Investigating Wildlife Crime and Forensic Techniques in the United States of America

June – August 2011

A report for The Winston Churchill Memorial Trust

Written by Louise Hurst MSc – Churchill Fellow 2011

"Every day you may make progress. Every step may be fruitful. Yet there will stretch out before you an ever-lengthening, ever-ascending, ever-improving path. You know you will never get to the end of the journey. But this, so far from discouraging, only adds to the joy and glory of the climb."
– Sir Winston Churchill

Acknowledgments

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In particular I thank Dr Steve Fain who invited me to join his research project and made this visit a reality. I thank Mary Curtis and her genetics team, Bonnie Yates and her morphology team, Tabitha Viner and her pathology team, Mark Kirms and his chemistry team, Michael Scanlan and his criminalistics team, Brian Horne and his digital forensics team, the evidence unit and all administration and IT staff.

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Thanks go to my referees Ian Redmond and Ross McEwing for being a constant source of incredible encouragement and support.

To Dyan Straughan for so kindly inviting me into her home and her family and for becoming a dear friend.

And finally the biggest thanks go to all those who accept the challenge to assist in the combat against illegal trade and wildlife crime.

Purpose of Fellowship

The purpose of this fellowship was to gain understanding of wildlife crime issues and study wildlife forensics in America and Canada where the field is further advanced and extensively used in criminal investigations. A large proportion of wildlife forensic cases involve specialised DNA analyses, of which many developments take significant time to publish or are not published at all. It is therefore imperative to learn first hand and gain the relevant skills and experience from the leading experts in order to progress the discipline in the UK.

The aim of my project was to learn more about wildlife forensics, in particular the application of DNA techniques in order to become an expert and to establish links and contacts. I aimed to complete a series of projects, which focus on laboratory skills in DNA analyses where they pertain to species identification and genetics and interpretation of forensic evidence. I also aimed to ascertain information about lessons learnt, tried & tested applications as well as exploring avenues of making wildlife DNA forensics analyses more cost effective and accessible to UK police forces. In addition, I aspired to raise the profile and incite motivation and dialogue about why wildlife crime should be considered in UK national priorities.

I intended to gain a broad overview of the subject from American and Canadian forensic practitioners who are specialised in the field of wildlife forensics. My intention was to meet, communicate and work alongside a range of scientists by visiting organizations, research institutes and universities and where possible carry out coordinated research. The following laboratories were initially chosen given they were established specifically to address wildlife crime issues 1) U.S. Fish and Wildlife National Wildlife Forensics Laboratory in Oregon 2) University of Maine, Molecular Forensics Laboratory 3) Trent University's Wildlife Forensic DNA Lab in Ontario, Canada. I also aimed to explore the opportunity to attend conferences during the travel fellowship period. Finally, I proposed to consider and experience the countries judicial systems where it relates to wildlife crime, this area is relatively new in the UK and wildlife lawyers are urgently in need of information and guidance.

I planned to disseminate my experiences, knowledge and skills in a number of ways. Firstly, I proposed to create a circuit of presentations on the topic of wildlife forensics to educate, raise awareness and encourage young scientists to become involved. The circuit would include universities, police wildlife crime officers and organizations such as the National Wildlife Crime Unit, RSPCA, SSPCA and local & national wildlife groups who support wildlife at risk from crime. I would aim specific knowledge at newly installed UK based wildlife forensic practitioners, including lawyers, with the aim to inform and educate on the advances in the American and Canadian context. My long-term plan is to develop a wildlife DNA forensic service to support the police and forensic providers. Ecological services are beginning to feature within some of the leading forensics providers, but wildlife DNA is costly and requires demonstration of its value, this fellowship I believed would greatly assist in achieving this goal. I will additionally distribute contacts made and provide links as a means to continue dissemination of knowledge.

The specific experience and information I gain will be beneficial to a number of sectors including the scientific community, police forces, animal welfare charities and academia. I will aim to extensively capitalize on publicity upon my return to the UK by gaining as much media coverage as possible both in print and interviews. I fully intend to develop and to follow up on the outcomes of this fellowship experience.

Proposed Itinerary

Ashland, Oregon, USA – June 8th 2011 until July 27th 2011
United States Fish & Wildlife Service Forensic Laboratory – Confirmed placement with Dr Steve Fain to learn world-class wildlife forensic applications and undertake an independent research project. Evaluate varied evidence, examine the justice system and legal reporting techniques and establish links for future ventures with the UK.

California, USA – July 1st until July 5th 2011
UC Davis Veterinary Genetics Laboratory (VGL) – unconfirmed placement to gain valuable experience in the first accredited wildlife crime laboratory, which offers comprehensive services for animal cases and human crimes involving animal evidence.

Lethbridge, Alberta, Canada – July 28th 2011 until August 11th 2011
Alberta Fish and Wildlife Forensic Unit, Canada - unconfirmed visit to observe evidence processing and an array of applications including anatomical examinations, chemical tests & immunological tests.

In addition a wildlife forensics conference/seminar is to be held from August 9th – August 11th 2011 organised by Careen Gonder of Simon Fraser University. My aim is to request authorisation from WCMT for additional funds to partake in this event. The fee is as yet unconfirmed but should be available soon and will be in the region of $600.

Washington DC, USA – August 12th until August 22nd 2011
USFWS Computer Forensics Department – unconfirmed short placement to gain understanding in the use of the Internet in wildlife crime.

Final Itinerary

Following a series of communications the itinerary changed to the following to maximize laboratory time in different disciplines within National wildlife forensic laboratory.

Ashland, Oregon, USA – June 8th – August 15th 2011
United States Fish & Wildlife Service Forensic Laboratory – Confirmed placement with Dr Steve Fain to learn wildlife DNA forensic applications and partake in a two year genetic research project. Experience all elements of the wildlife forensic laboratory including pathology, chemistry, morphology, criminalistics and evidence handling. Establish links for future ventures with the UK.

In addition I will work alongside USFWS special agents in the field and wildlife inspectors at the seaport and airport of Portland, Oregon.

My background

My wildlife related career path began by studying a national diploma in Animal Care. Through this I obtained a volunteer position at Bristol Zoo and later a paid position on the primate section. My first trip to Africa was to assist on a Bristol Zoo supported project in Cameroon. This involved rehabilitating orphaned apes whose families had been slaughtered for the illegal bushmeat trade. Subsequent to Cameroon I travelled to Gabon where I worked for the Zoological Society of London on a project habituating Western lowland gorillas. This post resulted in establishing a western lowland gorilla health study in collaboration with the Wildlife Conservation Society. I then studied and obtained a masters degree in conservation Biology from the University of Kent. Returning to Gabon I worked for the Wildlife Conservation Society managing a research project based at Langoué Bai. My work in the realm of great ape conservation continued in Rwanda where I managed a USFWS grant to educate trackers and guides on great ape ecology and health issues, assess mountain gorillas visitation guidelines, assess chimpanzee habituation and establish chimpanzee visitation guides.

Having spent seven years working in Great ape conservation and research in Central and East Africa, I decided to return to the UK. On my return I was employed by the Wildfowl & Wetlands Trust to carry out wildlife health research. This included Avian Influenza live and dead wild bird surveillance, Avian Tuberculosis screening and health management of captive stock, this involved a large proportion of fieldwork and laboratory based analyses. Whilst working for WWT I studied through Staffordshire University for a Masters degree in Forensic Science. My goal in carrying out this second MSc was to develop my career into the realm of wildlife forensics. With this in mind I carried out research relating to Eurasian Badger persecution. This subsequently established DNA data for Scottish badger populations, which until now has been absent and therefore restricted evidential items being of value in court. This research led me to collaborate within the UK wildlife forensics network.

The fellowship

The United States Fish & Wildlife Service (USFWS) National Wildlife Forensic Laboratory (NWFL) and Office of Law Enforcement (OLE) hosted my fellowship in Ashland, Oregon, USA. The original itinerary was required to be flexible given the fellowship period was not in semester time and at the height of vacation season. The end result was an itinerary of ten weeks spent solely at the USFWS NWFL in addition to a period of time in the field working with USFWS special agents and wildlife inspectors at the ports of entry. This was a unique opportunity being only the third ever-visiting scientist to benefit from the expertise and information available at the NWFL.

The aim of the visit was to learn about innovative forensic techniques where they pertain to wildlife crimes. The USFWS NWFL is the assigned laboratory to analyse evidence on behalf of Interpol and CITES (Convention of Illegal Trade in Endangered Species) and so it boasts an international reputation of excellence. Given the nature of the work undertaken at this facility this report cannot detail any casework I observed under current investigation and so procedures and methods will be used to highlight the types of casework undertaken throughout the laboratory.

In total I completed 400 hours working alongside scientists in the laboratory. The NWFL comprises five main sections and an evidence unit. I was predominately based in the genetics section carrying out molecular biology and DNA analyses. These experiences gained will help inform forensic practitioners in the UK context. The research project I assisted with investigated Y- chromosome polymorphism discovery in bear (*Ursus americanus*), wolf (*Canis lupus* & *C. lycaon*), coyote (*C. latrans*), cats (*Puma concolor*) and deer (*Odocoileus virginianus*). In addition to genetics I also rotated and gained experience within each section of the national laboratory including pathology, chemistry, morphology, criminalistics, digital evidence and some time based in the evidence unit.

In light of the information and experience gained I will cover two aspects of discussion in this report:

1. Wildlife forensics including aspects of all divisions of the NWFL
2. Wildlife law enforcement (USFWS Special Agents and Wildlife Inspectors)

Wildlife Crime

Wildlife crime as defined by Interpol is 'the taking, trading, exploiting or possessing of the world's wild flora and fauna in contravention of national and international laws'. Wildlife crime occurs at a global scale and is a component of law enforcement worldwide. Criminal activities involving wildlife, in particular illegal international trade can have far wider implications on aspects such as disease transmission, invasive species introduction and natural resource exploitation. The illegal trade in plants and wildlife can adversely affect people's livelihoods and the resources they depend upon, as well as threatening already dwindling populations of endangered species. Removal of species from the wild can also upset the delicate balance of nature in the ecosystems where they live.

Criminal activities include illegal trade in endangered species, both live and using by-products (animals and plants), falsification of wildlife products for economic gain, wildlife poaching and can also include cases of cruelty against wild and domesticated animals that are protected by law. Examples of wildlife crime include poisoning and persecution of species such as badgers, raptors and bats, illegal trade in endangered species such as tiger products for Chinese medicine and poaching of protected species such as rhino for ivory. Animal parts such as hides and feathers and eggs may also be targeted. Habitat protected by law against destruction can also be targeted, for example badger setts, nest sites and bat roosts.

In cases where permits are issued some hunting practices may be legal but in the cases of illegal activities this often causes declines in population numbers, causes unnecessary suffering and additionally links have been inferred between these wildlife crimes and other offenses such as gang related crime, money laundering and drug trafficking.

Internet based wildlife crime is extensive and includes the illegal buying and selling of protected species. This is a UK government priority given the immense scale of activities and scope to increase much more. Many species are protected by International cooperation.

International Wildlife Law Enforcement

The Convention on International Trade in Endangered Species (CITES) came into force in 1975. It is an international agreement between states that sign up (signatory parties) voluntarily to monitor trade in endangered species across their borders and safeguard species. CITES is legally binding between parties but does not take the place of national law. Species are defined based on levels of exploitation and their vulnerability and today more than 30,000 species of animals and plants are listed. Certain protected plants and animals may be traded or used for scientific purposes, providing permits are granted to do so. All species are listed in appendices based on the level of protection required. Appendix I is the highest level of protection and covers species threatened with extinction, trade is only permitted under special circumstances. Appendix II covers species that require controlled trade; these are not necessarily threatened but required protection to ensure sustainability of the species in the future. Appendix III covers species protected in at least one country, parties are therefore asked to monitor trade in these species to assist the survival of them into the future.

Interpol was created in 1923 and today has 188 member states, it is the world's largest international police organization. The aim of Interpol is to facilitate police cooperation across borders to assist in the mission to prevent or combat international crime. In collaboration with Interpol's environmental crime committee the Interpol wildlife crime working group (WCWG) focuses on expertise in law enforcement, this may include issues on trafficking, poaching and being in possession legally protected species. Interpol and CITES now have an Memorandum Of Understanding (MOU). The INTERPOL Environmental Crime Programme, the Wildlife Crime Working Group, and the CITES Secretariat have pooled resources to create a guide detailing operations of each entity. This document makes recommendations concerning cooperation and support between CITES management authorities and INTERPOL.

In September 2009 Interpol's WCWG held their 21st meeting. One session detailed an update of 'Operation Oxossi', an investigation into illegal trade in wild macaws and their eggs destined for Europe's pet trade. This operation involved more than 450 Brazilian Federal police agents and uncovered Brazil's largest ever trafficking ring. It was a hallmark operation due to the fact it lead to exposing the involvement of Czech nationals. Subsequently the Czech inspectorate engaged in intentional co-operation and assigned a Czech agent to work alongside the Brazilian police.

The UK Border Agency (UKBA) is in place to enforce the UK's obligations under CITES on behalf of the Department for the Environment, Food and Rural Affairs (DEFRA). In much the same way as the USFWS wildlife inspectors based at ports of entry, the UKBA officers aim to prohibit illegal importation of endangered species and products. To illustrate an example, in 2010 officers investigated the alleged importation of an endangered species seized quantities of wood and perfumes. Allegations were made of a rare agarwoord being imported from south-east Asia, the tree from which it is derived is listed as a threatened species under CITES and its oil can be used in perfumes and incense.

Wildlife law enforcement initiatives in the UK

Despite the best efforts of UK police and customs, this country is a hub for international wildlife criminals. The illegal trade in wildlife is both a multi-billion dollar criminal activity and one of the biggest threats to the survival of many endangered species. The UK is often seen to play a leadership role in the UN Convention on International Trade in Endangered Species.

Most police forces in the UK have at least one Police Wildlife Crime Officer (PWCO). However, constraints to carry out duties in the realm of wildlife crime are hindered by the lack of resources allocated to them. A PWCO will often respond to incidents in his/her own time due to lack of force resources, mainly time and funding.

Launched in 2006 the National Wildlife Crime Unit (NWCU) is an entity with the British police. The remit of the NWCU is to gather intelligence and carry out analytical and investigative support to law enforcement agencies on wildlife crime related issues.

The Partnership for Action Against Wildlife Crime (PAW) aims to reduce wildlife crime through effective and targeted enforcement, better regulation and improved awareness. Combining statutory and non-Government organisations with complimentary skills, experience and specialist knowledge, it is a multi-agency body with the objective to combat wildlife crime.

PARTNERSHIP FOR ACTION AGAINST wildlife crime

TAYSIDE POLICE
Making a Difference

Wildlife Crime

uk NWCU

An example of the impacts of wildlife crime in Scotland

Deer in Scotland are protected under the Deer Act (Scotland) 1996. The recent merger between the Deer Commission and Scottish Natural Heritage has resulted in a revolutionized direction for deer management both in terms of capacity and also the potential for achieving sustainable economic growth. The report 'Managing Scotland's deer: Our new role' summarises wild deer as substantial iconic assets of economic and cultural value to Scotland.

Scotland's deer form part of the national heritage and contribute significantly to the country economic status where it relates to tourism. A report for Scottish Government Social Research published in 2010 entitled 'The economic impact of wildlife tourism in Scotland' detailed research carried out by the International Centre for Tourism and Hospitality Research at Bournemouth University. Respondents for one specific question were different types of wildlife tourism organisations, they were asked what particular species they focused on. Whilst some identified a general focus (e.g. all birds or all plants) some identified specific species, with 70% specifying seabirds and other birds and 60% specifying deer. As a direct or indirect result of management and conservation wild deer provide abundant benefits to Scotland and the human population. As a natural and social resource deer present opportunities to contribute to the national economy in terms of ecological tourism and product demand relating to stalking, legal hunting and the venison trade; which exports up to 70% of its stock annually. In terms of recreation and tourism, the impact upon the nation's economy may be seen through regulated deer hunting as a sport that is estimated to contribute £170 million and the estimated 2,500 full time jobs it created. Product demand also features highly such as, rifles, ammunition and fencing.

For the period of July 2010 SNH provided a list of current research on deer issues in Scotland. Areas covered included, deer impacts, deer movements and numbers, deer management, disease and best practice but no coverage of deer poaching issues and related wildlife forensic applications. Research on obtaining human DNA profiles from animal carcasses is underway by Strathclyde university but work remains to be done on tackling deer poaching and contravening the law. A current study by Leicester University is investigating DNA profiling of red deer populations in Cumbria, England. It is estimated there are 1.5 million deer living in the British countryside but with recent increase in deer poaching it is estimated up to 50,000 are annually killed illegally. The meats from carcasses of poached deer are sold illegally but unwanted remains are often left in situ. The challenge lies in linking evidence in the form of biological material, discarded parts or confiscated meat to a crime which is where DNA profiling could be very successful and provide a means to provide scientific testimony in a court of law.

It has been widely reported in the media that deer poaching in Scotland is a considerable issue that appears to be on the increase. In May 2010 the PAW Scotland meeting reported on activities of the poaching priority group. In terms of enforcement they reported a substantial amount of poaching over the winter months including all types of deer poaching, trophy hunting, profit making and poaching on urban fringes.

Example of Eurasian Badger Crime in the UK

In the establishment of the UK wildlife crime priorities for the year October 2007 – October 2008 badger persecution was listed as an urgent intelligence requirement. The aim was to produce an assessment of the actual extent of badger persecution by September 2008 and if necessary recommend an appropriate tactical response to the findings. As a response to the findings, badger persecution is now listed in the UK 2009–2011 wildlife crime priorities alongside Poaching (deer poaching/coursing, fish poaching and hare coursing), bat persecution, Convention of International Trades in Endangered Species (CITES) issues, freshwater pearl mussels and raptor persecution.

Eurasian badgers are part of national heritage and although not an endangered species they are protected in the United Kingdom under a number of legislative acts including the Protection of Badgers Act (1992) and the Wildlife and Countryside Act (1981). However, despite this protection it has been widely reported by enforcement agencies that badger persecution is a considerable issue that appears to be on the increase. Badger crime activities include illegal snaring and poisoning but are more often attributed to baiting with dogs and/or sett disturbance, the volume of which continues in substantial numbers today. A priority plan involving partner agencies has been agreed to support prevention, intelligence and enforcement. 'Operation Meles' has been initiated by the badger crime priority delivery group, an inter-agency co-operation to enforce the law against badger persecution by gaining intelligence on criminals who travel between countries to commit badger offences.

Badger persecution and related crime threatens the conservation of the species in terms of population viability and as an animal welfare issue badgers are often subjected to prolonged acts of torture and brutality. Due to the nature of criminal cases not being reported or even if reported not documented there is little information published on the history of badger persecution. Indeed this remains a challenge today although perpetrators of badger related crimes are often linked to gang crime and drug related activities. Statistics on incidents of badger crime are sparse and wildlife crime incidents are not reportable to the Home Office therefore actual numbers are absent. These statistics are required to highlight a problem area, which needs urgent attention.

Attempts to investigate cases of badger persecution are often initiated by the police, the Scottish Society for the Prevention of Cruelty to Animals (SSPCA) or the Royal Society for the Prevention of Cruelty to Animals (RSPCA) and local badger groups. If sufficient evidence is available then offenders may be prosecuted but the challenge lies in connecting crime scene evidence to suspects. Typical items of evidence recovered in badger related crimes includes blood swabs or hairs which can provide species identification in forensic casework but also have the potential to additionally link crime scene evidence and suspect evidence by individual badger genetic profiles. This is where DNA plays a key role, this may be analysed from hairs, faeces, blood and tissue samples. For example, a bloodied evidence item such as a shovel confiscated from a suspect may be swabbed for DNA, the analysis would inform if the blood sample contained badger DNA and the profile of a specific badger which would enable a link back to the crime scene and/or suspect. Ogden, Dawnay & McEwing developed and validated an Short Tandem Repeat (STR) profiling system for individual identification using the Eurasian badger (*Meles meles*) as a case study and subsequently this forensic STR profiling system for the Eurasian badger was illustrated as a framework for developing profiling systems for other wildlife species.

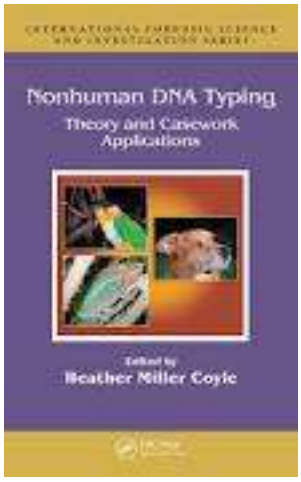
Very few validated wildlife forensic techniques exist therefore there is a requirement for more research.

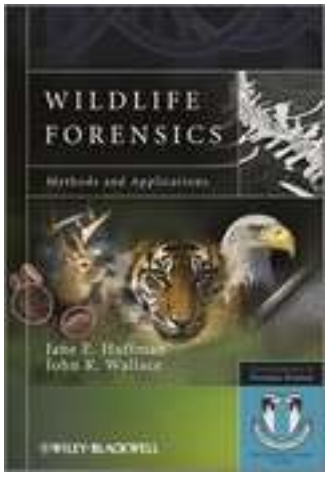
The RSPCA funded an initiative to genotype badger populations in England and Wales. This project produced a large dataset of badger genotypes but very little coverage of Scotland was included (only one population). This additional research was recently carried out to increase the Scottish badger genotypes in order to calculate allelic frequencies and thus enable evidential items recovered at crime scenes to be of use in court cases to match DNA with statistical analysis. The main offences under the Protection of Badgers Act, 1992, as amended by the Nature Conservation (Scotland) Act, 2004, are punishable by up to 3 years imprisonment, an unlimited fine, or both.

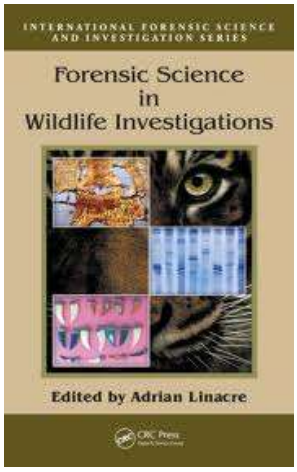
Wildlife Forensic Science

In 2005 a scientist called Budowle and his colleagues commented on the increasing use of genetic analysis used to distinguish animal products in forensic cases. Budowle and his colleagues additionally highlighted the requirement of quality practices and pointed towards human DNA forensic analyses, as a model from which recommendations and guidelines may be discussed for wildlife forensics. Discussions at this time included, analytical practices, data analysis, nomenclature, designation of alleles, statistics, validation, proficiency testing, casework files, and reporting. Ogden, Dawnay & Mc Ewing went on to review current technologies and applications available to wildlife forensic geneticists, in particular relating to what species is under consideration, where it came from and who did it come from, the importance of quality assurance is also highlighted. In summary, wildlife forensic experts can now use DNA evidence to uncover offenders and place them at the crime scene but in order to attain a successful conviction in court of law DNA reference databases must exist to provide statistical match probabilities.

Forensic science applications have been developed, modified and advanced in the realm of wildlife crime. As a result, projects and schemes have been initiated ranging from using DNA to improve compliance, traceability and enforcement in the fishing industry; to forensic identification of Asiatic Black Bear in a traditional Asian medicine and also genetic identification of ramin timber products.







Wildlife Forensics at the USFWS NWFL

The organisation of the National Fish & Wildlife Forensics Laboratory
- Administrative Support Branch
- Technical Support Branch
- Forensic Science Branch

Laboratory user groups:

- ~250 USFWS Special Agents
- ~100 USFWS Wildlife Inspectors
- Any Other Federal LE Agency
- All 50 State Fish & Game Agencies
- Signatory Countries of CITES
- Wildlife Subgroup of Interpol

Reporting according to legislation:
Endangered Species Act (ESA)
Marine Mammal Protection Act (MMPA)
Migratory Bird Treaty Act (MBTA)
Elephant Conservation Act
Lacey Act
Eagle Protection Act
Wild Bird Conservation Act
Rhino and Tiger Conservation Act
Great Apes Conservation Act
Convention on International Trade of Endangered Species (CITES)

The need to meet national accreditation standards led the laboratory to gain the American Society of Crime Laboratory Directors (ASCLAD) accreditation, currently all protocols have been renewed to apply for International Organization for Standardization (ISO) accreditation, which is the world's largest developer and publisher of International Standards.

"Accreditation is part of a laboratory's quality assurance program which should also include proficiency testing, continuing education and other programs to help the laboratory give better overall service to the criminal justice system." --ASCLD/LAB Manual

The NWFL is very similar to a human crime laboratory and functions with the same purpose, the only difference is the victim is an animal, and sometimes the suspect

may be too. The laboratory aims to examine, identify, and compare evidence items using a wide range of scientific procedures and instruments. These analyses aid to identify any human violations of wildlife laws and attempt to link suspect, victim and crime scene with physical evidence.

Examples of evidence items examined are:

Blood samples (ideally fresh or dried condition)

Tissue samples (frozen)

Whole carcasses

Bones

Teeth

Claws

Talons

Tusks

Hair

Hides

Furs

Feathers

Leather goods (e.g. purses, shoes, boots)

Poisons

Pesticides

Stomach contents

Projectiles (e.g. bullets, arrows)

Weapons (e.g. rifles, bows, traps)

Asian medicinals (e.g. rhino horn pills, tiger bone juice)

My visit

The first day was spent touring the facility and being introduced to all the laboratory staff during the weekly laboratory wide meeting. I took this opportunity to introduce myself and explain the purpose of my visit, including information about the Winston Churchill Memorial Trust. Later that day I was required to take computer training and a test under the secrecy act, given that I was working within a United States federal facility. A rough schedule was put together dividing my time between all divisions within the NWFL. The majority of my time however was spent in the genetics section assisting on a research project and learning new laboratory skills.

Forensic Genetics

Section Head: Mary Curtis
Wildlife Forensic Geneticist: Dyan Straughan
Wildlife Forensic Geneticist: Bob Hoesch
Wildlife Forensic Geneticist: Brian Hamlin
Wildlife Forensic Geneticist: Jim LeMay

Primary responsibilities are DNA & Protein Analysis
•Family, Genus & species
•Sub-species
•Gender
•Individualization

The genetics team uses protein and DNA analysis techniques to identify the family, genus, species, sub-species and gender of a blood or tissue sample and with some species, can also match two tissue samples (from the crime scene & one from the suspect) with statistical certainty using DNA techniques.

Resources used include:
•NWFL Standard Collection
- 343 Mammal species
- 453 Bird species
- 36 Fish species
- 50 Reptile species

•GenBank mtDNA cyt b sequence entries-
- 4,000 Mammals (Not human/mouse/rat)
- 3,000 Birds
- 2,000 Fish

Forensic Genetics Research

Section Head: Steven Fain

The research project I was invited to assist on is summarised below.

Y- chromosome polymorphism discovery in bear (Ursus americanus), wolf (Canis lupus & C. lycaon), coyote (C. latrans), cats (Puma concolor) and deer (Odocoileus virginianus).

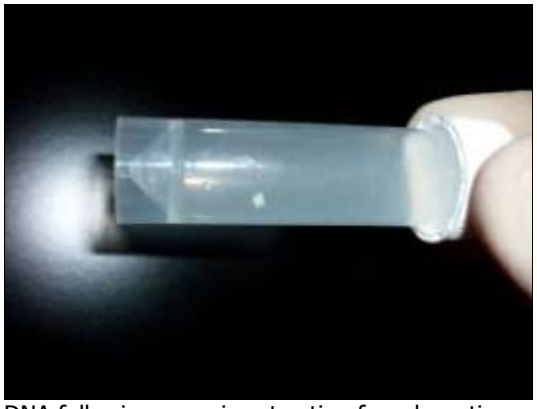
In order to determine the species origin and geographic origin of biological evidence, Mitochondrial DNA (mtDNA) is widely used in both human and wildlife forensic genetics. However, a significant limitation of this marker is that it only reflects the maternal line of inheritance. The Y-chromosome of mammals is the patrilineal counterpart and research on the human Y-chromosome has revealed that it is highly informative. The study of Y-chromosome diversity in wildlife species has been limited and confined to gender testing, but the extent of the forensic potential in wildlife casework has recently been demonstrated in endangered wolf populations in North America.

Rapid inter-species divergence resulting in low sequence similarity and the consequent inability of Polymerase Chain Reaction (PCR) primers developed for one

species (e.g. human) to cross-amplify on another (e.g. bear), is a significant disadvantage which impacts the identification of forensically informative polymorphism on the Y-chromosomes of wildlife species. The aim of the research project is the design & synthesis of PCR primers, optimization of PCR amplification conditions and then the sequence of DNA of all species to analyse any polymorphisms present.

Research Post

On my first day I met Dr Steve Fain and was introduced to the remaining genetics team. Following a tour of the genetics facility I set to work retrieving the samples of bear and wolf from large freezers in the sample preparation and extraction laboratory. One of the forensic scientists Dyan Straughan demonstrated the organic extraction protocol. I also carried out this process using a small piece of tissue sample (muscle tissue) or use 50µL whole blood sample. Following completion the procedure resulted in visulisation of DNA to the naked eye.



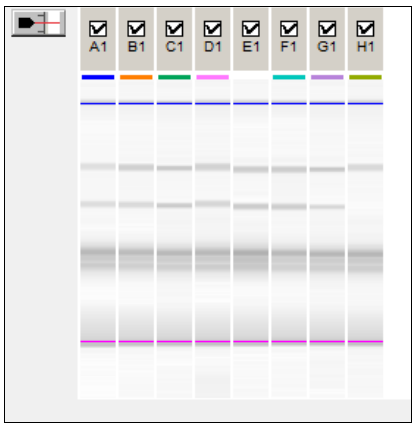
DNA following organic extraction from bear tissue

DNA quantification was measured with Cytoflour using picto green reagent. The ideal concentration required was between 12 and 15 ng/µL DNA. The detection of DNA present was assessed using the Multina and DNA was subsequently amplified by PCR. Samples were later sequenced and subjected to analyses.

The following is an excerpt from my bench notes -

22/06/2011 LH: Ran Multina for gender verification with 2500 kit

D40102	Male	Ursus arctos horribilis
E30426	Male	Ursus americanus
G40602	Male	Ursus americanus
D21053	Male	Ursus americanus
D30108	Male	Ursus americanus
D21175	Male	Ursus americanus
QA3G50	Male	Ursus americanus
QA3G81	Female	Ursus americanus



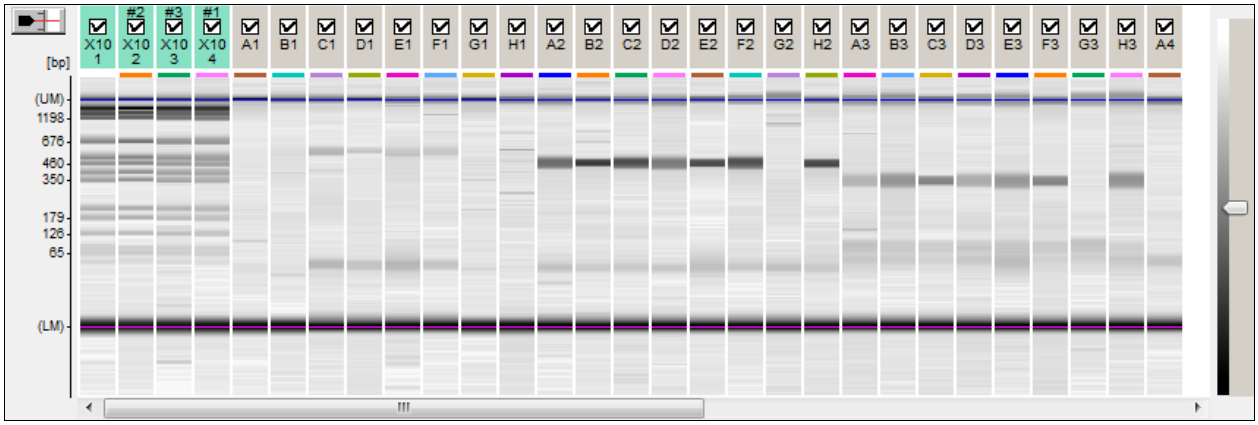
A1 (male), B1 (male),C1 (male), D1 (male),E1 (male),F1 (male), G1 (male),H1 (female)
Multina Results: All genders verified

Set up PCR for six YCat primer sets testing for both B and C profile temperatures

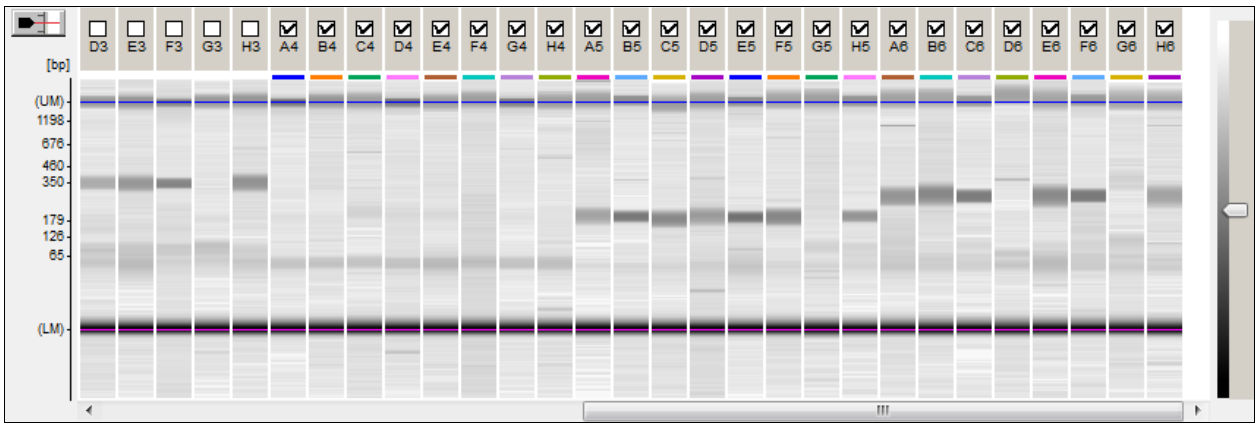
C Primers	DBY3 F (HE) R (HE)
	DBY5 F (HE) R (HE)
	UTY11 F (HE) R (HE)
B Primers	DBY4 F (SF) R (HE)
	DBY8 F (HE) R (HE)
	SMCY9 F (SF) R (HE)

*See mitochondrial Amplification sheets for master mix information etc. (LH Plate 1 (Bears) and Plate 2 (Bears))

Plates 1 and 2 Ran on Multina with 2500 kit. 1 µL DNA diluted in 4 µL sterile water to run.



A1-H1 =UTY11
A2-H2=DBY5
A3-H3=DBY3



A4-H4= SMCY9
A5-H5= DBY8
A6-H6=DBY4

Multina Results: SMCY9 did not amplify. Maybe need a smaller polymer or increased volume of DNA

Where the DNA extraction, quantification and/or amplification did not go according to plan, I gained much experience by trouble shooting these aspects with the forensic scientists. This research project has accomplished milestones 1 & 2 but will not terminate until end 2012.

During my time at the NWFL I was fortunate to rotate through the other laboratory departments. These include criminalistics, chemistry, morphology, digital evidence, pathology, and evidence. The scientists talked me through their roles within each department and gave a thorough overview of the forensic work carried out.

Pathology

Section Head: Tabitha Viner
Wildlife Forensic Pathologist: Rebecca Kagan
Wildlife Forensic Pathologist: Jennifer Johnson

Primary responsibilities include necropsy examinations to determine cause of death and time of death. They are able to determine the cause of death of an animal based on results of their necropsy of the organism. Cause of death can be disease, electrocution, gunshot, arrow wound, wounds sustained from another animal, and so on. Not all animals sent in to the laboratory died as the result of human interaction, but pathologists need to determine what did happen to the animal.
For pathology, not only is cause of death important, but also the history of the animal; how well feed was this animal, what condition is its coat in, etc. Pathology documents identity and species, or asks Genetics, Morphology or Chemistry for assistance in that.

A case I assisted with involved a grizzly bear shot by a suspect claiming it was in self-defence. The pathologist first documented the external aspect of the body, taking photographs of different aspects including wounds with scaled measurements, this took several hours. The next task with which I assisted was to skin the bear to remove the fur coat and expose the naked carcass. The bearskin was laid out and photographs taken of wound areas.


Myself with the bearskin


Bearskin showing bullet trajectories

The carcass was examined for haemorrhaging and further wound marks. At this time the criminalistics team were brought in to examine the bullet wounds and construct bullet trajectories. The resulting trajectories revealed entry and exit wounds that indicated the direction of the projectile shot.

Was it self defense?

Further necropsy of the bear revealed bullet casing and jackets found internally.

Bullet casing retrieved from the bear lung

The suspect was later charged with killing the grizzly bear, which is a protected species.

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Bonners Ferry Man Charged with Killing Grizzly

Contacts: Pamela Bearg, PIO (208) 667-8668
Nancy D. Cook, Asst U.S. Attorney, (208) 667-8668

COEUR D'ALENE – Jeremy M. Hill, 33, of Bonner's Ferry, Idaho, has been charged by the United States Attorney's Office for killing a grizzly bear, U.S. Attorney Wendy J. Olson announced.

The information filed today in United States District Court alleges that on May 8, 2011, Hill shot and killed a grizzly bear that was on his property in Bonner's Ferry. The grizzly bear is classified as a threatened species in the Lower 48 states, according to the Endangered Species Act of 1975, and protected by federal law.

The charge of killing a threatened species is punishable by up to one year in prison, a maximum fine of $50,000, and up to one year of supervised release.

The case was investigated by the Department of the Interior, U.S. Fish and Wildlife Service.

An information is a means of charging a person with criminal activity. It is not evidence. The person is presumed innocent until proven guilty beyond a reasonable doubt in a court of law.

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Many cases that come into the laboratory involve other sections. For example, if a wolf came into the laboratory, usually the question is: What is this? Is it a wolf, a dog or a wolf hybrid? How did this animal die? Pathology will necropsy the wolf, and determine how it died. If it was shot and the bullet can be recovered, then ballistics

will examine the fragment for comparison against the suspects weapon. If it was poisoned, then chemistry will try to determine what type of poison. A tissue sample is sent to Genetics to determine if it is a wolf or a dog, and often to Morphology as well to determine if it has lived in captivity. All sections of the laboratory work together as a team to try to assist law enforcement in protecting wildlife.

Pathology can also determine the difference between an arrow wound and a gunshot would. In the US, the use of firearms to take down an animal during archery season is illegal. Occasionally when someone does this, they stick an arrow in the gunshot wound to try to fool people. Pathology uses the wound characteristics to determine the type of wound and X-rays to determine the true cause of death.

Chemistry

Section Head: Mark Kirms
Forensic Chemist: Pam McClure

Mark uses a wide array of scientific instruments to identify pesticides, poisons, general chemical compounds, and traditional Asian medicines. The instruments include:

- gas chromatographs (GC's)
- a gas chromatograph/mass spectrograph (GC/MS)
- a liquid chromatograph/mass spectrograph (LC/MS)
- a high pressure liquid chromatograph (HPLC)

I was exposed to all the equipment and instrumentation used and explained how the tests are run for many poisons. Assistance in cause of death determinations can focus on the identification of a particular agricultural poison (organophosphates or carbamates). The GCMS is used for organophosphates and HPLC for carbamates. It can also look at a particular mammalian pest control agent (strychnine, anticoagulants, or sodium fluoroacetate), which is analysed using the mass spectrometer. An avian pest control agent such as 4-aminopyridine; or the identification of petroleum hydrocarbons found on/in "oiled" birds can also be analysed. Support in the area of species identifications encompasses characterization of haemoglobin proteins from blood and tissue samples; characterization of bile acids from gall bladders and Asian medicinal products; or characterization of keratins from products made of rhino horn or tortoise shell.

Pam covers different aspects of chemistry including the analyses of bear and shark gall bladders for bile and also turtle shell analyses. The instrumentation used for the initial screen for bear bile is Fourier transform infrared spectroscopy (FTIR), this is a technique used to obtain an infrared spectrum of absorption, emission, photoconductivity or Raman scattering of a solid, liquid or gas. If the sample is in powder form then it is reconstituted and smeared onto an IR window, statistics are then used to compare with a known reference standard.

Bear bile sample ready to analyse using FTIR

Diffuse Reflection Infrared Spectroscopy (DRIFS) analyses are used to detect keratin in turtle shells. Often objects are fake, sold as turtle shell for profit they are actually made of plastic. This technique probes the chemical and physical structures of materials, which are illustrated as peaks. Reference databases are used to label what the sample is made from.

DRIFS output showing the peaks indicating turtle shell

A new instrument had just been installed at the NWFL called Direct Analysis Real Time (DART). This is used to screen samples with no sample preparation required. For example, DART can be used to analyse a sample of gall bladder for Taurourso deoxycholic acid, this is a component found in bear bile. The sample is held between two external components and then ionized to give molecular weight using the molecular mass. This is an accurate method and can therefore be used to identify unknown samples.

Ed illustrating the ease of detecting cocaine on a dollar bill by visualising the output from DART

Morphology

Section Head: Bonnie Yates
Forensic Morphologist: Barry Baker
Forensic Morphologist: Pepper Trail
Forensic Morphologist: Cookie Sims
Morphology Administrator: Doina Voin

The Morphology unit is comprised of two mammalogists, Bonnie Yates and Cookie Sims, a herpetologist, Barry Baker and an ornithologist, Dr. Pepper Trail. The Morphology team identifies animals, birds and reptiles using recognisable characteristics of an organism. This is relatively easy when there is a whole carcass, but that is rarely the case, wildlife officers seize wildlife pieces, parts and products.

Primary Responsibilities are visual and microscopic identifications of evidence (mammals, birds, reptiles), maintaining and expanding a 'known standards' collection, preparation of identification notes for wildlife law enforcement, conducting research into new morphological ID protocols and laser scanning reference samples.

Often evidence is designated to morphology as a first point of call to help ascertain the species under investigation; often the evidence is not in the form of a whole animal but is a by-product and often in another form (e.g. Chinese medicine products).

Typical items of evidence received by morphology

The bug room compromises flesh eating beetles, these are used to strip reference samples of flesh to leave clean bone.

Flesh eating beetles at work

Doina Voin facilitates a system to request specimens to use as standards, these are mainly from zoos and private collections. If samples are requested internationally then CITES permits must be obtained. As an example, if there was an increase in bat cases then Doina will put out a call for bat species carcasses to be sent so the reference collection can be increased. When specimens arrive they go into large designated freezer for 72 hours to kill off any pathogens that may be present and are susceptive to freezing conditions, then each specimen will be placed in with the beetles. The NWFL have had the same colony of beetles for 20 years, every year the colony is reduced and allowed to re populate.

It was explained that evidence case reports are red files and sub case reports are yellow files. Where evidence is distributed to other sections by the case lead (first person to be appointed the case) the subsequent report is yellow. For example, a wolf carcass may be assigned to a forensic pathologist who raises a concern over possible poisoning and thus submits a sub section of evidence to chemistry to perform toxicological analysis.

The morphology team showed me how to check out evidence from the evidence hold. The forensic scientist needs an identification badge with a bar code, which is scanned by evidence to log chain of custody. The scientist then inputs a personal pin code to receive the evidence and also signs the evidence tag to log chain of custody.

I was later privileged to be given a comprehensive tour of both the laboratory based morphological reference collection, including items such as primate hands, ivory specimens (elephant, mammoth, walrus, hippo), animal hair reference collection and also the forensic park off site facility, which houses large specimens and whole animal taxidermy.



Myself in forensic park with large taxidermy collections

I was guided through morphology protocols and instrumentation. All outputs are in the form of written notes or images (no instrumentation with print outs), which are submitted in case files.

He is an example of a dyed handbag. The images of which were submitted in the casework file.


On the left the item of evidence and with infrared imaging on the right you can now see the pattern of the snakeskin.

I was able to observe the procedural-working of a photographic email request from a wildlife inspector for preliminary identification of a specimen. A wildlife inspector at Dallas airport had confiscated the item, with the owner claiming it to be a pig tooth from Vietnam. The tooth in question was photographed with a scale showing it to be approximately 2 inches long. It looked real due to fatty tissue scaring and the smooth sleek enamel finish. The tooth had an impression line (a shallow groove along the length of the tooth with the function to release air to allow punctured canine teeth to retract) consistent with that of felids. We examined reference samples of leopard and golden cat teeth and based on the morphological characteristics it was thought to be that of an upper canine possibly of a golden cat, which is listed as appendix I CITES. In conclusion the item was required to be submitted to the laboratory for definitive analysis. I was advised that photographed items would be welcome from the UK for preliminary identification should it be necessary.

Computer Forensics (Forensic Digital Evidence)

Section Head: Brian Horne
Computer forensic scientist: Jim Chamberlain
Computer forensic scientist: Tom Taylor
Computer forensic scientist: Ryan Erickson

Primary responsibilities are:

- Analysis of Digital Evidence
- Computer seizures
- Computer analysis
- Audio/video analysis
- Courtroom presentations

I spent some time with each member of the digital evidence team. I was guided through the processes that enable them to search and analyse various pieces of evidence or potential evidence.

Potential evidence items include:
•E-Mail
•User Documents (Letters, memos)
•Internet browsing: Favourites, Temporary files, History, activity logs
•Financial Records
–Price lists
–Vendors
–Buyers
•Videos
•Graphics (pictures)
•Registry Information
•Documents downloaded
•E-mail addresses
•Screen Names
•IP address
•Customer databases
•Scanned images of key documents
•Chat Logs
•Programs being used

The team members each have different remits, which include assisting with search warrants, restoration of hard drive data, mobile telephone data extraction, and audio and visual data.

Example of kit used to extract mobile phone data

Criminalistics

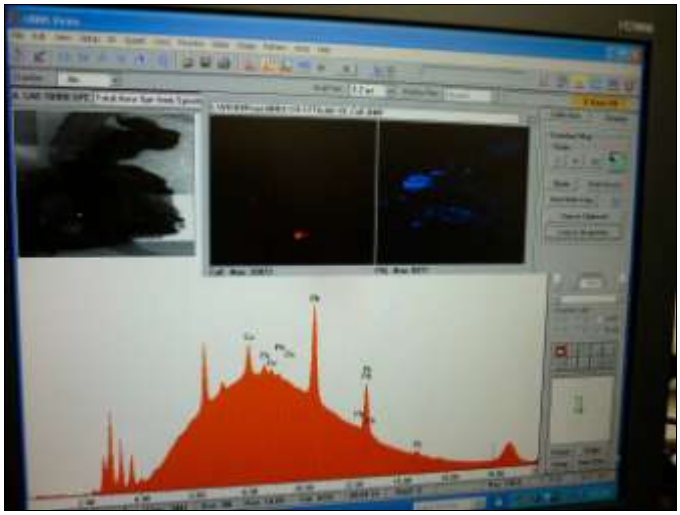
Section Head: Michael Scanlan
Forensic Criminalist: Andy Reinholtz

Primary responsibilities are visual & microscopic comparisons of evidence
•firearms, casings & projectiles
•latent fingerprints
•shoe & tyre impressions
•trace evidence
•Determine caliber
•Possible source weapons
•Individualize:
–cartridge cases
–bullets

The criminalistics team conducts 'standard' police crime lab examinations on firearms, bullets, cartridge casings, footprints, tire tracks, paint, glass, fibers, and items bearing latent fingerprints. Instruments utilized include a scanning electron microscope, and a Fourier Transform Infrared (FTIR) microscope.

I was fortunate to spend some time with Mike Scanlan, a former police officer and human forensic scientist. Mike explained his diverse background, which included overseeing a double murder case in Ashland in the 1980s.

Following a brief tour of the criminalistics department Mike started by explaining X-Ray Fluorescence (XRF) elemental analysis of shots. XRF uses ORBIS vision software. This instrument can detect down to sodium and can used with air or under vacuum. The XRF can also be used to scan tissue samples for example wound tracts. A casework example is that of California condor lead poisoning.



XRF output showing the evidence is a lead bullet

The IBIS firearms database is used but limitations include regional searches not specific to location. The FBI database includes parameters such as diameter, lands, grooves, and directional twist, limitations exist due to the representation of only those entered. There is a bias toward handguns and less information on rifles. During casework the firearm is often seized and submitted as evidence with any projectiles. This enables the criminalistics team to perform test fire and

subsequently carry out bullet comparisons. Mike had some bullets to test fire in the test fire tank and so I observed this process.

Mike using the water tank to test fire

If no firearm was submitted then the FBI database would be used to search for comparisons. Mike explained bullet comparisons and I then carried out some analyses.

Mike undertaking bullet comparisons

Bullet comparison software

Mike went onto explain aspects of fibre analyses, for example physical matches using feather and antler, paint analyses using FTIR instrumentation and tool mark and footwear comparisons.

Footwear comparison analysis

I spent time with Andy Reinholz who talked through his work as a fingerprint analyst. Latent fingerprints are routinely lifted and compared with prints lifted from the suspects. Not only are fingerprints examined but also palm prints, side of the hand and fingertips. Prints can be lifted off of many different kinds of surfaces. Such surfaces include ivory tusk from an elephant, bird eggs, jar lids, shell casings, antlers and horns. I observed Andy lifting prints from the under side of tape used to seal boxes with illegal items. The boxes in question were placed in a freezer and the tape was peeled off without removing parts of box. The prints were then compared with that of the suspect.

The following is an example to demonstrate the uniqueness of fingerprints. Fingerprints are unique and are permanent. Wear and tear due to lifestyle or job will not alter them in the long run. As your skin cells regenerate, so do your fingerprints. Accidental scarring will alter a fingerprint, but a trained fingerprint expert can distinguish between ridges that are altered because of damage and simply a different fingerprint. Fingerprints that have been damaged will have ridges with pucker, where as natural breaks and edges will be smooth. This is the fingerprint card of John Dillinger, who was notorious bank robber during the 1930s. Dillinger knew about fingerprints and their ability to link a suspect to a crime scene so he attempted to get rid of his fingerprints by burning them off with acid. He only succeeded in making himself more distinguishable.


NAME—JOHN DILLINGER CLASSIFICATION

CIRCULAR NO. 28 ISSUED JUNE 1, 1934

$5,000 REWARD

JOHN DILLINGER is wanted in several mid-western states for numerous felonies including murder.

The Governors of Indiana, Michigan, Minnesota, Ohio and Illinois have issued a proclamation offering a reward of Five Thousand Dollars ($5,000) for the apprehension and delivery of John Dillinger to any sheriff of the above mentioned states.

Description: Age 31. Ht. 5'8¾". Wt. 160. Eyes yellow slate. Hair medium chestnut. Complexion mediu

Notify any sheriff of Indiana, Michigan, Minnesota, Ohio, Illinois, or this Bureau.

Evidence

Section Head: Ena Gillette
Evidence Handler: Laura Daugherty

The evidence unit gave me a tour of the facility and explained each component. The NWFL can only receive evidential items that are both wildlife and law enforcement related. No human evidence is accepted on site.

When evidence is collected from a crime scene and suspect, the chain of custody is vital if the evidence is to be credible in court. I was explained the system of receiving and logging evidence by using a dummy case file. When casework evidence arrives it is logged onto a specialised computer program, which generates a case number. Each evidence item in the case is assigned a unique barcode reference and is subsequently assigned a casework lead. For example if the evidence requires toxicological analyses it will be assigned to a forensic chemistry scientist in the NWFL.

Ena logging some evidence items into the database

When special agents or wildlife inspectors collect evidence it must be carried out using devised protocols which include the safe package and transport to the NWFL. Collection toolkits include: odour control materials for carcass parts or decaying matter; sample tubes for tissue or hide; sample bags for hair; sample pots for caviar and hazardous materials, such as suspected poisons.

Hair sample kit

Hide and tissue collection kit

Wildlife forensics Outreach

I had the opportunity to accompany Dyan Straughan, a forensic geneticist on a wildlife forensics outreach trip to a children's summer camp in the Siskiyou National Forest. We took along many items including a polar bear head, cougar and bobcat hides, skulls, ivory and corals. The aim was for the Children to deduce what they were and why they thought so based on morphological characteristics. It was very informative for me and I was able to make my way around the classroom to help with identification.

The children identifying the polar bear head based on characteristics

Dyan explaining the morphology of different animal hides

Wildlife Law Enforcement at the USFWS

I was very fortunate to meet with William Woody, the new chief of the Office for Law Enforcement in the USFWS during his first official visit to the laboratory from Washington DC. Following a conversation regarding the purpose of my fellowship I explained my objective to understand more about how wildlife law enforcement activities are carried out in the US. Chief Woody subsequently introduced me to the federal special agent in charge of operations along the West Coast. It was suggested I spend a period of time in the field working alongside the operations team. Discussions were initiated with special agents in the Los Angeles office given they had planned a cyber operation. Unfortunately I could not obtain security clearance for the operation and thus the visit was not possible. Special Agent Robert Romero in the Portland office called and offered me to go there to work with inspectors at the airport and with passenger checks, visit warehouse container checks and get out on the ground to see real issues they face.

Special Agents are trained criminal investigators who enforce Federal wildlife laws throughout the United States. Special Agents conduct law enforcement investigations that may include activities such as surveillance, undercover work, making arrests, and preparing cases for court. They often work with other Federal, tribal, foreign, state, or local law enforcement authorities. Special Agents enforce traditional migratory bird regulations and investigate major commercial activities involving illegal trade in protected wildlife. Some agents work at border ports where they enforce Federal laws protecting domestic and foreign wildlife species that enter into interstate and international commerce.

Wildlife Inspectors are import-export control officers ensure that wildlife shipments comply with U.S. and international wildlife protection laws. Stationed at the Nation's major international airports, ocean ports, and border crossings, Wildlife Inspectors monitor an annual trade worth more than $1 billion. They stop illegal shipments, intercept smuggled wildlife and wildlife products, and help the United States fulfill its commitment to global wildlife conservation. They must be able to identify thousands of different species, both live and as parts or products. Inspectors clear legal imports and export, and stop shipments that violate the law. They make sure that wildlife imports and exports are accompanied by the required permits and licenses, and verify that the contents of shipments match the items listed on declaration forms. They pay special attention to live wildlife, checking to see that animals in transit are treated humanely.

My experience with the field operations team

Special agent in charge Robert Romero kindly collected me from Portland airport. I was then taken to the regional office and introduced to his team of special agents. Special agents are sworn federal officers of the law but are not uniformed, as they need to remain anonymous for undercover assignments. Later that day I was also introduced to the state wildlife inspectors, which are uniformed personnel based at ports of entry. Together we planned an itinerary for the week ahead to expose me to as much of their work as possible. This obviously was dependant upon the current workload and ongoing casework. The UK equivalents are officers at the UK Borders Authority (UKBA).

The numbers of wildlife inspectors based at various ports of entry are:
2 in Portland
2 in Seattle
10 in Los Angeles
1-2 in Blaine (border with Canada)
4 in San Francisco
2 in Washington DC
2 in Boston
12 in Miami
10 in New York
1 in Denver

Our first call was to visit the Portland Port Terminal 6, which is a container ship yard. An officer accompanied us from the agriculture division of the Customs and Border Patrol (CBP) team. The CBP officer was looking for invasive species, mainly insects and also wood products. During the initial check we found what was believed to be real animal fur used to make small mouse cat toys. The USFWS wildlife inspectors examined the goods and called the broker (person who organises paperwork etc) who first said it was fake hair, he later admitted it was real rabbit fur and so checks were made as to the species of rabbit. A photograph was taken and emailed to Bonnie Yates at the NWFL to identify. It was then confirmed the rabbit species was not endangered and therefore the shipment was authorised for release.


Myself and the USFWS inspectors


Rebecca inspecting the cat toy items

The next day we visited the air passenger terminal to check passengers on flights inbound from Japan via Bangkok and Africa via Europe. The CBP team seized amongst other things any chicken products (to contain any avian influenza infected goods), fruits and seeds. The USFWS wildlife inspectors have a very good working relationship with the CBP and assist in bag check for the illegal items in question. In turn, the wildlife inspectors effectively 'piggyback' on agriculture officers, as they do not have a check line of their own and work in a similar domain. This works very well and is effective and efficient having more trained personal on the check line.

Customs also have a 'check way' where passengers are searched for correct paperwork and are questioned on items they carry. I witnessed a young boy of 15 years being detained for carrying imitation firearms and knives.

Passengers are questioned by immigration and they are asked if have any food items. Passengers who declare items have any relevant paperwork checked and

either authorised or the items are confiscated. Passengers who do not declare food items are again questioned by CBP and selected bags are x rayed and searched. Any suspicious looking or nervous passengers are subject to questioning and bag check. As the flights entering Portland airport are both national and international the team at the bag check have a range of languages between them and there are also translators at hand.

On another occasion we returned to the container shipyard to carry out random searches of containers. This was again carried out with the agriculture division of CBP in order to maximise search efforts. A container of wood was located which was not stamped as treated before leaving country of origin, therefore the container was referred to unload area to check fully. If none of the wood is officially stamped it will be sent back to its origin at the cost of the importer.

The types of random searches carried out include, 'tailgate' (look at back boxes), and 'tunnel through to nose', 'full' or 'partial random'. If there are any doubts regarding a shipment of goods the container can go to a facility where it is all unloaded and checked at the cost of the importer. Exporters often try and hide shipments at the bottom of boxes of legitimate items, therefore the inspectors will randomly open boxes bottom up. Exporters of illegal products will also try to deter inspectors by including loose live animals such as snakes and spiders.

Other scheduled checks of shipments at the airport and seaport included, boxes of racoon dog and fox fur coats, commercial import of live fish, urchins and eels from Philippines (additional animal welfare issues to consider), shell related jewelery and leather bracelets in transfer transit terminal. A violin shipment was inspected and queried over the hair used on the bows, which was declared as domestic horse. The shipment was also held for further investigation, as inner lining of the instruments was shell, the type of which should have been declared in the export papers. Shipments of guitars searched were made from endangered wood, this was not declared and therefore the items were seized. If seized items are considered dangerous they are destroyed but in this case the guitars have been donated to a local school to aid with music lessons.

One of the most interesting shipments was series of hunting trophy imports from South Africa. Species included were African elephant (whole animal separated into parts), springbok, kudu and zebra. These were CITES imports, appendix II, which included checking permits were in order for export and import.

Rebecca and Gene checking the export CITES stamps were present on the African elephant tusks

Myself with a zebra hide

Zebra hide identification guide

An evening assignment involved the clearance of two pairs of live breeding falcons, which were being exported to Ontario Canada. Each bird was checked and linked to the identification chip and all the paperwork and permit were checked and stamped as authentic.

Wildlife inspectors demonstrated the computerised system that is used to clear or reject imports or refer onto further checks.

To round up the fellowship I met with Chief Woody at headquarters in Washington DC. We discussed the need to advance wildlife law enforcement partnerships and collaborations. As a result, I have been invited back to work with them in the future.

Conclusion

The scope of exposure to aspects of wildlife crime and forensics far exceeded my expectations. I learnt a great deal in a limited period of time. I established important links and contacts and motivated the ideas of collaborations with the UK in future anti-crime ventures. I am positive my experiences will assist in progressing UK wildlife forensics and I am confident there will be extensive follow up to my fellowship in the near future.

I was able to obtain information about lessons learnt and tried & tested applications, including current laboratory protocols. The relevant NFWL scientists are willing to collaborate with UK counterparts when the UK wildlife forensic community is active and resources are available.

I tried to raise the profile and incite motivation and dialogue about why wildlife crime should be considered in UK national priorities. I did this by means of:

- Wildlife Forensics in Action Blog

  This blog aimed to increase awareness and inform individuals and organisations about issues surrounding wildlife crime and law enforcement, in particular where it relates to wildlife forensics.
- Wildlife Forensics in Action Face book page
- Wildlife Forensics in Action Twitter Account

I found one challenge particularly difficult to overcome, this centered on writing about my work experiences at the laboratory. Active forensic cases are strictly confidential and so disclosure of any details was strictly forbidden.

Resources obtained to disseminate in the UK:

All laboratory ISO protocols (across all wildlife forensic disciplines)
Laboratory equipment and supplies list
Scientific papers relating to research carried out at the NWFL
Media articles about the laboratory and its work nationally and internationally
Comprehensive PowerPoint presentations (talks, education & awareness)
Contacts within wildlife forensics and law enforcement
Ivory identification booklet

Recommendations based on information gained:

- Morphology expertise is vital in any forensic analysis as the whole carcass is rarely available. In the absence of a designated section links must be made with appropriate institutions such as the natural history museum that have reference collections
- Genetic research is required to answer questions regarding forensic identification
- A sustainable budget is required to buy consumables, equipment and maintain equipment
- Need to improve and advance wildlife forensic technology in the UK
- UK Wildlife forensics need to be involved in societies, working groups and support networks