



The newsletter of the Society for Wildlife Forensic Science

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SWFS NEWS

Inside this edition: SWFS June 2017 Meeting • Conservation Dogs • SWFS TWG

Canada's New Approach for Tracking Polar Bear Hides in Trade

*by Joy Bruno, Wildlife Forensic Supervisor, Pacific and Yukon Laboratory
for Environmental Testing and Katherine Bemben, Program Development &
Partnership Coordinator, Environment and Climate Change Canada*

Polar Bears are harvested in Canada as part of the subsistence way of life of Northern Indigenous Peoples, including Inuit and First Nations. Polar bears are often hunted for food and clothing, and polar bear hides are sold and traded internationally. Hides that enter trade are handled by many individuals from harvester to end consumer. Trade in polar bear hides is highly regulated, as polar bears are listed as species of Special Concern under the federal Species at Risk Act (SARA), and their import and export is regulated through the Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act (WAPPRIITA), which is domestic legislation that implements the Convention on International Trade in

Endangered Species of Wild Fauna and Flora (CITES). Additional domestic and international agreements, such as the National Polar Bear Conservation Strategy for Canada, and the international 1973 Agreement on the Conservation of Polar Bears and Circumpolar Action Plan (CAP), by the polar bear range states, highlight threats and mitigation measures for polar bear conservation.

As part of Canada's efforts to further enhance the tracking of polar bear hides in trade, Environment and Climate Change Canada (ECCC) officials are collaborating with relevant provinces, territories, and Indigenous communities to pilot a new approach.

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Welcome from the SWFS President

Dear SWFS Members

Welcome to the January 2017 issue of SWFS News, I hope those of you who had a break over the New Year took time to relax and re-charge.

This year is already looking like a busy one, dominated for some of us by the organization of the SWFS Edinburgh 2017 meeting this June, something I am excited and daunted by in equal measure. It looks set to be a great event, with our broadest international attendance yet. At time of writing, as the early bird registration closes, we have already passed the 100 delegate mark. The inclusion of the one-day International Symposium, bringing together a diverse range of wildlife forensic stakeholders (not just scientists), should offer some stimulating perspectives on how our discipline is progressing. Please get your abstracts in by February 28th.

Aside from looking at what's on the horizon, the purpose of SWFS News is to review the past six months activities and give our members some broader background to the people and places involved in wildlife forensics around the world. So, in this edition readers have the chance to learn about forensics 'down under' in Australia, with profiles of both the people and regional networks, while towards the north pole we can read about the fascinating multi-disciplinary approach taken by Canada to monitor the polar bear trade.

For some reason the stars aligned on the international wildlife law enforcement conference bandwagon in the second half of 2016, meaning that some of us spent a lot of time in airports and self-similar meeting rooms. Not everyone's cup of tea and a long way from the lab, but the Society has received a lot of international coverage in the past six months that I believe has placed us in a leading role for advising on wildlife forensics globally over the coming years.

I was lucky enough to attend one SWFS meeting this autumn where I had relatively little responsibility – so much more pleasant! The first meeting of the SWFS Technical Working Group hosted by NOAA in Charleston in September saw Lucy Webster (SASA, UK) take the chair and lead the planning and implementation of a wide range of activities previously undertaken by SWGWILD. You can read more about Lucy's take on this event and the aims of the TWG on page 4.

Finally, thanks as ever to all of the contributors and the SWFS news production team for creating another great newsletter. See you in Edinburgh!

Regards

Rob Ogden



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Letter from SWFS Director of Communications

HELLO! DOES EVERYONE KNOW THERE IS A MEETING OF THE SOCIETY FOR WILDLIFE FORENSIC SCIENCE COMING UP???


Yes I am yelling this. Sorry if I was too loud. We really need to keep getting the word out to everyone about our meeting. This is going to be HUGE! All joking aside, we would like as many people as possible to have the opportunity to come and hear the latest news, technology and collaborate on issues in the field of wildlife forensic science. I don't want to hear someone in July tell me that they would have loved to have come but did not know anything about it. I am asking all of you to help get the word out. If you have been - **THANK YOU**—if you have not done so yet - **GET MOVING!**. The board is working exceedingly hard on all aspects of this meeting to make it as informative and fun as it can be. We certainly have started off right with the venue. How can you go wrong with Edinburgh, Scotland! If anyone has questions you cannot answer direct them to the web site, <http://www.wildlifeforensicscience.org/2017-meeting/>.

If they cannot find what they need have them send an e-mail to swfs2017@wildlifeforensicscience.org and we can help them with the information they are looking for.

As always, this issue of the newsletter has been a collaboration among many members of the field of Wildlife Forensics. I hope you will find lots of interesting information within the pages. I know you will learn just what goes on in the mind of a wildlife forensic scientist by reading Rebecca Johnson's spotlight article. If you know anyone interested in joining the field, have them read her insights first. Thank you Rebecca for sharing this with us.

As always we are looking for articles to include in our next newsletter. Please submit items to any board member but your first point of contact should be me, Brandt Cassidy at bcassidy@dnasolutionsusa.com. I am looking forward to seeing everyone in Edinburgh this summer and as always, Keep It Wild!

– Brandt Cassidy, Ph.D.

 SOCIETY FOR WILDLIFE FORENSIC SCIENCE

International Wildlife Forensic Science Meeting

University of Edinburgh, Scotland, June 2017

One-Week Scientific Meeting, 5-9th June
4th SWFS meeting on Wildlife Forensic Science

- Invited speakers
- Training workshops
- Expert discussions
- Presentations & Posters
- Networking
- Banquet & dance
- Excursions
- Stunning location

Join us for a fantastic week in Edinburgh to share the latest developments in wildlife forensics

One-Day International Symposium, 7th June
Integrating Policy, Enforcement and Forensic Science for tackling illegal trade

- Plenary speakers
- Panel discussions
- Knowledge exchange
- Full-day programme & evening reception
- Dedicated sessions:
 - Wildlife trade
 - Fisheries
 - Timber
 - National wildlife crime

- For further information visit: www.wildlifeforensicscience.org/2017-meeting
- Registration opens September 2016, student and early bird discounts available

Email: swfs2017@wildlifeforensicscience.org

SWFS Technical Working Group

Inaugural meeting, Charleston, South Carolina

by Lucy Webster (Chair of TWG)

The materials produced by SWGWILD have been of enormous benefit to SWFS members but the SWG system in the USA is being substantially revised and, as a result of this, SWGWILD will no longer exist. In order to provide technical support at an international level, the SWFS Technical Working Group (TWG) was formed and held its first meeting at the NOAA Marine Forensics facility in Charleston, South Carolina in September 2016.

The purpose of the SWFS TWG is “to support and promote the application and advancement of wildlife forensic science through the development and dissemination of consensus-based standards, guidelines, best practices, and recommendations.”

The SWFS TWG consists of a core membership with representatives from the USA, Malaysia, UK and Australia with a collective experience in DNA analysis, chemical analysis and morphology in wildlife forensic casework. In addition to this core membership, associate members will be temporarily co-opted into the TWG in order to assist with specific packages of work.

In Charleston, a set of objectives for the TWG were agreed and discussed, firstly to identify existing resources, and then also to identify gaps in knowledge. At this point it became clear that we needed to focus on a subset of our objectives so

that we didn't overwhelm ourselves with actions!

The four objectives we worked on in detail related to 1) the development of audit criteria, 2) technical resources, 3) standard practices and 4) training needs. Discussion on these four objectives led to the development of initial packages of work for the TWG which will develop resources for the benefit of SWFS members.

In relation to auditing, where SWFS member labs are not accredited to an international standard (e.g. ISO: 17025), how can they demonstrate that they

work to agreed standards? A voluntary external audit could give labs confidence that their processes meet the standards required, and also potentially identify areas for improvement, as required in any quality system. It was agreed that the SWFS standards and guidelines (S&G) should form the basis of any audit as these are the minimum standards that practicing SWFS members should follow. While an international audit scheme is not yet available, work towards this objective will put the tools in place for such a scheme to be implemented.

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TWG members and associates after a successful meeting; back row: Jeffrine Rovie Ryan Japning (Dept Wildlife National Parks, Malaysia), Kathy Moore (NOAA Marine Forensics, USA), Pepper Trail (USFWS NFL, Ashland, USA), Lucy Webster (SASA, UK), Ed Espinoza (USFWS NFL, Ashland, USA), Piper Schwenke (NOAA Marine Forensics, USA), Rob Ogden (TRACE, UK), Kim Frazier (Wyoming Game and Fish, USA), front row: Trek Knott (NOAA Marine Forensics, USA), Mary Burnham Curtis (USFWS NFL, Ashland, USA).

SWFS Technical Working Group

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Two levels of possible audit were proposed. Initially, an institutional evaluation should be carried out, forming a needs assessment of the institution in relation to infrastructure, quality management and personnel development. This could be followed up by a technical audit using the S&G as a framework.

Technical resources, specifically in relation to DNA reference material, were discussed in detail. In the first instance, existing reference DNA sequences among SWFS members could be used as a shared resource to help with species identification. Following from this, a project to sequence the mitochondrial genome for a number of highly traded species for use amongst the SWFS

community would provide a more flexible resource, given the variety of

However, to ensure we prioritise our work appropriately, we decided to survey SWFS members to identify their priorities. This survey will be distributed to members in early 2017.

different methods used for species identification. How these resources could be developed and shared with

members forms a package of work.

The discussions around standard practices and training needs identified a plethora of potential packages of work which the TWG could develop. However, to ensure we prioritise our work appropriately, we decided to survey SWFS members to identify their priorities. This survey will be distributed to members in early 2017.

It was a busy couple of days! There is clearly a lot of work that the TWG could do to support members and advance consensus-based standards in wildlife forensic science. The enthusiasm of the group will undoubtedly drive it forward to create work products that will be of substantial benefit to SWFS members.

Pepper Trail (National Fish and Wildlife Forensics Laboratory) Featured in Audubon Magazine Winter 2016 Article

Pepper Trail was featured in an article in *Audubon Magazine's* Winter 2016 edition. *Behind the Scenes With the World's Top Feather Detective* offers a glimpse into the world of forensic ornithology.

To see the full article, go to <http://www.audubon.org/magazine/winter-2016/behind-scenes-worlds-top-feather-detective>.

Pepper Trail in his lab at the National Fish and Wildlife Forensics Laboratory in Ashland, Oregon. Photo by Tom Fowlks.



Together Informing Justice: The 23rd Symposium of the Forensic Sciences, September 2016

by Greta Frankham

In September 2016 over 800 forensic scientists from 33 countries from around the globe descended on Auckland, New Zealand for the Australian and New Zealand Forensic Science Society's (ANZFSS) 23rd International Symposium on the Forensic Sciences. A week of workshops, plenary speakers, a multidisciplinary scientific program encompassing every form of forensic science imaginable, poster sessions, student talks and of course the all-important social events. ANZFSS is famous for its themed night (this year theme was aviation/flight) as well as its gala dinner to end the conference.

Wildlife forensic science is still a comparatively small discipline in amongst the well-established traditional forensic science fields that dominate the programme at conferences such as this. Wildlife forensic science presentations were mixed in with those presenting on environmental forensics that assist human victim crime throughout the week. However, the ever increasing presence of SWFS members and other academic and enforcement colleagues at ANZFSS continue to build the profile of wildlife forensic science as its own field which is deserving of its own symposium session at future meetings. The 2016 programme included presentations in the Botany, Science and Justice and of course Wildlife/Fisheries and Entomology sessions across the week. The week started with an exciting update on the first prosecution in the USA for illegal

interstate trade of wood products under the Lacey Act aided by the development of big leaf maple genetic markers. The high quality of science continued through the week with presenters introducing innovative electronic monitoring solutions for fisheries compliance; new developments in chemical odour profiling for endangered species and new tests to validate paternity/provenance in pythons and echidnas (an Australian egg laying mammal species that looks a bit like a hedgehog). I also provided an update on collaborative efforts to develop standardised methods for rhino horn forensics.

During the 2016 ANZFSS meeting, SWFS member Professor Adrian Linacre was elected to the role of Executive President of ANZFSS, and during 2016, SWFS board member Dr Rebecca Johnson took on the role of New South Wales Branch President ensuring that wildlife forensic science will continue to grow its profile within this ANZFSS community.

ANZFSS offers more than just wildlife and botany sessions to entice SWFS members. Sessions dedicated to Management & Quality Assurance, Education and Training, Isotope Analysis, Science and Justice and Biological Research should be of general interest many of those working in the field, both practitioners and academics alike. I encourage everyone to think about attending the ANZFSS 24th International Symposium 'Forensic Science Without Borders' in Perth, Australia in 2018 to

continue to promote and highlight wildlife forensic science at these cross-disciplinary forensic science meetings.

ANZFSS 2016 AWARD WINNERS:

Botany:

Best oral presentation:

Kirstie Scott, University College London: *Examining the temporal variation of diatoms as trace evidence indicators: implications for forensic ecology?*

Highly Commended Oral Presentation:

Duncan Jardine, University of Adelaide: *Genetic assignment testing on tree species*

Wildlife/ Fisheries and Entomology :

Best oral presentation:

Natalie Gasz, Deakin University: *The effect of humidity on blowfly growth rates, and the impact on post mortem interval calculations*

Highly Commended Oral Presentation:

Greta Frankham, Australian Museum Research Institute: *Together informing progress: regional capacity building to improve frontline wildlife forensics*

Canada's New Approach

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The "3-Pronged Approach"

In most jurisdictions, polar bear hides are tracked using metal, plastic or paper harvest tags labeled with an identification number. The "3-Pronged Approach", which capitalizes on existing and emerging technologies by combining DNA analysis, Stable Isotope analysis (SIA), and PIT (Passive Integrated Transponder) tagging – encrypted microchips embedded in the hide, complements the identification tags and contributes to the tracking of hides from harvest to export. This pilot initiative was developed by ECCC's Canadian Wildlife Service, Science and Technology Branch, and Enforcement Branch.

Under this new approach, when a polar bear is harvested and brought to a local conservation officer (or similar authority), PIT tags are inserted into the hide and biological samples are collected for DNA analysis and SIA. Using all three prongs together facilitates polar bear identification and the monitoring and verification of hides once they enter trade.

When a hide is destined for export, the PIT tags provide a quick and easy way to identify the hide by enforcement officials. If no PIT tag is detected, DNA and/or Stable Isotope analyses can be used next to identify the hide. The DNA analysis allows individual bears to be identified by comparing the DNA from a bear hide in transit to a sample that was previously collected at the time of harvest or during field research. Stable Isotope analysis provides information on the geographical provenance of the bear. The DNA and Stable Isotope



Rachel Miliano and Joy Bruno from ECCC's Pacific Science Centre DNA lab, with "Harvey" the polar bear and DNA/SIA sampling kits. Photo © Environment & Climate Change Canada

data supplements other information collected by researchers on polar bear subpopulations for conservation purposes.

Developing the methodology: DNA fingerprint method and Stable Isotope analysis

ECCC's toxicology laboratory at the Pacific Environmental Science Centre in North Vancouver is well-positioned to conduct the DNA work by using existing infrastructure (molecular instrumentation and clean rooms for DNA/PCR analysis) and staff trained in molecular/DNA analytical methods. Laboratory staff have been conducting genomic analyses since 1999, and started accepting samples for DNA species identification in 2013.

In May of 2015, the toxicology laboratory became the hub for DNA forensic analysis for the Wildlife Enforcement Directorate

of ECCC's Enforcement Branch, supplying wildlife officers with DNA sampling kits and instruction products for DNA species identification. During the latter part of 2015, the ISO17025-accredited species identification lab was asked to assist in the development of a training manual and accompanying kits for the Polar Bear 3-Pronged Approach.

To develop the pioneering DNA fingerprint method for polar bears as part of the 3-Pronged Approach, we solicited help from colleagues at the Society for Wildlife Forensic Science (SWFS), including Rick Jobin, Alberta Fish and Wildlife Forensic Unit; Vicky Albert, provincial Government of Quebec; Mary Burnham-Curtis, U.S. National Fish and Wildlife Forensics Laboratory (NFWFL); and from experts in the polar bear field, including Corey Davis, Fragment Support Analyst at the

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Canada's New Approach

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Dr. Geoff Koehler and technician Chantel Gryba in ECCC's National Hydrology Research Centre stable isotope lab. Photo © Environment & Climate Change Canada

University of Alberta, and Evan Richardson, Polar Bear Research Scientist at ECCC. We also obtained archived polar bear tissue and corresponding genotypes from Corey and Evan. The next step is to extract DNA from the tissues, amplify the chosen microsatellites by PCR and sequence the amplicons using our Next Generation Sequencer (NGS). Genotype information obtained from the NGS pipeline will be compared with the genotypes obtained using capillary electrophoresis sequencing for validation of the approach.

Until recently, NGS technology has not been widely used to sequence microsatellites (also known as single tandem repeats (STRs)) and certainly not for STRs found in wildlife species. There are a handful of examples of this technology being

employed for STR analysis and they have all been human CODIS (Combined DNA Index System) loci, which are easier to analyze, given that the human genome has been fully annotated. Commercial kits are readily available for the determination of human STRs and all CODIS STRs are tetrameric (repeats of 4 base pairs), while wildlife STRs are typically dimeric (repeats of 2 base pairs). In order to identify and characterize the sequenced STRs, they must be aligned to reference sequences. Given that many wildlife species, including polar bear, are not fully annotated, it is more challenging to characterize the STRs. Traditional CE-based methods of STR detection reveal only the length of alleles, but the increased resolution that NGS offers allows for both length determination as well as the identification of nucleotide variations within the

repeat regions (SNPs – single nucleotide polymorphisms), which is far more discriminating.

The Stable Isotope analysis, led by Dr. Geoff Koehler, stable isotope chemist at ECCC's National Hydrology Research Centre (NHRC) lab in Saskatoon, Saskatchewan, which will complement the DNA analysis and PIT tagging, utilizes stable isotope ratios ($^{13}\text{C}/^{12}\text{C}$, $^{15}\text{N}/^{14}\text{N}$, $^{34}\text{S}/^{32}\text{S}$ and $2\text{H}/\text{H}$) that are specific to given geographical locations and can aid in determining the geographical source of the polar bear. This strategy is based on the fact that all living organisms possess stable isotopic signatures that reflect the trophic position and geographical location in which a particular species resides. Incorporation of trace elements from the environment can be used once elemental profiles have been established. The SIA and DNA methods require creating databases for isotopic/elemental maps and genetic markers, respectively.



Training of Nunavut Government conservation officers on the 3-Pronged Approach, in Iqaluit, Nunavut. Photo © Environment & Climate Change Canada

SPOTLIGHT ON REBECCA JOHNSON

What is a brief overview of your work?

In April 2015, I was appointed Director of the Australian Museum Research Institute, Science and Learning Division--the first time a woman has held this position. I oversee about 120 staff from a range of research and collections, including the Australian Museum's Lizard Island Research Station on the Great Barrier Reef, and direct the education programs, such as the Australian Museum Science Festival, Australian Centre for Citizen Science, and museum outreach programs. I also continue my research through the Australian Centre for Wildlife Genomics, which is one of the only ISO17025 accredited wildlife forensic facilities in the country.

How did you first get involved with Wildlife Forensics?

Not long after I arrived at the Australian Museum (in 2003), we were approached by the NSW Police and NSW RSPCA to provide expert identification and evidence on an animal cruelty case involving the mass killing of sulphur crested cockatoos using a motor vehicle. Our evidence was fairly crucial in showing the suspect was at the scene and resulted in a change of plea (to guilty).

It was rewarding to combine molecular genetics techniques

with the museum's extensive wildlife reference collections for such a tangible outcome. I pursued this WF focus thanks to the support of the museum (and hard work and tenacity), so that now, over a decade later, we have an international reputation, an ISO17025 accredited lab, a great lab team, fantastic students, and a steady and diverse case load involving WF work for enforcement, the airline industry and a range of government and non-government clients.

What did you do before you began your current position?

I've been with the Australian Museum since 2003, first as manager of the DNA laboratory and later Head of Research and Head of the Australian Centre for Wildlife Genomics. Prior to that, I was a postdoctoral researcher at Tufts University in Boston working for a wonderful Professor, Phil Starks, on honeybees and invasive wasps.

What do you find most challenging about Wildlife Forensics?

Australia's unique fauna presents interesting challenges, as many species and populations are unique (87% of our mammal species are endangered!). That makes some



of the questions a little more diverse than you may encounter in more northern continents. We hardly ever get two cases the same, which is both stimulating (because we are always learning) and challenging (new marker panels, validation and often limited resources). I also find the cruelty that can be associated with the illegal wildlife trade very confronting at times.

What would you tell someone thinking about starting out in Wildlife Forensics?

Ensure you are the best scientist you can be. Talk to WF scientists; understand the questions they are routinely called upon to answer; then do your best to learn as much as you can. The forensic (legal) side can come after you have concentrated on learning the science that underpins the application. This is best done by carefully choosing your advisor and your project. Following that I would say go for it! It's a constantly evolving field, which provides many research opportunities for excellent young scientists to make their mark.

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SPOTLIGHT ON REBECCA JOHNSON

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What do you think will change about Wildlife Forensics over the next five years?

The incredible pace of research and development in new technologies is awe inspiring. When I very first began my research career, DNA sequencing was quite a laborious process compared to now. I'm looking forward to seeing how technological advancements increase the capabilities of labs over the next five years and beyond. I think the speed at which we are able to get results and the ability to deal with miniscule samples are some of the many exciting areas for growth.

Interest in Wildlife Forensics seems to be growing. Why do you think that is?

I think the loss of so many species is spurring next generation of scientist to find novel ways to preserve wildlife populations. As technology advances, there are increasingly more sophisticated ways to study and apply Wildlife Forensics science effectively which is really appealing to both established and emerging scientists.

What motivates you to do what you do?

It can be summed up as 'wanting to make a difference'. From a young age, I knew I wanted to harness science to make a real change in the

world, and as a Wildlife Forensic Scientist I get the chance to do that every day. I find the sense of directly contributing to the conservation of the natural world, particularly, at a time when so many species are under threat, a real motivation to keep pushing forward.

Where did you grow up? Where did you go to school?

I grew up in a small, beachside suburb, Bilgola, which is on the Northern Beaches of Sydney where I also attended the local primary and high school. It is a beautiful part of the world, laid back lifestyle with extraordinary beaches.

I did my undergraduate and honours degree at the University of Sydney, where I studied under Professors Marianne Frommer and John Sved. I went on to do my PhD in Molecular Evolutionary Genetics at La Trobe University in Melbourne, and worked with eminent social insect geneticist and mentor, the late Professor Ross Crozier. I feel very fortunate to have had these learning opportunities in such dynamic laboratories and the environment I try to emulate now I hold a senior position myself.

What do you do in your free time?

I love Australian hip-hop music, particularly a South Australian outfit called the Hilltop Hoods (for the curious). I'm also a huge sports

fan and unwind by watching sports. Being Australian, I have a team for every location and season, whether it's the Boston Red Sox baseball team, or the Manly Sea Eagles rugby league team. In summer you'll usually find me either at the beach or watching a cricket match somewhere!

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

I'm looking forward to continuing our research at the AM in the field of WF and also conservation genetics more broadly through our work with koalas, cockatoos, echidnas and other iconic Australian species. Importantly, we must communicate the work of WF broadly so it has a high visibility from policy makers right through to the public.

I'm particularly looking forward to the upcoming 2017 SWFS meeting to be hosted in Edinburgh Scotland. The biannual SWFS meetings are always full of fantastic science and are lots of fun. A great opportunity to catch up on the latest science and meet new collaborators.

Western Carolina University Bears It All

by Maureen Hickman, Forensic Research Scientist, Western Carolina University

On May 10th 2016, a hiker was attacked by an American black bear (*Ursus americanus*) while sleeping in his tent near the Spence Field Backcountry Shelter along the Appalachian Trail in the Great Smoky Mountains National Park. While the hiker suffered non-life threatening injuries, National Park Service (NPS) officials wished to positively identify the attacking bear, as NPS biologists did not consider the unprovoked attack to be consistent with normal bear behavior.

NPS officials collected damaged items from the campsite and transported them to the Forensic Science laboratory at Western Carolina University, Cullowhee, NC, for DNA analysis. Samples were taken from items likely to harbor DNA. Clippings were taken from presumably chewed edges of a torn stuff sack and paperback book, and bite marks on a cellular phone and plastic bottle were swabbed with a moistened flocked swab. Evidence items were processed using trace DNA extraction methods frequently used in human-perpetrated cases. A black bear-specific STR assay previously developed by the Wildlife Forensics Laboratory in the California Department of Fish and Wildlife was used to generate DNA profiles for the evidence¹. A full DNA profile was recovered from the paperback book. Partial DNA profiles were recovered from the plastic bottle and stuff sack and were consistent with the profile recovered from the paperback book.

Following the attack, NPS officials captured three bears who independently entered the vicinity of the attack site. Each bear was



American black bear (*Ursus americanus*)

tranquilized and samples such as an ear punch or oral swab were collected. Samples were transported to Western Carolina University for processing, and a DNA profile was generated for each captured bear within 24 hours. Quick processing of reference samples allowed bears whose DNA profile did not match that of the evidence to be quickly excluded, and the search for the attacking bear could ensue.

The first bear, a large 400-pound male, entered the attack site within 48 hours of the attack. According to NPS officials, the bear was too large to fit with a radio collar and transportation to a holding facility was not feasible due to the remoteness of the capture site. Officials felt the bear fit the profile of the bear responsible for the attack including possessing dental injuries consistent with the hiker's wounds. The bear was euthanized, but later DNA analysis revealed that the euthanized bear's DNA profile did not match the profile recovered from the evidence.

The next two bears to enter the campsite were both 200-pound males and were small enough to be radio collared and released. Subsequent DNA analysis of these bears revealed that neither bear's DNA profile matched that of the bear responsible for the attack. NPS officials suspended the search for the attacking bear approximately three weeks following the attack.

Though in this instance, the offending bear was not recaptured and identified, we now have the ability to rapidly process wildlife samples using the optimized assay in future attacks. Our hope, and the hope of officials in the Great Smokey Mountains National Park, is that in the case of a future bear attack, expedited turnaround of suspect samples will allow the possibility of holding a bear while waiting for results, thereby avoiding euthanasia of uninvolved bears.

¹Meredith, EP, et al. (2009). Characterization of 29 tetranucleotide microsatellite loci in black bear (*Ursus americanus*) for use in forensic and population applications. *Conservation genetics*, 10(3), 693-696.

Conservation Dogs Help Protect Imperiled Species and Intercept the Spread of Invasive Organisms

by Megan Parker and Ngaio Richards

Now more than ever, there is a pressing need and great demand worldwide for conservation detection dogs that can be deployed in various forensic and enforcement applications.

We work with NGOs and governments in seven countries, with the main aim of uncovering and halting the unlawful movement of wildlife and plants, and thereby upholding the strides made during ongoing conservation efforts. We also incorporate ecological monitoring components (e.g., scat or dung detection) whenever it is complimentary to parallel initiatives.

In Africa, we're partnering with several organizations that provide law enforcement capacity across large regions, and use dogs to detect contraband ranging from illegally harvested lumber and bushmeat to elephant ivory, rhino horn and other wildlife parts, in addition to prohibited firearms and ammunition. Some of the dog and scout teams also have the ability to track poachers and individuals suspected of wildlife crimes. We promote, support and offer training of conservation dog teams throughout the continent via program exchanges, tailored curriculae and workshops, where best practices and current methods are demonstrated by a both local and international practitioners and experts.

In Asia, we help canine custom teams considerably refine their ability to detect the transport of



Conservation K9 Ruger searches a vehicle at a roadblock in Zambia. Adopted from a Montana (USA) shelter, he completed his training in late 2014 and has since alerted to the presence of many items that people were attempting to conceal. Ruger is blind.

illegal wildlife at border crossings, many of them remote, and where previously only the transport of narcotics were of concern. There, we are also assisting in devising conservation training protocols within the framework of protecting endangered species such as snow leopards, argali sheep and saiga antelope.

In Canada and the United States, we have joined forces with government agencies and community groups to stop the movement of highly invasive zebra and quagga mussels from one watershed to another - by a series of watercraft inspections. Entry of a single infested boat into a lake, river or stream can completely obliterate

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Conservation Dogs

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Dogs are outstanding conservation ambassadors, helping to facilitate outreach and communications that might not otherwise be as successful, or even possible.

native aquatic species and result in very costly damage to the equipment and infrastructure in those waters.

The dogs ultimately selected for this work are primarily sourced from animal shelters, where they may have been surrendered several times, since the specific set of traits harnessed for conservation detection (e.g., toy drive and high intensity, among others) make for very challenging pets. Following rigorous vetting and a series of step-wise assessments, successful candidates then go on to make an enormous and lasting contribution to conservation. It is gratifying to know that many of these dogs have escaped euthanasia or an uncertain future and all have been given a 'second chance' to do a job which they are in fact uniquely qualified to deliver. These dogs are also immensely effective conservation ambassadors, facilitating many interactions and outreach opportunities which might not have been possible without them. They are also immensely important to their handlers, and their bond and indomitable personalities helps the team remain motivated and focused upon the task at hand.



<http://wd4c.org>

NGAIO RICHARDS, PhD, Forensics & Field Specialist, Working Dogs for Conservation will be teaching two online courses for the University of Florida's Veterinary Forensics program: an intro in the summer and advanced followup in the autumn.

In essence, these courses are intended to help students recognize, anticipate and address the threats that veterinary agents and related practices may pose to wildlife and the environment.

For more information, contact Ngaio Richards, ngaio@workingdogsforconservation.org or visit the University website : <https://www.forensicscience.ufl.edu/veterinary/>

International Wildlife Forensics Round-Up

It's been a very busy six months for global conservation and forensic science meetings, and with an increasing focus on wildlife law enforcement, wildlife forensics (and SWFS) has been really in the spotlight. Here's a very quick summary of what's happened on the international conference stage.



IUCN World Conservation Congress – Honolulu, September 1st-10th, 2016

Held every four years, the IUCN WCC brings together around 10,000 delegates from over 180 countries, participating in 1,380 sessions. This huge melting pot of projects, people, policy and conservation energy included a significant focus on conservation law enforcement with multiple meetings and events aimed at tackling wildlife crime. A number of presentations by TRACE and UNODC were dedicated to wildlife forensics and its role in investigating transnational organized crime (GIZ-TRAFFIC session) and specifically its applications to the global illegal timber trade (World Bank event). While it would be easy to feel that individual messages were swamped by the sheer mass of activities at WCC, it was great to see that coinciding with the adoption of a new resolution on tackling illicit trafficking in wildlife by the United

Nations General Assembly during the meeting, the UN Secretary General's report called for, among other initiatives, the development of regional and international wildlife forensic networks.

CITES 17th Conference of the Parties (CoP17) – Johannesburg, Sep-Oct 2016

Following the IUCN WCC, international wildlife policy focus switched to the CITES CoP, held every three years. Hosted by South Africa, CoP17 was the largest ever CITES CoP meeting and once again brought together a mix of government CITES Management

and Scientific Authorities, with a large number of intergovernmental agencies and international NGOs. The Society for Wildlife Forensic Science was represented through the co-organisation of a dedicated wildlife forensics workshop. Alongside TRACE, TRAFFIC and UNODC, SWFS presented on the potential applications of forensics to CITES enforcement and described how the Society is acting to bring together and represent the international wildlife forensic community. In addition to this talk by Rob Ogden, SWFS members Dr Kanita Ouitavon (Thailand WIFOS lab) and Dr Stephanie Pietsch

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Ross McEwing, Technical Director, and Rob Ogden, Programme Director, TRACE Wildlife Forensics Network at their booth at CITES. Photo by Laurel Neme

International Wildlife Forensics Round-Up

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(TRACE) delivered excellent presentations concerning wildlife forensic traceability applications in Thailand and the development of the African Wildlife Forensics Network, respectively. The South African National Zoological Gardens forensic lab (Prof Antoinette Kotze), UNODC and TRAFFIC Wildlife TRAPS programme also gave talks on wildlife forensic applications at global, regional and national levels. The event was extremely well attended with a packed room of over 200 delegates, confirming the level of global interest in our discipline. SWFS also co-sponsored a wildlife forensics exhibition stand at CoP17 that attracted a lot of delegates keen to learn more about what wildlife forensics is and how we do it.

Several other side events at CoP17 organized by SWFS members featured wildlife forensics, including dedicated sessions on the University of Pretoria's RhODIS system (Dr. Cindy Harper's lab) and the latest developments of Prof. Sam Wasser's lab (University of Washington) researching African ivory traceability. This included the integration of existing DNA data with stable isotopes (Prof Thure Cerling, University of Utah) within a larger investigative analytical approach.



Interpol Wildlife Crime Working Group 2017 meeting – Johannesburg, Oct 2nd-4th, 2016

Coinciding with CITES CoP17, Interpol organised its annual Wildlife Crime Working Group (WCWG) meeting under its Environmental Crime Programme in early October. This meeting included a half-day session on wildlife forensics at which SWFS had the opportunity to be represented. Rob Ogden delivered a summary of the global review on wildlife forensic capacity, a project in which SWFS partnered with UNODC and CITES, and the results of which were included as part of an official document at CoP17 (Doc 25 Annex 4). Following a call for further development of this project at CITES, it is hoped that SWFS will have the chance to develop its international coordination role in this area further over the coming years.

Interpol 18th International Forensic Science Managers Symposium, Lyon, 11-13th October 2016

Every three years all national forensic science managers are invited to attend a symposium run by Interpol at the headquarters in Lyon, France. This year's meeting brought together over 140 delegates from 60 countries to discuss recent

advancements and issues across all forensic disciplines. Rob Ogden was invited to give a plenary talk about wildlife forensic science and had the opportunity to introduce SWFS and our subject area to an audience of forensic practitioners with relatively little previous knowledge of wildlife crime or the specialised forensic techniques used to investigate and prosecute offences.



Hanoi Conference on Illegal Wildlife Trade, Vietnam, November 17-18th 2016

Finally, the Hanoi IWT Conference took place in mid-November, the third in a series of IWT meetings following London, UK (2014) and Kisumu, Botswana (2015), that aim to coordinate international efforts to tackle the illegal wildlife trade. A number of discussions were held concerning wildlife forensics within the Enforcement theme and the conference ended with a Statement on IWT, in which the importance of wildlife forensics was highlighted, alongside a number of specific national declarations concerning the development of wildlife forensic capacity in Africa.

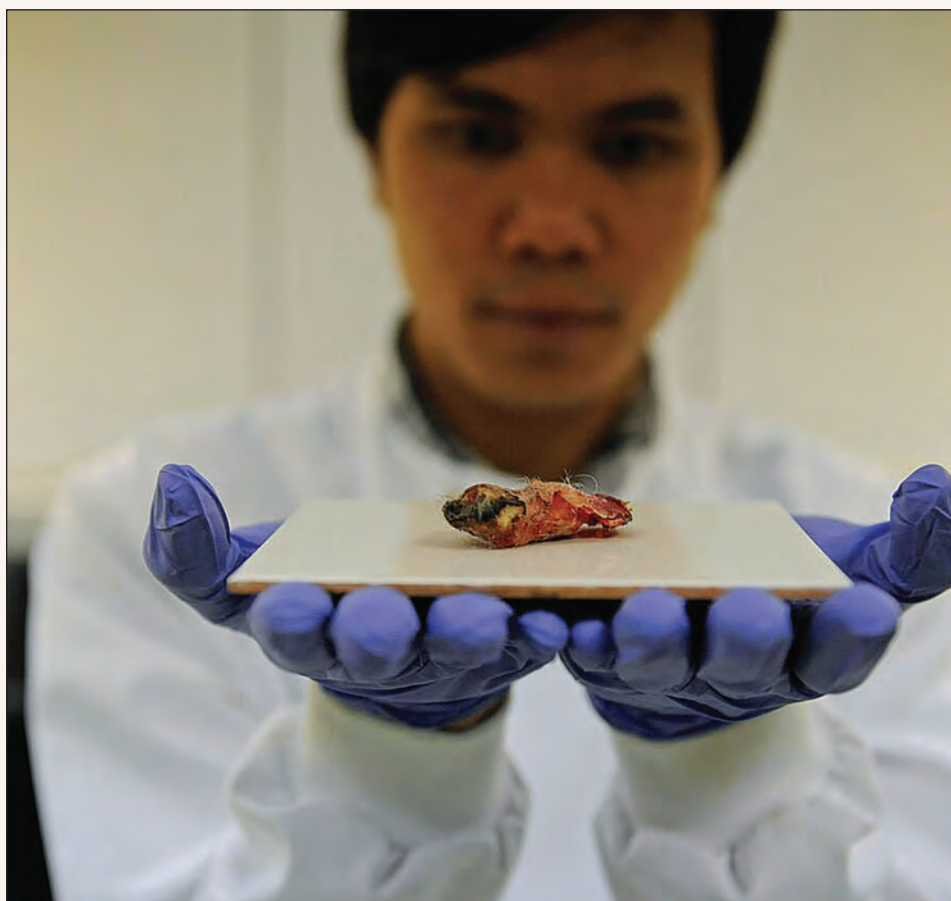
OUT OF SEQUENCE:

Is Wildlife DNA Forensics Delivering As An Illegal Trade Enforcement Tool?

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DNA analysis of wildlife is unquestionably providing valuable insights into ecology, evolution and conservation (Frankham et al., 2009) but is the technique being used effectively for international wildlife law enforcement as a wildlife forensic tool? At the seventeenth meeting of the Conference of the Parties to CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) (CoP17) dedicated wildlife forensic events and discussion featured prominently in subjects as diverse as synthetic fabrication of rhinoceros horn to monitoring the trade in timber. With all this attention on the emerging discipline of wildlife forensics—which can be subject to divergent interpretations by the international community—it is important to evaluate the current landscape and challenges when applying wildlife forensics for various purposes.

The discipline of wildlife forensics focuses on using scientific techniques to help address illegality in relation to national laws or international wildlife conventions. Although many different scientific techniques help address aspects of wildlife crime, DNA analysis is by far the most commonly used technique owing to its ability to resolve most of the important common questions; the generic accessibility of the technique through established academic or government laboratories, and the



Malaysia's National Wildlife Forensic Laboratory developing Tiger identification techniques. photo by TRACE WFN

prior legal precedent for accepting DNA evidence in courts.

“Forensics” as defined, relates solely to the application of a scientific technique to a legal case. Commonly, scientists working in the wildlife field are generally applying this discipline in three different, but not mutually exclusive areas, either directly in casework; or indirectly in traceability and intelligence gathering.

“Casework” is the use of DNA analysis to address a specific

question relating to a criminal investigation or “case”. As this area of work is supporting, or refuting, a legal matter, it therefore requires the highest degree of assurance that any DNA analysis is fit for legal purpose and that the interpretation of any result is measured and fairly presented for the benefit of the court. Similar to human DNA forensics, wildlife DNA forensic evidence can result in a criminal conviction and a loss of liberty and therefore

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Wildlife DNA Forensics

the process is not to be undertaken lightly or with pretence that wildlife crime requires less stringency in the production of data or scrutiny of those data.

Wildlife DNA forensics as a casework tool commonly goes underreported in the media as the DNA analysis tends to be a component of a larger evidence base for a wildlife prosecution, which is often lost in media reporting and typically the time period between analysis and any judgement often means the laboratories undertaking the work are themselves unsure of the outcome and too busy to self promote, despite the benefits of quantifying the use and success of

DNA testing in this field.

The most frequently used DNA test for casework addresses questions of the identification of a species when the normal morphological characters are absent. Only by first categorically identifying the species of a wildlife specimen can enforcement action based on the legal status of that species and/or its trade be initiated. As DNA analysis for protected species identification has been technically feasible for some time (e.g. Baker and Palumbi, 1996), it does not attract large amounts of research or international collaborative interest, despite a continued need for this, and when this does occur, it is often well

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intentioned but with limited utility. However, at a forensic rhinoceros DNA workshop, held in July 2016 in South Africa (TRAFFIC, 2016), where discussions were focused around testing the benefits of the individualization of rhinoceros, it was the absence of a standardized DNA species identification test for rhinoceros that was identified as the most immediate and useful casework requirement from an international perspective. Similarly, various research groups are working on methods to identify the geographical provenance of illegally traded species. Although this information is important, the most pressing enforcement tool from a casework perspective may simply be the ability to identify the species from the parts or derivatives in trade. The pangolin trade is a useful example of where the immediate casework requirement is a species DNA test to identify robustly all pangolin species from scales, something currently hampered by a lack of suitable and trustworthy reference DNA data. The rush to tackle more academically interesting research orientated projects such as pangolin geographical origin, often shows a disconnect between the immediate requirements of law enforcement and the well meaning direction of academic researchers. "Intelligence" or information-gathering from DNA testing of wildlife products is the most commonly reported area of wildlife forensics as it can produce results in a manner and timeframe suitable for enforcement action, and media attention without any issues around the sub judice of reporting casework.



Malaysia's National Wildlife Forensic Laboratory developing Tiger identification techniques. Photo by TRACE WFN

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Wildlife DNA Forensics

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Collaborating on ivory DNA identification in Thailand. Photo by DNP THAILAND

The aim is to provide information to direct enforcement investigations or inform policy in relation to illegal trade of wildlife.

The most comprehensive system for gathering information on illegal wildlife trade is the geographical provenance DNA testing of African Elephant *Loxodonta africana* ivory developed by Professor Sam Wasser at the University of Washington (Wasser et al., 2004). At the direction of CITES, ivory seizures greater than 500 kg are required to be geographically sourced (CoP16 Decision 16.83) and although other methods to establish this exist (Ziegler et al., 2012), generally sub samples from large seizures are physically transferred to the USA, and the DNA tested to identify its likely African country of origin. As DNA data for this purpose are not intended for prosecutions, the data can be interrogated in a more general way to identify trends.

However, to be effective as an enforcement tool, intelligence about wildlife trade or illegality in the wildlife trade needs to be current to initiate a meaningful counter response or a subsequent criminal investigation. The testing of DNA to establish the provenance of African ivory has resulted in useful high profile research publications (e.g. Wasser et al., 2007; Wasser et al., 2015) and policy discussion, but perhaps future developments should centre around expanding the technical capacity to undertake this DNA testing in transit/consumer countries, therefore ensuring results are generated in a timescale suitable for interventions at the earliest opportunity to support enforcement and prosecution, as urged by CITES (Resolution Conf. 10.10 (Rev. CoP16)).

Similarly, the Rhino DNA Index System (or RhODIS) DNA database system (Harper et al.,

2013) used to individually identify Black and White Rhinoceroses *Diceros bicornis* and *Ceratotherium simum* in Africa also has a function in providing information on trade routes for rhinoceros horn, in addition to its core focus of providing evidence for national casework in South Africa linking seized rhinoceros horn with poached rhinoceros carcasses. Again, DNA samples from seizures in transit/consumer countries are requested, and urged by CITES (Doc. 54.2, CoP16), to be analysed in South Africa. However, the international transfer of rhinoceros horn samples back to South Africa for the RhODIS system to be used to its full potential has not been well coordinated to date, with considerable time lags experienced and delays in reporting, and also a lack of enforcement agencies identified to interrogate the data from an international perspective to justify the exercise meaningfully.

The third area for wildlife DNA forensics is the use of DNA testing for the “traceability” of illegality associated with wildlife or derived products, such as DNA registration schemes of wildlife or wildlife products. This area is probably the most underused but arguably the most useful, wildlife DNA forensics technique. The ability to demonstrate legal, and illegal, trade of wildlife products such as ivory, rhinoceros horn, Tiger derivatives or captive-bred animals using DNA tests to monitor or register large populations has generally been deemed too financially expensive to initiate. However, advances in

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Wildlife DNA Forensics

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DNA profiling technology now makes such DNA registration and monitoring schemes affordable and deliverable and therefore of great utility in addressing trade issues. Recent examples of this kind of system are the DNA registration scheme on trial by Thailand's Department of National Parks for domestic elephants, with the aim of ensuring wild elephants are not laundered into the legal trade for domestic elephants, and the DNA registration schemes being tested for captive Tigers in both Malaysia and Thailand to prevent the laundering of Tigers or their parts into the illegal trade. Both of these projects were driven by enforcement needs identified by TRAFFIC (Nijman, 2014) and CITES (SC66 44.2) respectively. This needs-based approach is key to delivering tangible results from wildlife DNA forensics testing. The current approach however, seems to involve academic researchers developing, or being encouraged to develop new techniques (<https://wildlifecrimetech.org/>),

with a greater emphasis needed to understand the intricacies and limitations of wildlife crime investigation and legal reporting. In order to develop DNA testing into the wildlife forensic technique it should be, networks of like-minded individuals need to be created and should comprise: the non-governmental organizations (NGOs), enforcement officers and prosecutors identifying the drivers for developing new DNA tests, the academic researchers developing these new tools and technologies based on the needs, and the scientists tasked with undertaking forensic DNA testing ensuring the tests are run within their identified limits and reported without bias in a neutral evidential way. There are membership organizations such as the Society for Wildlife Forensic Science and International Society of Forensic Genetics with a remit to promote such networks. Historically these organizations predominantly comprised scientists from developed countries, but more concerted efforts have been made

to include members from emerging laboratories in Africa and Asia in recent years.

As part of a joint initiative between the USAID-funded Wildlife TRAPS (Wildlife Trafficking, Response, Assessment, Priority Setting) project, implemented by TRAFFIC, and the UK Government-funded TRACE Wildlife Forensics Network organization, a process of engaging scientists in key developing countries from range, transit and consumer countries with an interest in this field has begun. The recent RhODIS Scientific Workshop funded by the USAID Wildlife TRAPS Project and WWF, in partnership with the University of Pretoria Veterinary Genetics Lab (VGL) and TRACE Wildlife Forensics Network in South Africa, epitomises this approach, bringing together key scientists and enforcement officers from across the world to identify fully the wildlife enforcement issues and challenges and develop a range of DNA testing

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Advances in DNA profiling technology allows for DNA registration schemes to be tested for captive Tigers. Photo by TRACE WFN

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outputs to address shortfalls in the current suite of tools. Only this needs-based, collaborative approach will fully develop the field of wildlife DNA forensics into an applied and useful enforcement tool to disrupt the illegal trade in wildlife products and prosecute those involved.

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- Advances in DNA profiling technology allows for DNA registration schemes to be tested for captive Tigers. TRACE WFN

Notes from the Director of Assessment



The Director of assessment is responsible for assembling teams that conduct voluntary evaluations of SWFS member labs to determine if their processes and QA/QC systems conform to

the “SWGWILD Standards and Guideline v2”. SWFS does not conduct Audits of a Lab’s quality control system or provide any form of accreditation.

Labs can request a pre-assessment review of their quality control systems and the result will consist of recommendations to improve the Lab’s quality control systems to meet the “SWGWILD Standards and Guideline v2” criteria before a full assessment.

Results of an assessment will be reported as follows:

“SWFS Conformance Assessment Result: Laboratory conforms to ____% of the standards present in the S&G document as determined by on-site assessment”

Please refer any questions to the Director of Assessment, Ed Espinoza.

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University of Central Oklahoma Establishes Center for Wildlife Forensic Science & Conservation Studies (C-FACS)

by Wayne D. Lord, PhD

The University of Central Oklahoma (UCO) recently established the Center for Wildlife Forensic Science and Conservation Studies (C-FACS), which hosts a diverse cadre of internationally recognized faculty and staff in disciplines ranging from wildlife biology, conservation ecology, forensic science, criminal investigation, and justice programs. It also maintains cooperative, multi-disciplinary relationships between the W. Roger Webb Forensic Science Institute (FSI), the College

of Mathematics and Sciences (CMS), and extramural agencies, organizations, and corporate stakeholders.

Founding C-FACS faculty currently maintain active partnerships with the Oklahoma Department of Wildlife Conservation, United States Fish and Wildlife Service National Forensic Science Laboratory, National Marine Fisheries Service Forensic Science Laboratory, Society for Wildlife Forensic Science, U.S. Forest Service,

Shoals Marine Laboratory, New Mexico Game and Fish. Evolving partnerships include Oklahoma-based energy corporations, environmental assessment companies, biotechnology and wildlife forensic companies, the Oklahoma City Zoo, and outdoor sports and recreation companies.

The UCO Center for Wildlife Forensic Science and Conservation Studies (C-FACS) is currently co-directed by Drs. Wayne D. Lord and Chad King.

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and/or visit the C-FACS website at
<http://www.uco.edu/cms/biology/cfacs.asp>.



SOCIETY FOR WILDLIFE FORENSIC SCIENCE

International Wildlife Forensic Science Meeting

University of Edinburgh, Scotland, June 2017

- For further information visit: www.wildlifeforensicscience.org/2017-meeting
- Registration opens September 2016, student and early bird discounts available

Email: swfs2017@wildlifeforensicscience.org