Institution: University of Portsmouth		
Unit of Assessment: UoA 20: Social Work and Social Policy		
Title of case study: Using Forensic Science to Empower the Fight Against Pangolin Extinction		
Period when the underpinning research was undertaken: October 2017 - Present		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	**Role(s) (e.g. job title):**	**Period(s) employed by submitting HEI:**
Dr Paul Smith	Reader in Crime Science	01/02/2009 - date
Jac Reed	Lecturer	01/09/2014-date
Dr Nick Pamment	Principal Lecturer	18/02/2008 - date
Dr Brian Chappell	Senior Lecturer	01/04/2011 - 12/01/2021
Period when the claimed impact occurred: April 2018 - present		
Is this case study continued from a case study submitted in 2014? N		

1. Summary of the impact

Research undertaken by the University of Portsmouth Forensic Innovation Centre (FIC) has led to the development of the first forensic evidence recovery technique for pangolin scales. Poaching of pangolins for their scales has resulted in them being at risk of extinction, and they are thought to be the most trafficked mammal in the world. The FIC's fingerprint recovery process builds on extensive research and practice expertise in forensic investigation and countering wildlife crime. This pioneering technique enables the capture of multiple evidence types (fingerprints, DNA, pollen traces) from one lift off the target surface using gelatine lifters. Wildlife crime rangers can process scenes quickly and effectively, enhancing efforts to disrupt this illegal trade. The methods are now distributed worldwide through partner agencies, including the Zoological Society London (ZSL), Border Force UK, Interpol and the Wildlife Conservation Society (WCS).

2. Underpinning research

The extensive expertise of our researchers in forensic science, criminal investigation and wildlife crime was the basis for the development of the FIC with Hampshire Constabulary in 2009, supporting collaborative and applied research in forensic and investigative science. A notable focus of this research has been on the development and enhancement of new techniques to capture evidence at crime scenes, as for example with new methods to profile DNA from marks left by gloved hands (R1). A key dimension of this work has been to optimise the use of the emergent technology of gelatine-based lifting of evidential traces, which as a consequence has become an integral part of police operational investigative practice.

Central to the success of the FIC's approach has been the marriage of technical advances with enhanced understanding of the limitations and opportunities of their practical application. The researchers have worked ethnographically with frontline users of forensic technologies, notably to devise means to embed mobile technology into crime scene investigative practice (R2), and to measure the impact of team skills, interactions, and communication of shared narratives on practice in investigations (R3). FIC researchers have over 15 years' experience of going where the work takes place, engaging with the frontline users, understanding their systems and designing methods that work in context and are operationally and culturally acceptable.

This long-term record of impactful research outputs, combined with extensive experience of research into wildlife crime at a national and international level (R4 and R5), formed the basis for a partnership with the Zoological Society of London (ZSL) in 2017, with the aim of developing forensic recovery methods and associated training workshops for wildlife crime rangers in wildlife parks across the world.

A key objective of the collaboration was to tackle pangolin poaching. The 8 species of pangolins – mammals covered in hard keratinous tissue in the form of overlapping scales – are all on the International Union for Conservation of Nature (IUCN) "Red List" of threatened species. Previous studies have estimated that between 2011 and 2013, for example, up to 234,000 pangolins were slaughtered, with only some 10% of this illegal traffic being intercepted. The meat is considered a delicacy in some countries, and pangolin scales are in demand alongside other wildlife products for the illegal use of contraband in traditional Chinese medicine. The trafficking of pangolins for their meat has recently been linked to a possible means by which the Covid-19 virus mutated to

infect humans, highlighting the environmental pressure on these species and the need to improve the investigative response.

Prior to the current project, there was no method of recovering fingerprints or other forensic evidence from pangolin scales. Unless someone was caught red-handed there was no way to associate individuals to seized scales; this lack of investigative tools meant such crimes had no repercussions, which contributed to the extent of this illegal trade. An initial collaborative research project with ZSL led to the development of a wildlife forensic investigation working group made up of the FIC, ZSL, wildlife crime enforcement officers in Benin, Cameroon and Kenya and, later in the project, through WCS India.

The first stage of research was an ethnographic study, which visited several wildlife reserves in Asia and Africa to work alongside local officers and explore the social and technical factors of their duties (R4). Building on prior FIC technical research, a gelatine lifting kit was developed through experimental trials. Experiments were undertaken to verify the viability of the gelatine lifting process for collecting fingermarks, DNA and trace materials from various wildlife contraband. In more standard criminal investigations gelatine lifting is limited to footwear marks and fingermark lifting, our research was the first to research its use on wildlife contraband, and the first to consider its application to traces such as cellular DNA, pollen and environmental traces.

The experimental research trials determined the viability of gelatine lifters for full evidence recovery, with gelatine lifts on pangolin scales being particularly productive. The gelatine lifters visualised a mark or ridge detail on 98% of the samples in the first trials (R6). In 59% of these there was full ridge detail, which would support a conventional “fingerprint” identification, and in the remaining tests there was sufficient indication to identify a touch on the surface, providing a target for DNA or trace evidence recovery. This research thus successfully demonstrates that these techniques can achieve the same likelihood of successful evidence-collection, working with wildlife materials in the field, as those addressing conventional non-porous surfaces in a more normal scene-of-crime investigation.

The technique offers a quick, easy and deployable method which is as effective as using chemical reagents and high-specification light sources, but can be made available in an inexpensive package and distributed to all wildlife crime enforcement organisations worldwide. Both the ethnographic and technical dimensions of the research findings were then taken forward into practical collaboration on frontline implementation.

3. References to the research

(R1) **Smith, P.A.** Mound, S. Brown, N. Leonard, R. Lovell, C. and Bennett, S. (2017). Empirical approaches to improving the use of DNA in investigative practice. *International Journal of Police Science & Management, 19*(1), 54-60. https://doi.org/10.1177/1461355716688921

(R2) Baber C., **Smith P.A**, Butler M., Cross J., Hunter J. (2009). Mobile technology for crime scene examination. *International Journal of Human-Computer Studies, 67* (5), 464-474. https://doi.org/10.1016/j.ijhcs.2008.12.004

(R3) **Smith P.A**, Baber C., Hunter J., Butler M. (2008). Measuring team skills in crime scene investigation: exploring ad hoc teams *Ergonomics,* 51 (10), 1463-1488. https://doi.org/10.1080/00140130802248076

(R4) **Smith**, P.A., **Pamment**, N., Cox, C., **Reed, J**., **Chappell**, B. and Plowman, C., (2019). Disrupting wildlife crime: The benefits of meaningful collaboration. *Forensic Science International*, *299*; e1 and e2. https://doi.org/10.1016/j.forsciint.2019.04.021

(R5) Collins, A, Cox, C and **Pamment, N.** (2017). Culture, conservation and crime: regulating ivory markets for antiques and crafts. *Ecological Economics, 135,* pp. 186–194. https://doi.org/10.1016/j.ecolecon.2017.01.018

(R6) Moorat, G., **Reed, J**., Bleay, S., Amaral, M., **Chappell**, B., **Pamment**, N. and **Smith**, **P.A**., (2020). The visualisation of finger marks on Pangolin Scales using gelatine lifters. *Forensic Science International*, *313*, 110221. https://doi.org/10.1016/j.forsciint.2020.110221

Evidence for the quality of research

Our research is published in reputable industry journals with good to excellent impact factors, for example, Forensic Science International has an impact factor of 1.99; the International Journal of Human Computer Interaction is rated 2.01; Ergonomics is 2.18 and Ecological Economics is 4.28.

4. Details of the impact

There are 194 member states working collaboratively with Interpol to tackle wildlife crime. Globally there are some 20,000 identified wildlife crime enforcement officers, but spread across several continents this number breaks down into relative handfuls. In India, the Wildlife Control Bureau (WCB) employs 109 staff, working collaboratively with a range of local organisations. FIC were able to supply one kit for every two WCB officers, covering every region in India. Similarly in Benin, 20 gelatine lifting kits have been provided, 1 for approximately every 4 officers, equipping all local and regional offices in the country.

The outcome of the FIC's twin-track collaborative ethnographic and technical approach has been the production of a kit that is easy to use, portable and inexpensive, making on-scene evidence recovery simple and rapid. Follow up visits to end-users consolidated the techniques and refined the kit, making it suitable to local environments, resources and capabilities. Researchers took part in several workshops with practitioners to verify the usability of the gel and to discuss a suitable strategy for deployment. In late 2018 and 2019, gelatine lifting kits were distributed to rangers in Asia and Africa through partnering agencies, principally ZSL and WCS.

The method targeted points of interaction using a 'one-lift' system to capture available evidence and preserve it to analyse away from the scene. This evidence is used as an intelligence tool to link scenes, individuals and potentially endangered species, and where necessary, establish the provenance of impounded materials. These kits also provide a deterrent, introducing the threat of successful forensic-evidence-based prosecutions in jurisdictions where this has previously been unavailable. This is notably the case in India, and this deterrent threat is seen by law enforcement officers as a way of educating, reaching out and rehabilitating some members of the community who fall into trafficking-related criminality. The scale of the wildlife crime problem and the impact on local ecologies is well publicised, and the kits provide a means to equip law enforcement agencies to tackle local issues.

First use in Benin

After developing the gelatine lifting kit through research work, the first deployment was in Benin as part of the Proactive Law Enforcement Training Programme, a scheme initiated and run by ZSL (S1). As part of this operational deployment, FIC explored the kit's fitness for purpose for use in the field in collaboration with local officers, and ran workshops to both refine the kit for improving usability, and train officers in how to use the kit in the field. In Benin the 20 provided kits are now standard issue following the officers' investigative and forensic training. Following their training officers in Benin are using the gelatine lifters to recover evidence as part of operational process (S5)

Work in India

Following the success in Benin, ZSL recommended its extension to their ongoing work in India, allied with WCS. The FIC ran workshops here, and with user feedback, we developed mobile phone methods to capture the marks lifted on the gelatine lifters. This meant that local officers could use the kit and capture fingerprints without extensive technical equipment. FIC trained over 50 wildlife crime officers working in national parks across India. Each of these officers received a kit, and through dialogue with them, we helped them construct their own models of best practice for use of the kits in their local conditions.

[Text removed for publication], Assam, India commented (S2) that *"forensic techniques will have a dramatic impact on the levels of wildlife crime"*. The India workshops resulted in positive feedback from delegates (S3). Positive results have begun to feed through to enforcement. In the same month (August 2019) that WCS India reported on the FIC workshops on their blog (S9), officers used the kit *"to record the fingerprints of three accused, arrested in a red sanders smuggling case in* [text removed for publication]*"*. The officers were *"very pleased with the kit and*

shared that it is a much easier way to record fingerprints than the earlier rubber stamp method" (S4), and the gelatine fingerprint lift was used to support the prosecution of the smugglers.

Upskilling ZSL

To scale up the impact generated in both Benin and India, the FIC recognised the need for upskilling others in investigative knowledge and accurate interpretation of results from the kit. FIC members trained 4 ZSL colleagues to accurately interpret kit results, and put in place an ongoing mentoring programme for them, providing long-term support as they became trainers themselves, working with further groups of wildlife officers. ZSL wildlife crime enforcement leads deployed their newfound expertise, along with kits provided by FIC, to Cameroon and Kenya. The ZSL [text removed for publication] for Cameroon reported that local officers were successfully using the kits to *"visualise finger marks on scales and other items in the field"* (S6).

Further international impacts

Through the partnership with ZSL, continuing training in the use of the gelatine kits and basic forensic techniques has now been certified as a formal structure of *"Provision of intensive adapted training in the use of Forensic Gel Technology"*, endorsed by the global agency of CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) (S7). The gelatine lifting method will be integrated in operational practice and it will be an intrinsic part of the evidence recovery processes of the wildlife crime investigators. Further, with this method and other innovations, The FIC team is joining with WCS on a joint global training programme to embed this and other techniques into operational practice.

In October 2020, an agreement was reached with the Wildlife Conservation Society (WCS) Asia division for the FIC team to deliver their training material as part of a course on leadership in wildlife crime investigations throughout Vietnam and Indonesia. This is the first phase of a further roll-out across Asia (S8). [Text removed for publication], supported the integration of the gelatine lifters into the training programme and promoted use of the technique. He reported that it *"has provided immeasurable benefits, not only to the scientific and investigative communities globally, but also to the officers in developing and under-resourced countries where support, guidance, advice and training in evidential retention and forensic awareness has been given."* [text removed for publication] expects this to have *"far-reaching and long term benefits, improving knowledge and capacity of law enforcement officials, and ultimately representing the move towards more effective policing and investigations to combat the illicit trade in illegal wildlife products"* (S5).

As a result of this, WCS have awarded the FIC a contract worth up to GBP200,000 in the first year, to deliver training, and develop further awareness of the techniques. This is part of an international training programme to develop investigators with leadership skills across global regions affected by high volumes of wildlife crime. With the CITES certification noted above, the impact of the work has been endorsed by industry experts worldwide.

Conclusion

There are now 90 kits deployed in Benin, India, Cameroon and Kenya, in the hands of trained frontline officers who can use the kits in the field, and know how to interpret the results for effective investigation and prosecution; a cadre of ZSL staff has been equipped with the skills and support to train others in the use of the kits; with plans in hand to expand the scope of operations significantly. Research undertaken at the University of Portsmouth has been instrumental to putting a radical new tool for the reduction of illegal killing of pangolins and the illegal trade of their scales on the global agenda, and with the partnership and collaboration with WCS we expect the geographical reach and impact of this innovation to increase steadily.

5. Sources to corroborate the impact

(S1) LEAP Workshop in Benin, mission report cites distribution and training on using the gelatine lifting packs

(S2) WCS India workshop: This features an online report on the collaborative workshops at Guhawati, India 12/07/2019.

(S3) WCS India letter supporting evidence from region Director 19/08/2019.

(S4) Email of testimony from Wildlife Officers in India. Used at two scenes and endorsing the effectiveness 09/11/2020.

(S5) Testimonial from [text removed for publication], representing **ZSL**, **WCS** and **Cops without Borders** 02/07/2020**.**

(S6) Foreign Commonwealth Office / ZSL [text removed for publication]: Mentions the Forensic Kits being deployed in Cameroon 04/08/2019.

(S7) CITES Endorsement of the Fingerprint following the Seventieth meeting of the Standing Committee Rosa Khutor, Sochi (Russian Federation), 1-5 October 2018.

(S8) Email from WCS inviting us to undertake wildlife crime leadership training in Vietnam and Indonesia 09/10/2020.

(S9) WCS India: Fighting Wildlife Crime with new age Forensics. This features a blog from the WCS team on the introduction of new techniques, 04/10/2019.