bear bile. Photo by Laurel Neme

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# CITES and Forensics

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relation to flora is that, unlike fauna, it is possible to specify which parts and derivatives of plants are covered by the Convention. And this has been done for many species. For instance, the regulation of trade in some timber species is limited to specific forms, such as logs, sawn wood or veneer sheets, other kinds of specimens being excluded from regulation. In the case of other kinds of plants, the seeds or cut flowers of many species are exempt from controls.

This is one reason why it is vital to consult the Appendices to determine exactly which CITES provisions, if any, apply to specimens to be transported. Let us now turn to a third element from the definition of 'specimen', one which deserves special consideration.

## What is 'readily recognizable'?

Answering that question might appear simple. After all, most border control agents would probably recognize the distinctive stripes and patterns of a tiger's skin, although they might not know whether it was real or fake. They would probably seek confirmation from an appropriate expert (and certainly ought to) before they formally confiscated such an item or reported its possessor to a prosecution authority but they would probably be sufficiently confident to at least seize and detain the skin initially. However, what if tiger bones had been dissolved in liquor and a traveller was in possession of a bottle of such liquid, with nothing to indicate the nature of the contents? These are much



Smuggled caviar. Photo courtesy of US Fish and Wildlife Service.

more difficult circumstances for a Customs officer to respond to.

Having recognized that interpretation of the term 'readily recognizable' was not going to be as straightforward as the Convention's drafters might have thought, the CITES community responded, as it so often has, and does, by adopting a Resolution on the subject: Resolution Conf. 9.6 (Rev. CoP16) - <https://cites.org/eng/res/09/09-06R16.php> - entitled 'Trade in readily recognizable parts and derivatives'.

Before continuing, it may be useful to explain that the text of the Convention itself is legally-binding upon those countries (Parties) that have ratified or acceded to CITES. Strictly speaking, the provisions contained in Resolutions, however, are not binding – and they generally don't pretend to be,

using such terms as 'recommends', 'urges' and 'encourages'. However, the guidance contained in them is very weighty and many nations subsequently incorporate it into their domestic law. Even where they have not done so, courts often look upon the language in Resolutions as having legal significance. Indeed, some commentators have described the Convention as being 'primary legislation', i.e. similar to a statute enacted by parliament, with Resolutions being 'secondary legislation', i.e. similar to regulations that might be issued by a Ministry. This is the principal guidance contained in the Resolution: "...the term 'readily recognizable part or derivative', as used in the Convention, shall be interpreted to include any specimen which appears

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# CITES and Forensics

from an accompanying document, the packaging or a mark or label, or from any other circumstances, to be a part or derivative of an animal or plant of a species included in the Appendices, unless such part or derivative is specifically exempted from the provisions of the Convention...”

So, returning to the traveller's bottle containing tiger bone dissolved in liquor ... if it had a label proclaiming it as 'tiger bone wine', the Customs official could immediately take action. Depending upon which nation he or she served, the Customs authority might be obliged to turn to a forensic laboratory and ask its personnel to determine whether the liquid did, indeed, have tiger-based ingredients. In other countries, the legislation places the 'burden of proof' on the traveller; in other words, to avoid punishment, he or she would have to satisfy a court that the liquid

contained nothing originating from one of the world's most endangered and CITES Appendix I-listed species.

## Why is this relevant to a forensic scientist?

Any experienced investigator, forensic specialist or prosecutor knows that a competent defence lawyer will invariably seek out weaknesses in a prosecution case. One area that will always be critically examined is the chain of custody, i.e. how evidence and exhibits have been handled, processed and recorded, so that judicial requirements have been complied with, ensuring that they will be 'admissible'. It is here, long before any laboratory examination begins, that mistakes can occur.

Many forensic facilities conduct examinations on behalf of neighbouring countries or to assist investigators located perhaps thousands of miles away.

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This will involve the cross-border transportation of 'specimens'. It is vital that such movements comply with national legislation to implement CITES if they involve specimens of species covered by the Convention. Deciding just when this is the case is the very root of this article.

For instance, if an investigator in country A has seized what he believes is a rhinoceros horn, but country A does not have the appropriate forensic capability to determine this, it may be decided to send the suspicious item to a facility in country B. In the accompanying request, the investigator has options with regard to how he frames the request for assistance. For example, he might ask, "What is this?" Alternatively, the question posed might be, "Is this a rhinoceros horn?" It should, by this stage, be obvious to readers that, if the second question is posed, the provisions of CITES immediately take effect. This means that an import permit will need to be issued by country B followed by an export permit by country A. (Please note the order in which the CITES documents require to be issued – many people do not appreciate that what might seem an illogical sequence is what the Convention dictates.)

It may be tempting to opt for the first question in order to simplify matters and circumvent CITES. However, a defence agent is likely to leap upon such unscrupulous or questionable behaviour if the object being transported across borders has the physical appearance of a rhino horn. Few forensic scientists,



Tiger bone plasters. Photo by Laurel Neme.

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# CITES and Forensics

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though, see their role as engaging in a guessing game, where they are given no clues as to where to begin their work nor guidance as to what they are expected to look for or confirm the presence of. Consequently, the first question is unlikely to be popular with them either; regardless of any legal implications.

Leaving aside items that even a layman might guess to be a tiger skin, elephant tusk or rhino horn, there will, undoubtedly, be occasions when investigators may truly have very little notion as to what is before them. For example, officers may have seized smoked meat and wish to determine whether it comes from a CITES-listed animal. How should the investigator proceed in these circumstances? If he or she does decide to apply for CITES permits, the person responsible for issuing them faces difficulties too. After all, it would not be unreasonable to complete the document with wording such as “Suspected rhinoceros horn” or “Believed-to-be elephant ivory shavings”. But it would be most unusual, and also unacceptable, to issue a CITES export permit that described the specimen as simply ‘meat’.

If nothing else, this shows the need for investigators and forensic specialists to discuss cases prior to any despatch of evidence for examination. It goes without saying, of course, that if something were truly unidentifiable and were dispatched for examination without CITES documents, but was subsequently identified as being a part or derivative of a CITES-listed species, the necessary re-export



Rhino horn ointment, tea balls, and rhino horn. Photo by Laurel Neme

certificate would have to be obtained before it were returned to the country that had sought assistance. And it would be important for that certificate to record why no ‘original’ export or import permit could be referenced.

This may seem a legalistic nightmare, but it is just the type of scenario that a defence agent may seek to exploit.

## Is nothing simple?

Fortunately, the Parties to CITES have recognized that the transfer of specimens for forensic purposes can be complex. They have also acknowledged that the issuance of CITES permits and certificates, for a variety of reasons, can be a lengthy process in many countries. But delays can have a

very detrimental impact upon investigations and prosecutions, for example where there may be ‘statute of limitations’ implications or in cases when samples and specimens may degrade or decompose.

The CITES Resolution on ‘Permits and certificates’, Resolution Conf. 12.3 (Rev. CoP16) - <https://cites.org/eng/res/12/12-03R16.php> - in Section XII, provides the possibility for Parties to apply a simplified process that specifically relates to movements for judicial, law enforcement and identification purposes. Not all countries have put this process in place. Laboratories and other relevant facilities should apply to their national CITES Management Authority to see

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## CITES and Forensics

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Tiger bear rug. Photo courtesy of US Fish and Wildlife Service.

whether they can benefit from this process and be formally registered.

Once registered, laboratories will be issued with a stock of partially-completed, pre-authorized permit/certificate documents, which they are then entitled to complete and use for transportation of specimens. It is understood that some laboratories may, currently, be using an exemption that is provided in Article VII, paragraph 6, of the Convention. This exemption, however, relates only to labelled herbarium and museum specimens and live plant material. It does not apply to forensic-related exchanges.

In conclusion, it would be most unfortunate if a forensic facility,

seeking to assist in the enforcement of CITES, were to mistakenly violate the Convention. It is hoped that this very simple guidance will help highlight some of the potential pitfalls and point forensic specialists along the right path, including where to find support in accessing a simplified process.

*Authors: John M. Sellar, Anti-Smuggling, Fraud and Organized Crime Advisor, and Jonathan Barzdo, Consultant on CITES and wildlife trade*

## SWFS Certification Program Applications for next round due July 31

In 2013 the Scientific Working Group for Wildlife Forensic Science (SWGWILD) created a general certification program for the Society for Wildlife Forensic Sciences (SWFS). The general scheme is for the certification of forensic practitioners working on any evidence of non-human biological origin, including wildlife, domestic animals and plants. Wildlife Forensic Scientist Certification is meant to encompass all non-human biological materials. This certification program was crafted to ensure that those who practice wildlife forensics are well-qualified for their individual scope of work. Becoming certified will demonstrate and document your expertise to the court, your

employer, and the public, and represents an investment in your future as a wildlife forensic scientist. Applications for this round of certification are due by July 31, 2016.

To apply, create an applicant user profile that will give you secure access to the SWFS certification site. When all application materials have been uploaded, you may submit the application upon payment of the Application Fee (US\$250). For first-time applicants, the US\$250 application fee includes your proficiency test fee for either the Mammal or Fish Genetics Proficiency Test, if enrolled in the SWFS Proficiency Testing Program. If applications are incomplete, the application fee will be refunded less a US\$50 processing fee.

Criteria include: Annual proficiency testing; a minimum of a B.S degree (or equivalent) in any related field such as biology, chemistry, environmental science or forensic science; one year of casework experience; an evaluation of casework by an assessor, agreement to follow the SWFS Code of Ethics and Standards and Guidelines; and a letter of reference from your supervisor or a professional familiar with your experience.

Please go to: <http://www.wildlifeforensicscience.org/become-certified> for more information. If you have any questions please contact Kim Frazier, The Certification Body Chair, at [kim.frazier@wyo.gov](mailto:kim.frazier@wyo.gov).

# Outwitting Poachers with Artificial Intelligence

## NSF-Funded Researchers Apply Computer Science and Game Theory to Protect Earth's Endangered Animals and Forests

*National Science Foundation*

*This article first appeared on April 22, 2016. Reprinted with permission.*

A century ago, more than 60,000 tigers roamed the wild. Today, the worldwide estimate has dwindled to around 3,200.

Poaching is one of the main drivers of this precipitous drop. Whether killed for skins, medicine or trophy hunting, humans have pushed tigers to near-extinction. The same applies to other large animal species like elephants and rhinoceros that play unique and crucial roles in the ecosystems where they live.

Human patrols serve as the most direct form of protection of endangered animals, especially in large national parks. However, protection agencies have limited resources for patrols.

With support from the National Science Foundation (NSF) and the Army Research Office, researchers are using artificial intelligence (AI) and game theory to solve poaching, illegal logging and other problems worldwide, in collaboration with researchers and conservationists in the U.S., Singapore, Netherlands and Malaysia.

"In most parks, ranger patrols are poorly planned, reactive rather than pro-active, and habitual," according to Fei Fang, a Ph.D. candidate in the computer science department at the University of Southern California (USC).

Fang is part of an NSF-funded team at USC led by Milind



A group of patrollers follows routes suggested by PAWS (Protection Assistant for Wildlife Security) in a protected area in Malaysia. (The photo is taken by a team leader from Rimba.)

Tambe, professor of computer science and industrial and systems engineering and director of the Teamcore Research Group on Agents and Multiagent Systems. Their research builds on the idea of "green security games" -- the application of game theory to wildlife protection.

Game theory uses mathematical and computer models of conflict and cooperation between rational decision-makers to predict the behavior of adversaries and plan optimal approaches for containment. The Coast Guard and Transportation Security Administration have used similar methods developed by Tambe and others to protect

airports and waterways.

"This research is a step in demonstrating that AI can have a really significant positive impact on society and allow us to assist humanity in solving some of the major challenges we face," Tambe said.

### **PAWS puts the claws in anti-poaching**

The team presented papers describing how they use their methods to improve the success of human patrols around the world at the AAAI Conference on Artificial Intelligence in February.

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# Outwitting Poachers with Artificial Intelligence

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The researchers first created an AI-driven application called PAWS (Protection Assistant for Wildlife Security) in 2013 and tested the application in Uganda and Malaysia in 2014. Pilot implementations of PAWS revealed some limitations, but also led to significant improvements.

PAWS uses data on past patrols and evidence of poaching. As it receives more data, the system “learns” and improves its patrol planning. Already, the system has led to more observations of poacher activities per kilometer.

Its key technical advance lies in its ability to incorporate complex terrain information, including the topography of protected areas. That results in practical patrol routes that minimize

elevation changes, saving time and energy. Moreover, the system can also take into account the natural transit paths that have the most animal traffic – and thus the most poaching – creating a “street map” for patrols.

“We need to provide actual patrol routes that can be practically followed,” Fang said. “These routes need to go back to a base camp and the patrols can’t be too long. We list all possible patrol routes and then determine which is most effective.”

The application also randomizes patrols to avoid falling into predictable patterns.

“If the poachers observe that patrols go to some areas more often than others, then the poachers place their snares elsewhere,” Fang said.

Since 2015, two non-governmental organizations, Panthera and Rimbac, have used PAWS to protect forests in Malaysia. The research won the Innovative Applications of Artificial Intelligence award for deployed application, as one of the best AI applications with measurable benefits.

The team recently combined PAWS with a new tool called CAPTURE (Comprehensive Anti-Poaching Tool with Temporal and Observation Uncertainty Reasoning) that predicts

attacking probability even more accurately.

In addition to helping patrols find poachers, the tools may assist them with intercepting trafficked wildlife products and other high-risk cargo, adding another layer to wildlife protection.

The researchers are in conversations with wildlife authorities in Uganda to deploy the system later this year. They will present their findings at the 15th International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2016) in May.

“There is an urgent need to protect the natural resources and wildlife on our beautiful planet, and we computer scientists can help in various ways,” Fang said. “Our work on PAWS addresses one facet of the problem, improving the efficiency of patrols to combat poaching.”

## AI to prevent illegal logging

While Fang and her colleagues work to develop effective anti-poaching patrol planning systems, other members of the USC team are developing complementary methods to prevent illegal logging, a major economic and environmental problem for many developing countries.

The World Wildlife Fund estimates trade in illegally harvested timber to be worth



Researchers from the University of Southern California and the Nanyang Technological University collect information for the design of PAWS in a protected area for a trial patrol. Photo courtesy of Rob Pickles, Panthera

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# Outwitting Poachers with Artificial Intelligence

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between \$30 billion and \$100 billion annually. The practice also threatens ancient forests and critical habitats for wildlife.

Researchers at USC, the University of at Texas El Paso and Michigan State University recently partnered with the non-profit organization Alliance Vohary Gasy to limit the illegal logging of rosewood and ebony trees in Madagascar, which has caused a loss of forest cover on the island nation.

Forest protection agencies also face limited budgets and must cover large areas, making sound investments in security resources critical.

The research team worked to determine the balance of security resources in which Madagascar should invest to maximize

protection, and to figure out how to best deploy those resources.

Past work in game theory-based security typically involved specified teams -- the security workers assigned to airport checkpoints, for example, or the air marshals deployed on flight tours. Finding optimal security solutions for those scenarios is difficult; a solution involving an open-ended team had not previously been feasible.

To solve this problem, the researchers developed a new method called SORT (Simultaneous Optimization of Resource Teams) that they have been experimentally validating using real data from Madagascar.

The research team created maps of the national parks, modeled the costs of all possible security

resources using local salaries and budgets, and computed the best combination of resources given these conditions.

"We compared the value of using an optimal team determined by our algorithm versus a randomly chosen team and the algorithm did significantly better," said Sara Mc Carthy, a Ph.D. student in computer science at USC.

The algorithm is simple and fast, and can be generalized to other national parks with different characteristics.

The team is working to deploy it in Madagascar in association with the Alliance Vohary Gasy.

"I am very proud of what my PhD students Fei Fang and Sara Mc Carthy have accomplished in this research on AI for wildlife security and forest protection," said Tambe, the team lead. "Interdisciplinary collaboration with practitioners in the field was key in this research and allowed us to improve our research in artificial intelligence."

Moreover, the project shows other computer science researchers the potential impact of applying their research to the world's problems.

"This work is not only important because of the direct beneficial impact that it has on the environment, protecting wildlife and forests, but on the way that it can inspire other to dedicate their efforts into making the world a better place," Mc Carthy said.



Artificial Intelligence may help reduce logging of illegal rosewood stockpiles in Antalaha, Madagascar.

# Recent Publications in Wildlife Forensics

In this section we will provide a list of recent wildlife forensic publications pulled from web of science. This list covers the period from November 2015 to May 2016. We aren't commenting on their quality or advocating their application, hopefully you will have your own opinions on this. If you know we've missed something, particularly one of your papers (!), please let us know and we'll include it in the next edition.

*Detection of mislabelled seafood products in Malaysia by DNA barcoding: Improving transparency in food market.* Chin et al. FOOD CONTROL, vol. 64, pages 247-256

*SkydancerPlex: A novel STR multiplex validated for forensic use in the hen harrier (Circus cyaneus).* Van Hoppe, Moniek J. C.; Dy, Mary A. V.; van den Einden, Marion; Iyengar, Arati. FORENSIC SCIENCE INTERNATIONAL-GENETICS. Volume 22, Pages: 100-109; published May 2016.

*Accurate continuous geographic assignment from low- to high-density SNP data.* Guillot, Gilles; Jonsson, Hakon; Hinge, Antoine; Manchih, Nabil; Orlando, Ludovic. BIOINFORMATICS. Volume 32, Issue 7, pages: 1106-1108; published April 1, 2016

*Oxygen isotope composition of North American bobcat (Lynx rufus) and puma (Puma concolor) bone phosphate: implications for provenance and climate reconstruction.* Pietsch, Stephanie J. and Tutken, Thomas. ISOTOPES IN ENVIRONMENTAL AND HEALTH STUDIES. Volume 52, Issue 1-2, Special Issue, pages 164-184, published March 3, 2016.

*Species Identification Of Golden And Bald Eagle Talons Using Morphometrics.* Appleton, Avery J.; O'Brien, R. Christopher; Trail, Pepper W.. JOURNAL OF RAPTOR RESEARCH. Volume 50, Issue 1, pages: 76-83, published March 2016.

*Role of DNA barcoding in marine biodiversity assessment and conservation: An update.* Trivedi, Subrata; Aloufi, Abdulhadi A.; Ansari, Abid A.; Ghosh, Sankar K.. SAUDI JOURNAL OF BIOLOGICAL SCIENCES. Volume 23, Issue 2, pages: 161-171, published March 2016.

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